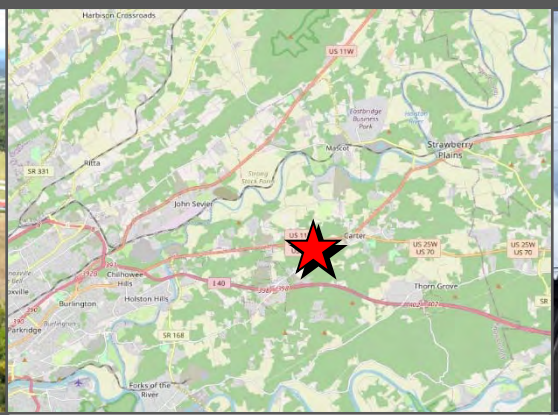
AJAX ENGINEERING

CIVIL ENGINEERING / TRAFFIC ENGINEERING

Transportation Impact Study
8014 Asheville Highway Subdivision
Knox County, Tennessee



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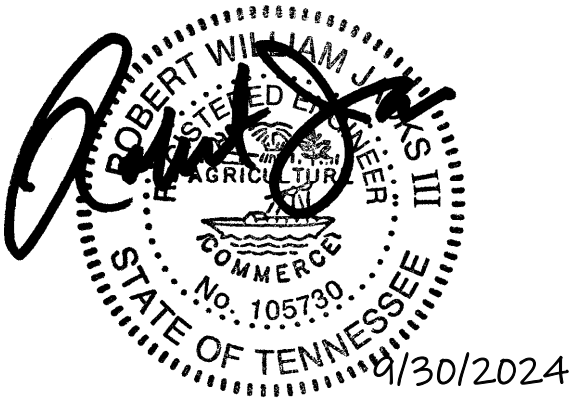

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EXECUTIVE SUMMARY

Preface:

Mesana Investments, LLC proposes a residential development adjacent to Asheville Highway in East Knox County, TN. The proposed development will include constructing 174 multi-family attached townhouses and 71 single-family detached houses on 49.18 +/- acres. The development is named and referenced in this study as "8014 Asheville Highway Subdivision" since a name has not yet been chosen. The development proposes a single entrance from the south to Asheville Highway, east of Cash Road, at an existing driveway and median opening. The development is 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 development on the adjacent transportation system. The study includes a review of the primary access road and the entrance intersection. This report is a Level 1 study established by Knoxville/Knox County Planning. This study also includes the impact and increase in traffic due to other nearby unrelated planned residential subdivisions along Asheville Highway. 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 8014 Asheville Highway Subdivision, with 174 multi-family attached townhouses and 71 single-family detached houses, is estimated to generate 2,306 vehicle trips at full build-out and occupancy on an average weekday. Of these daily trips, 144 are estimated to occur during the AM peak hour and 198 in the PM peak hour in 2028.
- With the proposed development of the 8014 Asheville Highway Subdivision and the other nearby residential developments being completed and occupied by 2028, the proposed northbound exiting left-turn lane at the Proposed Entrance is projected to operate at LOS F during the projected AM and PM peak hours. This proposed lane at the entrance is projected to have moderate volumes but high vehicle delays due to the large conflicting volumes on Asheville Highway during peak hours. This lane will also experience large vehicle queues, particularly during the PM peak hour. Further analysis determined that the Proposed Entrance at Asheville Highway will not likely meet warrants for traffic signalization in the projected 2028 conditions.

Recommendations:

The following recommendations are offered based on the study analyses to minimize the impacts of the proposed development on the adjacent transportation system while attempting to achieve an acceptable traffic flow and improved safety. These recommendations also take into account the contribution of additional traffic from the other known nearby planned residential subdivisions. More details regarding all the recommendations are discussed at the end of the report.

Asheville Highway at Proposed Entrance:

- This intersection is not expected to meet signalization warrants based on the projected 2028 traffic volumes. However, once and if the 8014 Asheville Highway Subdivision is entirely constructed as proposed, it is recommended that a traffic count be re-conducted to ensure that the actual, realized traffic volumes do not exceed what has been estimated in this study.
- Since it is apparent that the intersection will likely not meet warrants for signalization in the projected 2028 conditions and is calculated to operate with very poor conditions for the northbound exiting left-turn lane traffic, other remaining potential alternatives would include one of the following:
  - Developing an additional entrance to Asheville Highway to the north with a median opening.
  - Reducing the number of proposed lots.
  - Eliminate northbound left turns at the Proposed Entrance by constructing a J-Turn Crossing in the median of Asheville Highway further to the east. This restriction would force exiting westbound motorists to first turn east and then perform a U-turn downstream to travel back towards the west. J-Turns would prevent direct left-turn movements from the entrance road and provide additional safety for exiting left-turn motorists by reducing vehicle conflicts. Overall, a J-Turn could at least equal or take less time than a standard left turn, requiring a motorist to wait for a sufficient gap to cross two lanes of traffic and enter the opposite stream with numerous vehicle conflict points. This alternative would require cooperation with TDOT.
- The construction of a westbound left-turn lane on Asheville Highway at the Proposed Entrance for entering traffic into the proposed subdivision is warranted based on the projected 2028 traffic volumes and TDOT's thresholds. The

recommended lengths for this proposed left-turn lane in the center median include a lane change and deceleration distance of 340 feet and a storage length of 50 feet, for a total length of 390 feet. The bay taper length within the lane change and deceleration distance is recommended to be 180 feet (15:1). With a 180-foot bay taper, the full-width left-turn lane will be 210 feet long.

- Based on TDOT's warrant thresholds and the projected 2028 traffic volumes, an eastbound right turn lane is also warranted and recommended to be constructed for the Proposed Entrance. This lane should have a lane change and deceleration distance of 340 feet. The bay taper length within the lane change and deceleration distance is recommended to be 180 feet (15:1), and these distances will provide a full-width lane length of 160 feet.
- If northbound left turns are allowed from the subdivision towards the east at the Proposed Entrance, separate left and right turn lanes are recommended for the Road "A" approach at Asheville Highway since substantial left-turning vehicle queues are anticipated. It is recommended that the left-turn lane at the Proposed Entrance be the continuation of Road "A" and that the right-turn lane have a separate lane with a minimum vehicle storage of 150 feet. A distance of 150 feet would be the approximate length between the Proposed Entrance stop bar at Asheville Highway to the first intersecting internal street to the south, Road "B". The separate left and right exiting lanes for the development at Asheville Highway should be marked on the pavement with the appropriate white turn arrows and delineated with white lane lines.
- The construction of the Proposed Entrance on Asheville Highway will require a TDOT Highway Entrance Permit. The developer will need to apply for this permit and coordinate with TDOT regarding their specific requirements for this entrance and any other proposed median modifications.
- Due to the proposed median opening and divided lanes on Asheville Highway at the Proposed Entrance, many regulatory signs should be installed to reduce the possibility of wrong-way vehicles. Refer to Figure 2.10 in TDOT's Traffic Design Manual, which illustrates the signage required for the Proposed Entrance at Asheville Highway.

8014 Asheville Highway Subdivision Internal Roads:

- A 25-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the Proposed Entrance, Road "A", off Asheville Highway. It is also

recommended that a "No Outlet" Sign (W14-2a) be posted at the front of the subdivision. This sign can be posted above or below the street name sign.

- Stop Signs (R1-1) with 24" white stop bars are recommended to be installed at the internal road locations, as shown in the study.
- At the internal intersection of Road "D" and "E", a four-way intersection is proposed. Stop Signs (R1-1) are shown on the Road "D" approaches in the provided image in the Conclusions and Recommendations. However, it is recommended that a mini-roundabout with the appropriate signage at this intersection be considered. If a mini-roundabout is not feasible, further discussion with Knox County Engineering in the detailed design phase should include whether this intersection should include Stops Signs (R1-1) on all approaches, the reverse as shown, or as proposed.
- The Stop Sign (R1-1) on the entrance approach to Asheville Highway should include a One-Way Sign (R6-1) and a Divided Highway Sign (R6-3), as shown in Figure 2.10 in the TDOT Traffic Design Manual.
- Dual end-of-roadway object markers (OM4-1) should be installed at the end of the subdivision's internal roads that end abruptly, which include Roads "B" and "C", as shown in the report. The ends of these internal roads should include hammerhead turnarounds to facilitate motorists' ability to turn around.
- Additional signs should be posted internally at the western end of Roads "B" and "C" to follow Knoxville-Knox County Subdivision regulations. These signs are for notification of possible future street connections. They should state, "NOTICE – This road may be extended and connected to the west – for more info. contact Knox Co. Engineering & Public Works (865) 215-5800".
- The proposed lots within the development adjacent to Asheville Highway should not be allowed direct access to the north.
- 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 required stopping sight distance is 155 feet for a level road grade. The site designer should ensure that internal sight distance lengths are met and account for different proposed road grades.
- If directed by the local post office, the site designer should include a parking area and a centralized mail delivery center within the development for the subdivision residents.
- All drainage grates and covers for the residential development must be pedestrian

and bicycle-safe.

- Several internal roads in the proposed subdivision will have 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.
- All road and intersection elements should be designed to AASHTO, TDOT, and Knox County specifications and guidelines to ensure proper operation.

DESCRIPTION OF EXISTING CONDITIONS

- **STUDY AREA:**

The proposed location of this new residential development is shown on a map in Figure 1. This proposed residential development will be located on the south side of Asheville Highway, 1,300 feet east of Cash Road in East Knox County, TN. The proposed entrance will be located at an existing gravel driveway with a median opening and will also be approximately 550 feet to the west of a new street, Tribute Lane. Tribute Lane does not have a median opening at Asheville Highway, and this road was built as part of a relatively new sports therapy clinic and building (Andrews Physical Therapy) at 8020 Asheville Highway.

The development will be constructed from three existing parcels that, when combined, expand an area between Asheville Highway to the north and Strawberry Plains Pike to the south. The proposed subdivision, however, only proposes a single entrance to Asheville Highway. As requested, transportation impacts associated with the development were analyzed at the Proposed Entrance at Asheville Highway, where the development will have road access to and from external destinations. The existing median opening on Asheville Highway is where the Proposed Entrance will be constructed.

View of Existing Development Site at Asheville Highway (Looking South)

The proposed development property is in a formerly rural area, very slowly transitioning to a more suburban area of East Knox County, TN. There are many residential subdivisions and stand-alone houses in the surrounding area, as well as commercial development along Asheville Highway. The adjacent commercial properties include the previously mentioned sports therapy

Existing Structures on Proposed Development Property (Looking South)

clinic, a multi-unit storage/garage facility, a plumbing contractor, and a portable building sales business. There are also many unoccupied properties nearby as well. One of these unoccupied properties includes a 16.74-acre parcel owned by Habitat for Humanity. A concept plan for this parcel was recently submitted for a residential subdivision that will include 37 lots with 74 multi-family attached duplexes. This subdivision will be adjacent to the 8014 Asheville Highway Subdivision but will only have external access to Asheville Highway to the north via Tribute Lane. Likewise, the existing sports therapy clinic currently has access to Tribute Lane and the existing gravel driveway and median opening to the west, where the proposed 8014 Asheville Highway Subdivision entrance will be located. This business will be adjacent to the proposed subdivision. Unlike the Habitat the Humanity Subdivision, this entity will have access to the Proposed Entrance for the 8014 Asheville Highway Subdivision via a joint permanent easement. It will maintain access to Tribute Lane as well.

The 8014 Asheville Highway Subdivision property is mainly cleared on the north side of the property near Asheville Highway. A house on the property near Asheville Highway was recently demolished. Several outbuildings, large barns, and shipping containers are located on the property, and these structures will be removed during the construction of the subdivision. A single-family detached house is located on the southern end of the property with a private gravel driveway to Strawberry Plains Pike and is presumed to remain. The topography for the subdivision property is mostly defined by rolling terrain but has a couple of major drainage swales with significant elevation changes. A small area of hillside protection is also located on the property.

Major road access to this area of Knox County is provided by Asheville Highway, which traverses east towards Jefferson City and Dandridge and Knoxville to the west. Brakebill Road, further to the west and south, provides minor access to the area by traversing between Asheville Highway to the north and Strawberry Plains Pike to the south, where it intersects near Interstate 40.

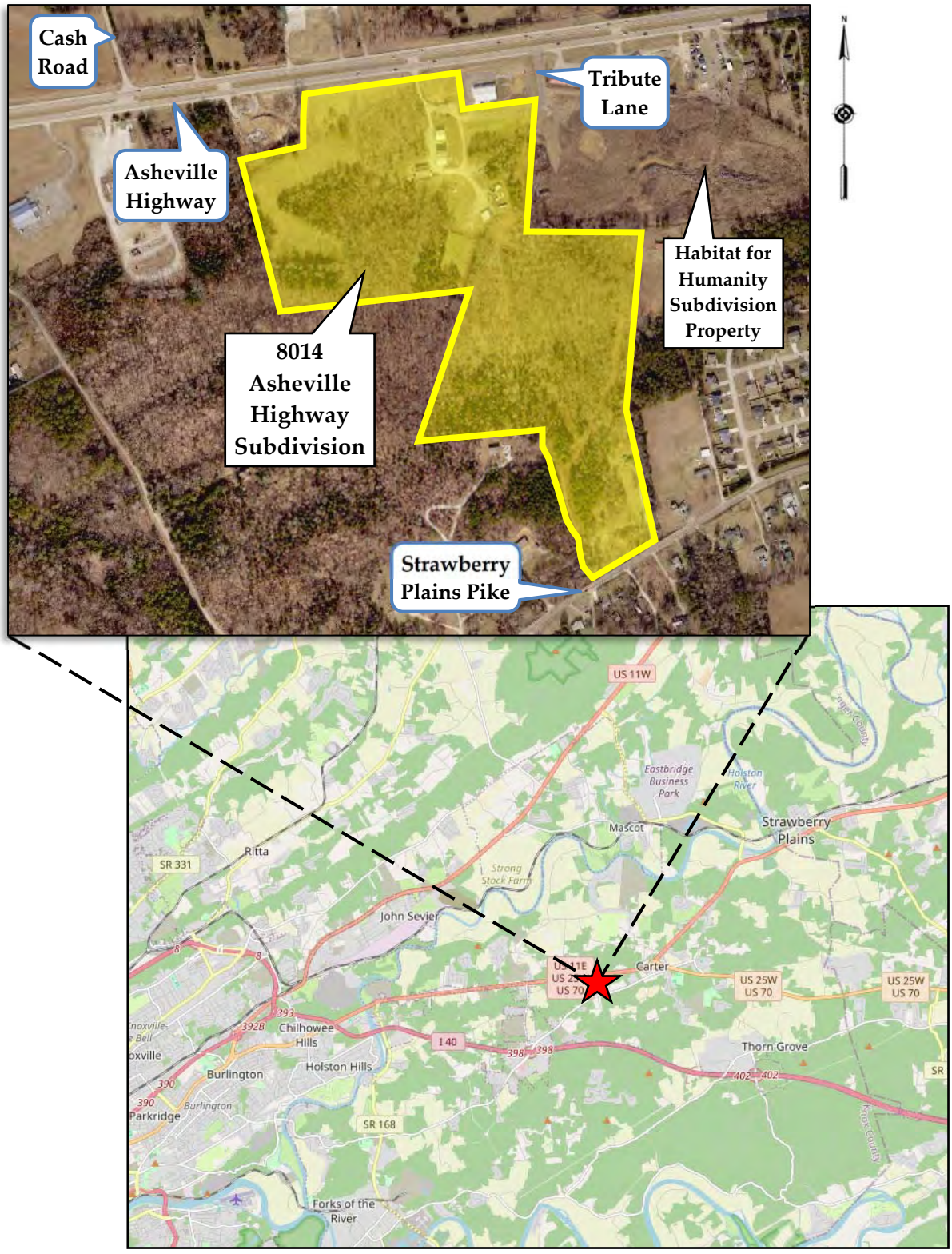


Figure 1
Location Map

- **EXISTING ROADWAYS:**

Table 1 lists the characteristics of the existing primary roadway 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
Asheville Highway (US 25E/US 11E/US 70/SR 9)	Principal Arterial	55 mph	4 lanes with divided median	100 feet	None	No sidewalks along roadway	No bike lanes

[1] TDOT Functional Classification Map (9.14.18)
[2] From edges of pavement near project site
[3] According to Knoxville Area Transit System Map

Asheville Highway (US 25E/US 11E/US 70/SR 9) is a 4-lane Principal Arterial that traverses in a generally east-west direction. Closer to the study area, Asheville Highway provides convenient access to Knoxville to the west, Jefferson City to the northeast (via Andrew Johnson Highway), and Dandridge to the east. The posted speed limit on Asheville Highway is 55 mph at the development property.

Asheville Highway is a divided highway at the development property with a grassed median and an average 30-foot width. A median opening is currently provided on Asheville Highway at the existing private driveway and the Proposed Entrance's location. The existing driveway operates under stop control, but a Stop Sign (R1-1) is not posted. Turn lanes are not provided at this median opening, and there is no approach or driveway from the north. The median opening is 50 feet wide between the noses of the median.

Asheville Highway at Existing Driveway / Proposed Entrance Location

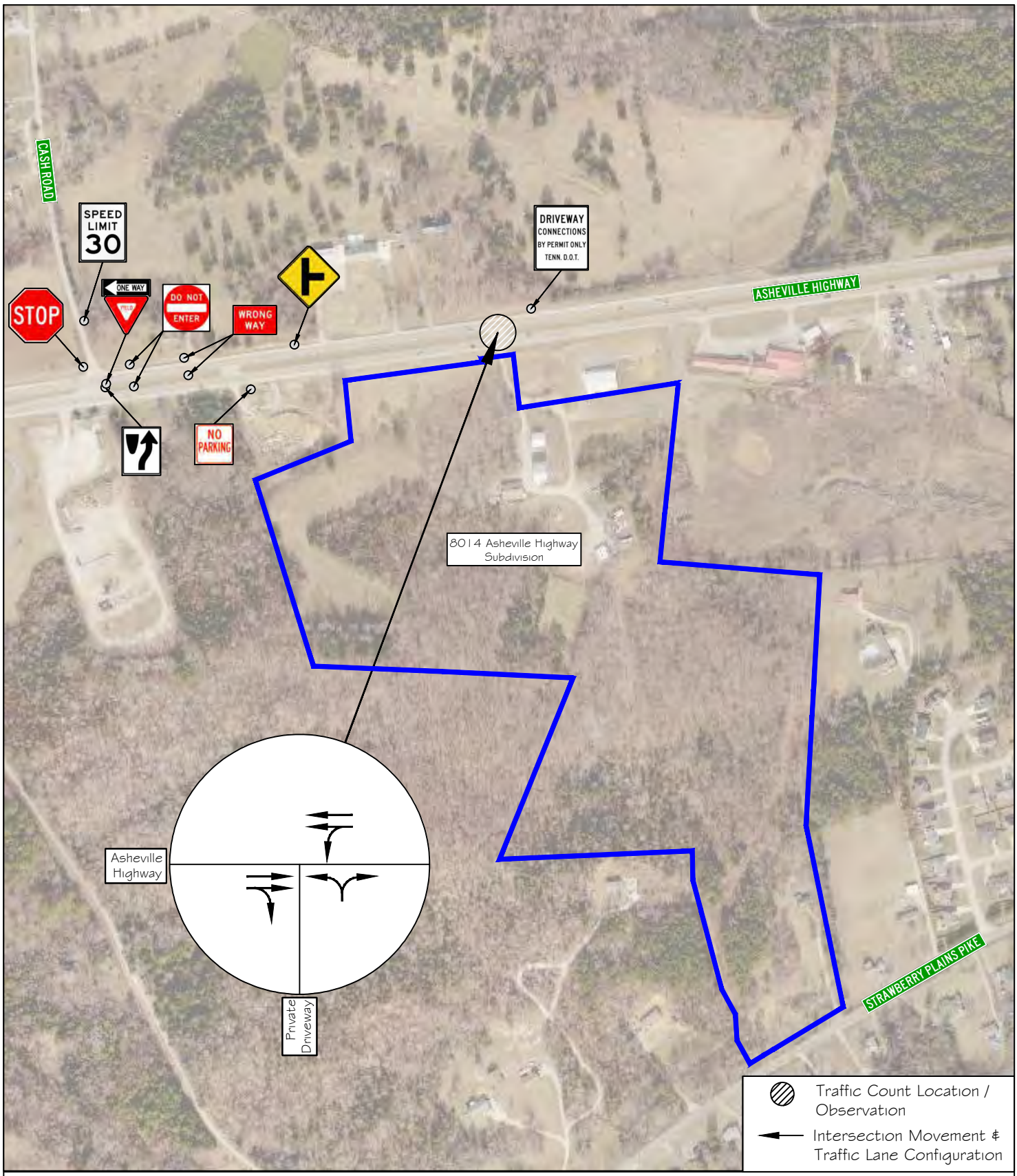
In both directions, grooved pavement rumble strips are located just outside the white edge lines along the shoulder of Asheville Highway. Along this stretch of Asheville Highway, the road has a very straight alignment with a few minor vertical curves. Roadway features, including sidewalks, bike lanes, and greenway paths, are not provided

along Asheville Highway.

Asheville Highway has relatively good pavement conditions and will be the primary road for future residents of the 8014 Asheville Highway Subdivision to and from external destinations. All lanes on Asheville Highway are 12 feet in width, and the paved shoulders are 10 feet in width.

This median opening does not currently have any commercial development to the north. A single-family detached house and a plumbing contractor are a bit further to the northwest, with private driveways to Asheville Highway further to the west of the median opening.

Figure 2 shows the existing lane configurations of the intersection examined in the study, the traffic count location, and the current traffic signage 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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NOT TO SCALE

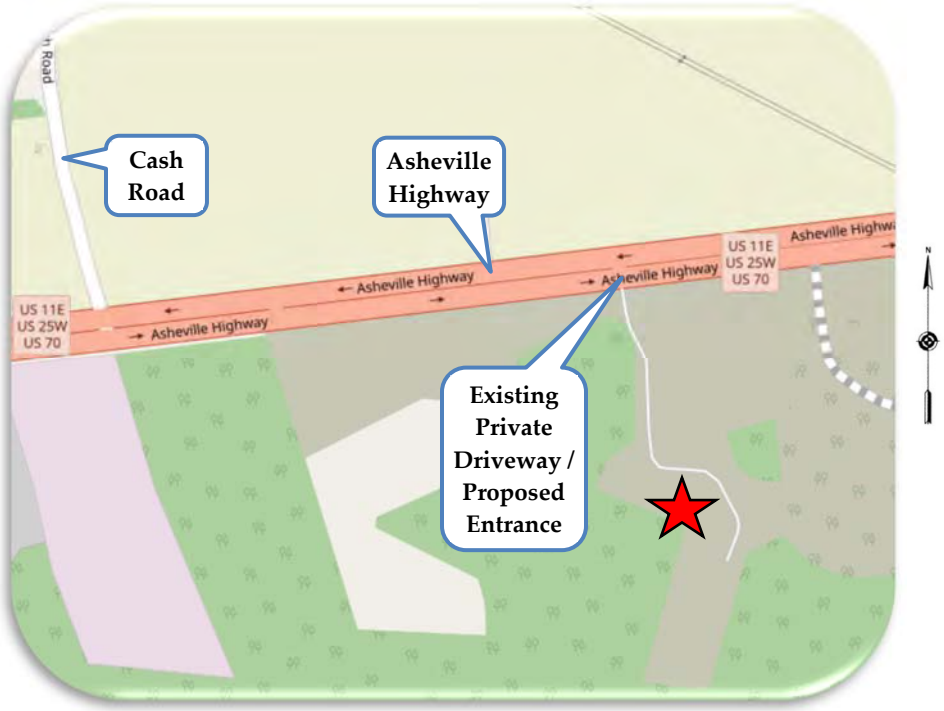
NORTH

FIGURE 2

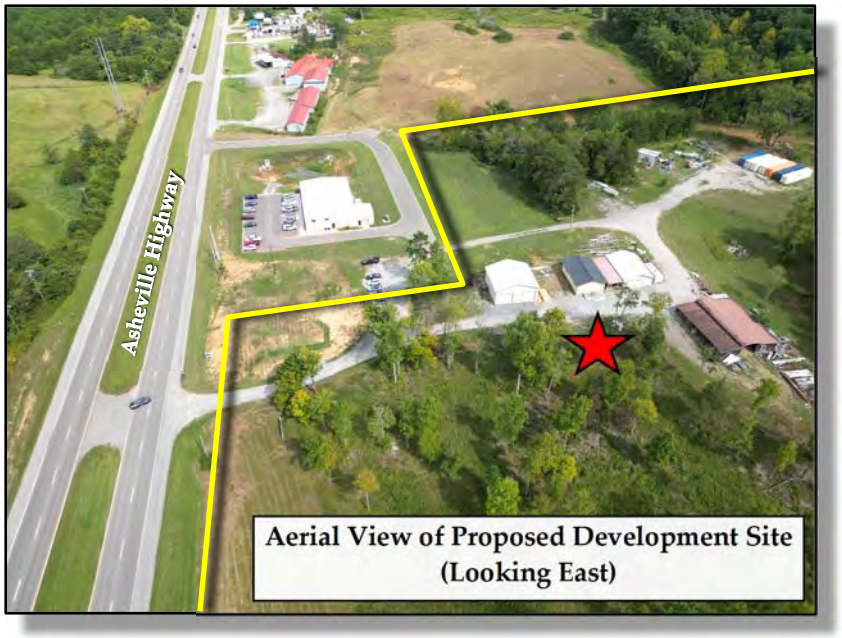
8014 Asheville Highway Subdivision

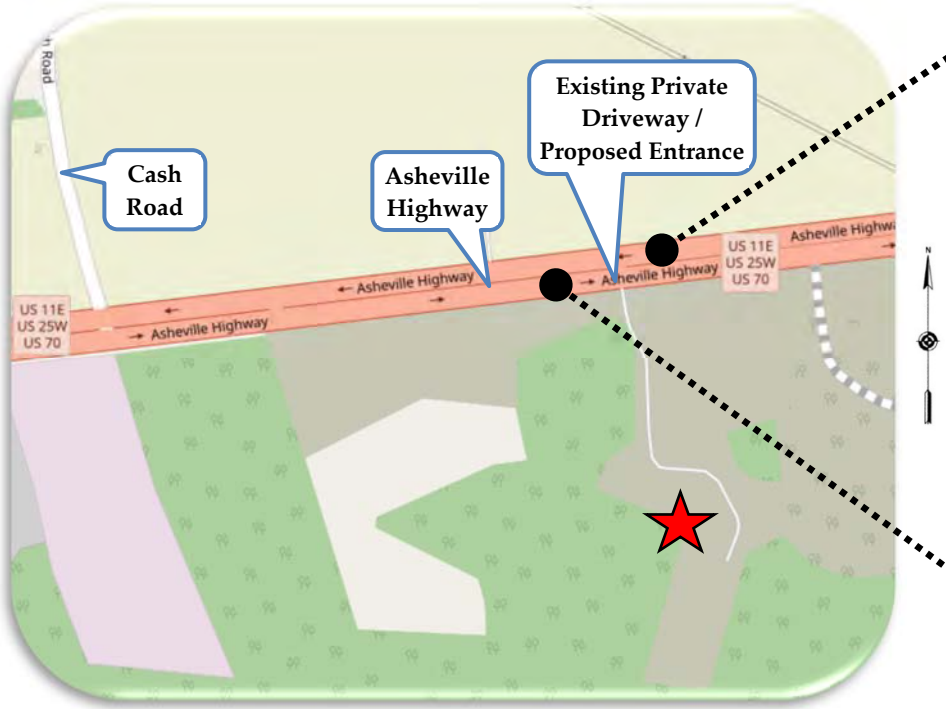
Traffic Count Location, Traffic Signage & Existing Lane Configurations

PHOTO EXHIBITS



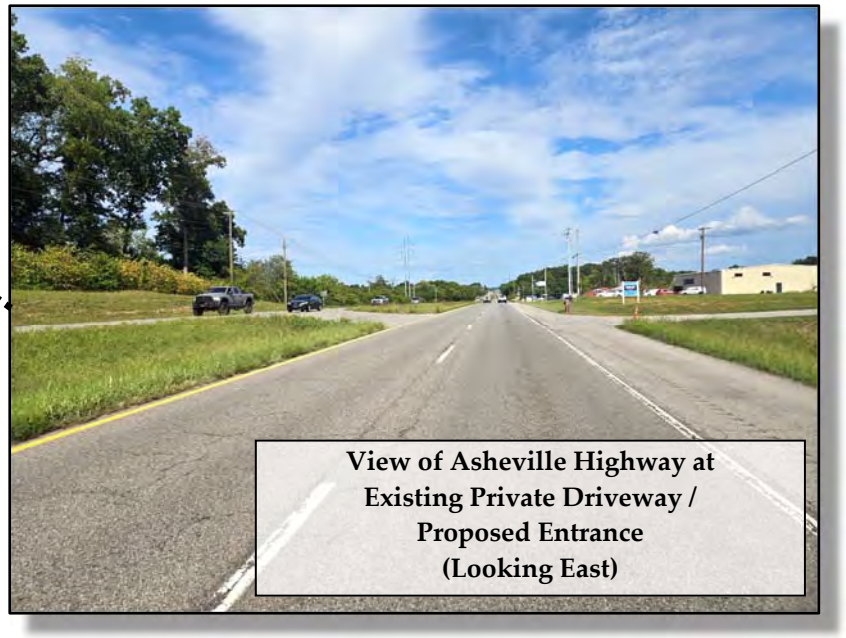
Proposed Development Site



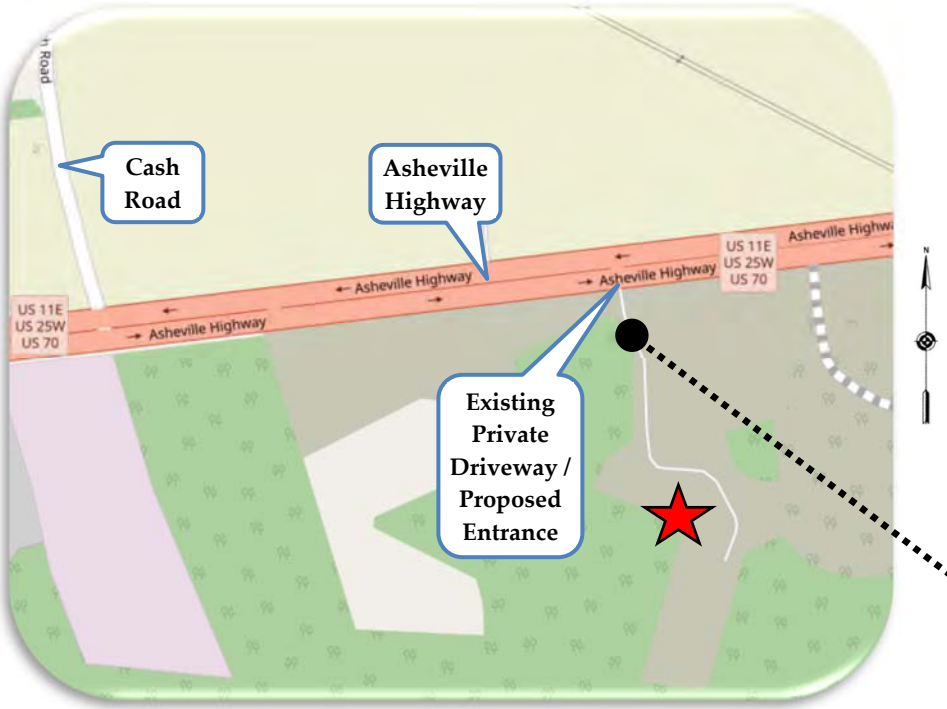


Proposed Development Site

View of Asheville Highway at Existing Private Driveway / Proposed Entrance (Looking West)



View of Asheville Highway at Existing Private Driveway / Proposed Entrance (Looking East)



Proposed Development Site

View of Existing Private Driveway / Proposed Entrance at Asheville Highway (Looking North)

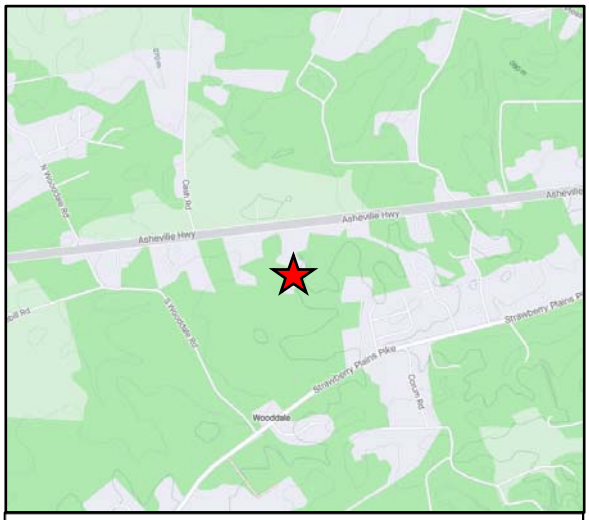
- **EXISTING TRANSPORTATION VOLUMES PER MODE**:

One annual vehicular traffic count location is located near the study area, and the Tennessee Department of Transportation (TDOT) conducts this count on Asheville Highway. The count location data is the following and can be viewed with further details in Appendix A:

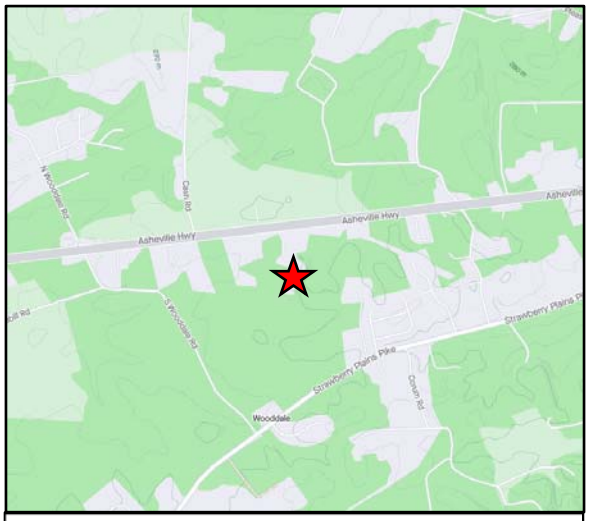
- Existing vehicular roadway traffic:
  - The Tennessee Department of Transportation (TDOT) reported an Average Daily Traffic (ADT) on Asheville Highway east of the project site at 20,381 vehicles per day in 2023. From 2013 – 2023, this count station has indicated a -0.9% average annual growth rate.

- Existing bicycle and pedestrian volumes: The average daily pedestrian and bicycle traffic along Asheville Highway is unknown. However, with the lack of sidewalks and bike lanes, as well as high vehicular volumes, this roadway is assumed to have minimal pedestrian and bicyclist activity. During the traffic counts for this project, no bicyclists and a handful of "pedestrians" were observed on Asheville Highway near the development site. The observed "pedestrians" were members of a litter crew cleaning the shoulders and median along Asheville Highway.

  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



Strava Heat Map for Pedestrian and Joggers

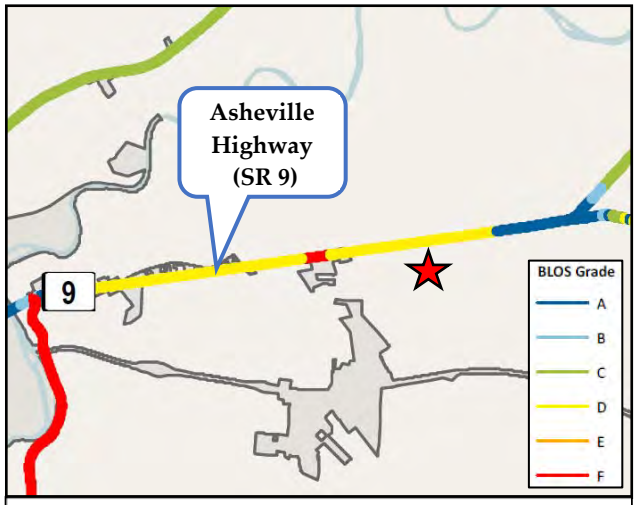


Strava Heat Map for Bicyclists

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, jogger, or bicycle activity along Asheville Highway or any roads in the surrounding area.

- **PEDESTRIAN AND BICYCLE FACILITIES**:

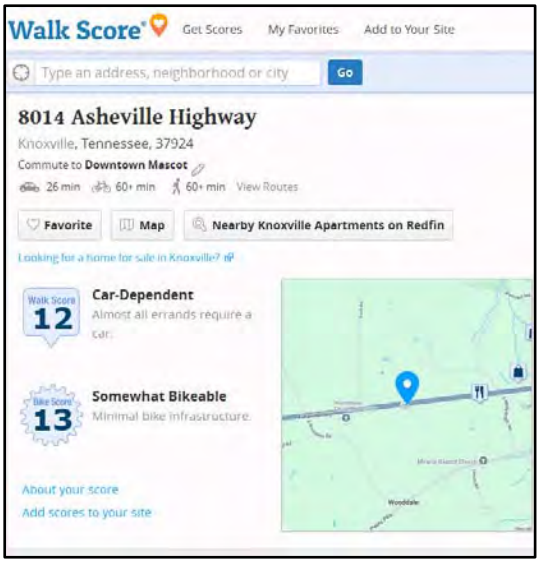
TDOT has published mapping illustrating the Bicycle Level of Service (BLOS) for State Routes. BLOS is a nationally used measure of bicyclist comfort based on a roadway's geometry and traffic conditions. BLOS A designates the route as most suitable for bicyclists and BLOS F as the least suitable. At the development site, the BLOS for Asheville Highway, State Route 9, has a grade of D, suggesting that the highway is unsuitable for bicycle traffic near the proposed development site.



Mapping of Bicycle Level of Service (BLOS) - TDOT

- **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 12 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, lack of nearby amenities, and the high vehicular volumes on the highway adjacent to the site. The site

is given a Bike Score of 13, meaning there is minimal bike infrastructure. The site is not given a Transit Score since no public transportation opportunities are near the development site. Overall, for this study, no vehicle trip reductions for pedestrian or bicyclist activity were used or assumed.

- **TRANSIT SERVICES:**

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

KAT Route 34, "Burlington Shopper"

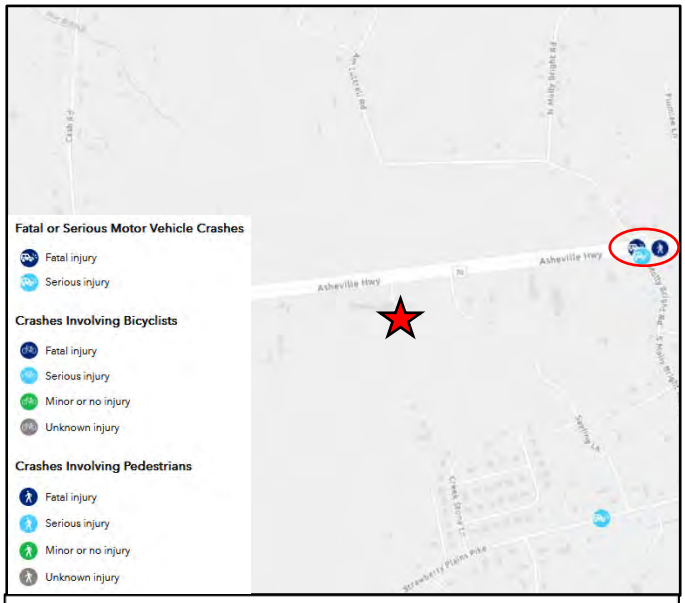
The closest public transit to the development site is 5.3 miles to the southwest by roadway. The closest bus stop to the proposed development is on Route 34, "Burlington Shopper", at the intersection of North Chilhowee Drive at Asheville Highway. KAT made several changes and improvements to their routes that began on August 26th, 2024. This recent change has established bus service every 30 minutes at this bus stop. It operates on weekdays and weekends; the route map is also included in Appendix B. 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.

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 development is not expected to have any reduced vehicle trips due to public transit usage.

- **CRASH DATA**:

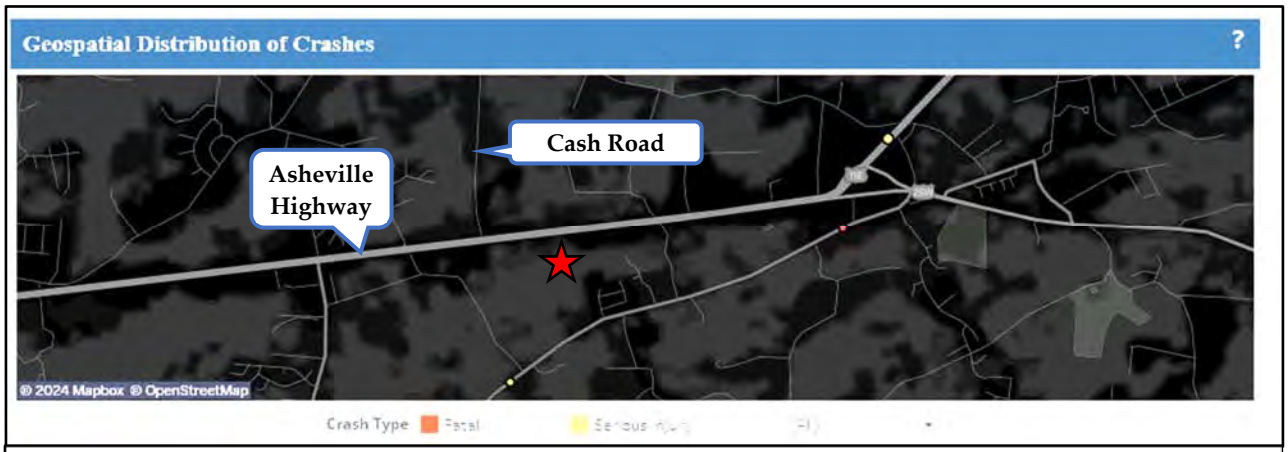
The Knoxville Transportation Planning Organization (TPO) provides a website that lists bicycle, pedestrian, and vehicle severe or fatal crashes from October 2016 to September 2021. The data shows that, unfortunately, two fatal crashes occurred to the east near the intersection of Asheville Highway at South and North Molly Bright Road on May 19th, 2017, and on January 8th, 2018. No crash factors were listed as the causes of these crashes, but one involved a senior driver, and another involved a teen driver. Subsequently, an online news search was undertaken to determine further details of these crashes, and news reports were found on the Knoxville News Sentinel website. The fatal crash that occurred in 2017 involved a man walking along the highway who stepped out from the shoulder and was hit by two sedans. No charges were filed against

either of the two drivers. The other fatality is assumed to have occurred when a vehicle left the roadway and went down an embankment near South Molly Bright Road. This crash occurred during cold and icy conditions, but the news article did not report a fatality, and it is assumed that the driver passed later on. A third crash that involved a teen driver occurred on August 27th, 2019, resulted in serious injuries, and occurred just south of Asheville Highway on South Molly Bright Road.



Bicycle, Pedestrian, and Vehicle Crash Data in Study Area (TPO)

TDOT publishes and lists State crash data on its website that has involved a serious injury or a fatality over the past three calendar years. Between 2022 and 2024, the data shows no serious or fatal crashes near the proposed development site.



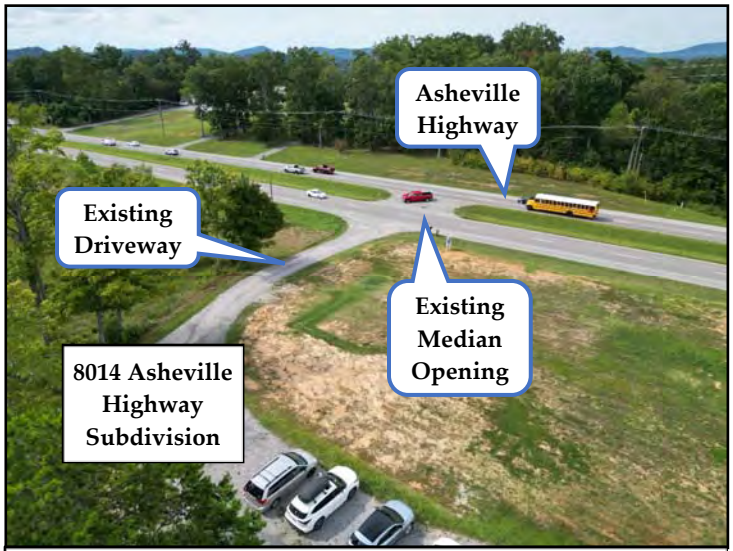
TDOT - Serious or Fatal Injury Traffic Crashes in Study Area (2022 – 2024)

Ultimately, the crash data from the Knoxville TPO and TDOT is not specific enough to ascertain crash patterns or types to incorporate into the recommendations for this proposed development. However, TDOT continually monitors for high crash locations and conducts further investigations if a spot location or intersection experiences above-average crash rates.

PROJECT DESCRIPTION

- **LOCATION AND SITE PLAN:**

The proposed plan layout with 174 multi-family attached townhouses and 71 single-family detached houses on 49.18 +/- acres is designed by Urban Engineering and is shown in Figure 3. The three proposed property parcels will create a jigsaw-shaped subdivision when formed for the development. The design shows five new internal streets, Roads "A" through "E". As shown in the figure, an entrance will be constructed for the development on the south side of Asheville Road. Road "A" will be the entrance street for the Proposed Entrance off Asheville Highway, with a median opening already provided at the entrance location. Road "A" at Asheville Highway will be constructed with a boulevard road section down to the first intersecting internal street, Road "B". This boulevard will be approximately 160 feet long, and the center-raised median will be 8 feet wide. The townhouses will be located on the development site's west and northwest portions, and the single-family detached houses will be located on the southern and southeastern portions. Two internal streets are shown ending abruptly with a potential for further construction, and two others will end at cul-de-sacs.



View of Development Site (Looking Northwest)

The 8014 Asheville Highway Subdivision will have several common areas. Some of these common areas will include stormwater controls for the proposed subdivision. These areas will be located on the northern corners along the highway frontage near Asheville Highway and to the south, closer to Strawberry Plains Pike. The open areas will be nearly a quarter of the entire development property.

The typical lot dimensions for the attached townhouses in the subdivision will be 100 feet deep and either 22 or 27 feet wide, providing a typical townhouse lot area of 2,200 or 2,700 square feet. The typical lot dimensions for the single-family detached houses in the subdivision will be 125 feet deep and 55 feet wide, providing a typical single-family house lot area of 6,875 square feet.

Each townhouse and single-family house will have a garage and driveway. The developer is not proposing on-site amenities for the future subdivision residents other than providing open common areas. Internal sidewalks are not proposed for this subdivision.

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. This study assumed that the total construction build-out of the development and full occupancy would occur within the next four years (2028) to provide a conservative outlook.

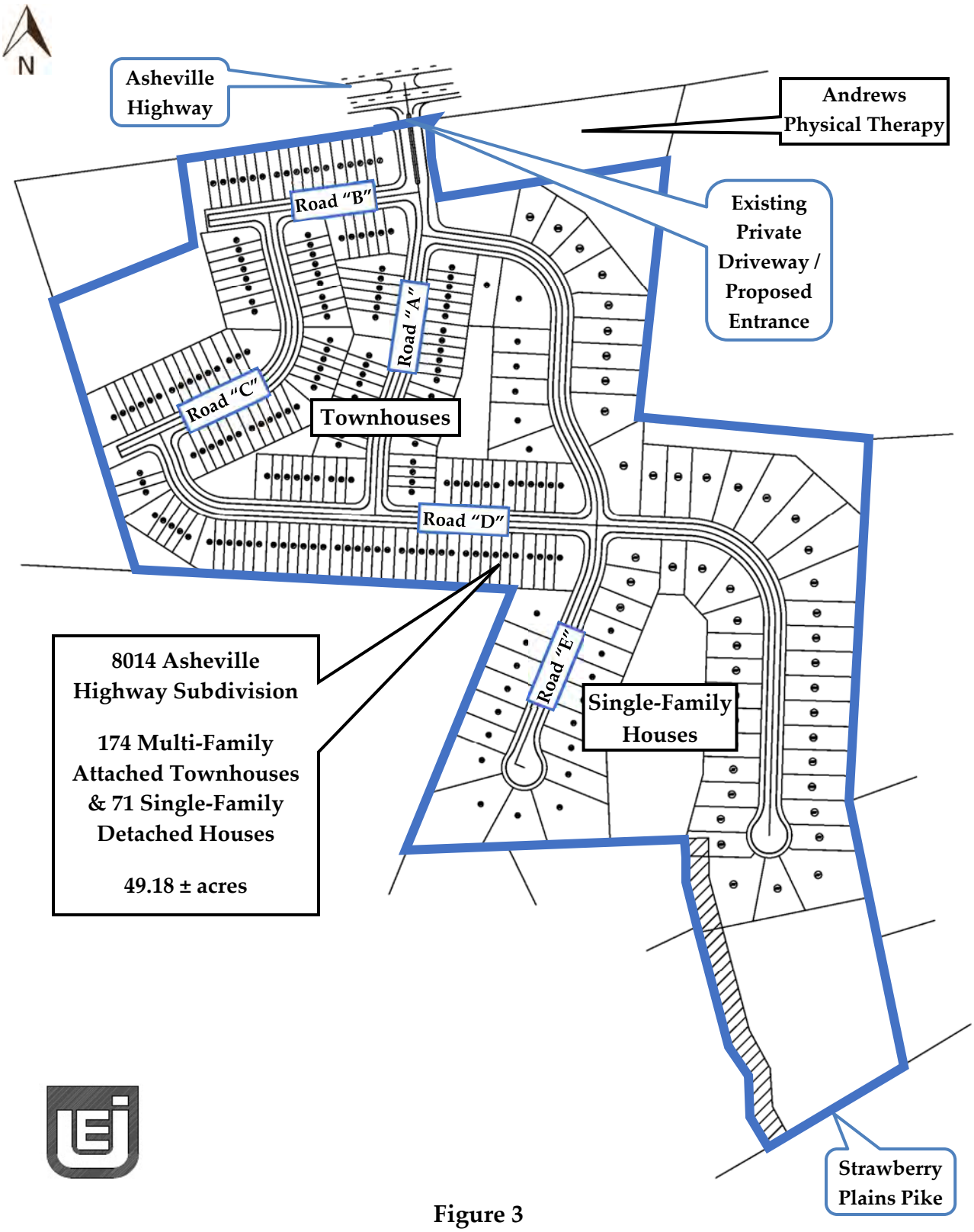


Figure 3
Proposed Plan Layout
8014 Asheville Highway Subivision

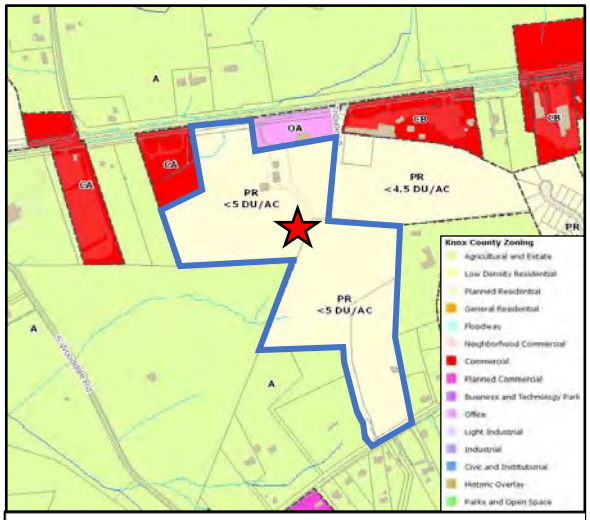
Not to Scale

- **PROPOSED USES AND ZONING REQUIREMENTS:**

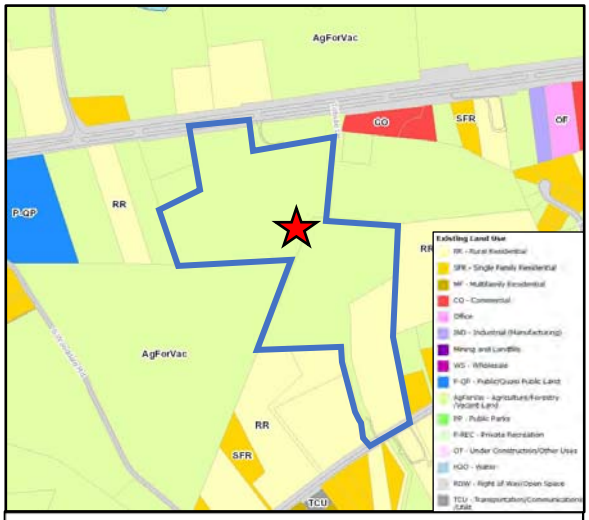
The three parcels comprising the 8014 Asheville Highway Subdivision development property are in Knox County and were recently requested to be rezoned. The Knoxville/Knox County Planning Commission approved the rezoning, and the Knox County Commission gave final approval on July 15th, 2024. The property's previous zoning was Agricultural (A) and General Business (CA), and it was requested to be changed to Planned Residential (PR). The property rezoning was approved with a density of up to 5 units per acre. Uses permitted in the Planned Residential (PR) zone include single-family dwellings, duplexes, and multi-dwelling structures and developments. The most recently published online KGIS zoning map is provided in Appendix C. The existing adjacent surrounding zoning and land uses are the following:

- Asheville Highway binds the development property to the north. Across Asheville Highway, the properties are zoned as Agricultural (A). A plumbing contractor, a single-family detached house, and undeveloped property occupy the parcels to the north, with road access to the south at Asheville Highway provided by private driveways. None of these private driveways from the north have median openings on Asheville Highway for access to the south.
- One adjacent parcel to the northwest on the south side of Asheville Highway is zoned as Commercial (CA). It is currently unoccupied, except for rubble, and at one time was occupied by a small group of efficiency apartments. The property to the northeast and on the south side of Asheville Highway is zoned as Office (OA) and is occupied by the Andrews Physical Therapy clinic. The clinic has access to Tribute Lane to the east and the existing driveway to the west at 8014 Asheville Highway, where a median opening and the subdivision's Proposed Entrance will be located. The access to this existing driveway is currently provided via an existing gravel path.
- To the east, one parcel is zoned Planned Residential (PR) with a density of up to 4.5 units per acre and is owned by Habitat for Humanity. This property was recently approved for a residential subdivision and is proposed to have 74 multi-family attached duplexes on 37 lots. Access to this subdivision will be via Tribute Lane to Asheville Highway. The Habitat for Humanity Subdivision will not be allowed access to and from the west at the Proposed Entrance for the 8014 Asheville Highway Subdivision. Since Tribute Lane does not have a median opening on Asheville Highway, entering and exiting trips to and from this other subdivision will create additional U-turn maneuvers at the adjacent median openings, including the median opening where the 8014 Asheville Highway Subdivision will have a Proposed Entrance.

- All the other properties to the west, southwest, and southeast are zoned as Agricultural (A). These properties include undeveloped land, forested areas, and single-family detached houses. For the most part, these properties all have or potentially have road access to the south at Strawberry Plains Pike or the west at South Wooddale Road.



KGIS Existing Zoning Map



KGIS Existing Land Use Map

- **<u>ON-SITE CIRCULATION</u>:**

The total length of the 8014 Asheville Highway Subdivision internal roads will be 5,711 feet (1.08 miles), designed and constructed to Knox County specifications. The development will have asphalt-paved internal roadways with 8" extruded concrete curbs. The lane widths internally will be 13 feet each for a total 26-foot pavement width. The public right-of-way width within the development will be 50 feet. No sidewalks are proposed on the internal roads in this development. Knox County will maintain the streets in the development after construction, and these will be dedicated public roads.

- **<u>SERVICE AND DELIVERY VEHICLE ACCESS AND CIRCULATION</u>:**

Besides residential passenger vehicles, the internal roadways will provide access for service, delivery, maintenance, and fire protection/rescue vehicles. 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 with cul-de-sacs will accommodate the larger vehicle types and residents' standard passenger vehicles and be sufficiently sized to allow vehicles to turn around.

ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

- **EXISTING TRAFFIC CONDITIONS:**

This study conducted an 8-hour traffic count at the intersection of Asheville Highway at the existing driveway / Proposed Entrance location on Wednesday, September 4th, 2024. 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. The intersection had an AM and PM peak hour at 7:00 – 8:00 a.m. and 3:30 – 4:30 p.m. The manual tabulated traffic counts can be reviewed in Figure 4 and Appendix D. Some observations at the intersection include the following:

- No pedestrians or bicyclists were observed in the morning or afternoon traffic counts except for a litter crew cleaning up Asheville Highway.
- Most vehicles at the intersections were passenger vehicles, but school buses, semi-tractor trailer trucks, single-unit trucks, and construction vehicles with trailers were observed.
- Much higher westbound volumes on Asheville Highway and turning volumes to the west were observed in the morning versus eastbound volumes. In the afternoon, the opposite occurred, with more vehicles overall heading east versus west. This pattern indicated most motorists in the area heading towards Knoxville in the morning and returning in the afternoon.
- A few U-turns were observed on Asheville Highway at the median opening at the existing driveway and where the Proposed Entrance will be located.
- The observed volumes to and from the existing driveway were primarily individuals entering and leaving the sports therapy clinic. The clinic is connected to the existing driveway median opening via a gravel path. This median opening and existing driveway provide motorists entering from the east and leaving towards the west on Asheville Highway access to the clinic since the other entrance is at Tribute Lane, where a median opening is not provided.
- Most of the existing northbound left-turning motorists from the existing driveway towards the west on Asheville Highway found a gap in traffic, crossed the eastbound lanes, used the center median as a temporary refuge, and waited for an appropriate gap in the westbound traffic before fully completing their turn.

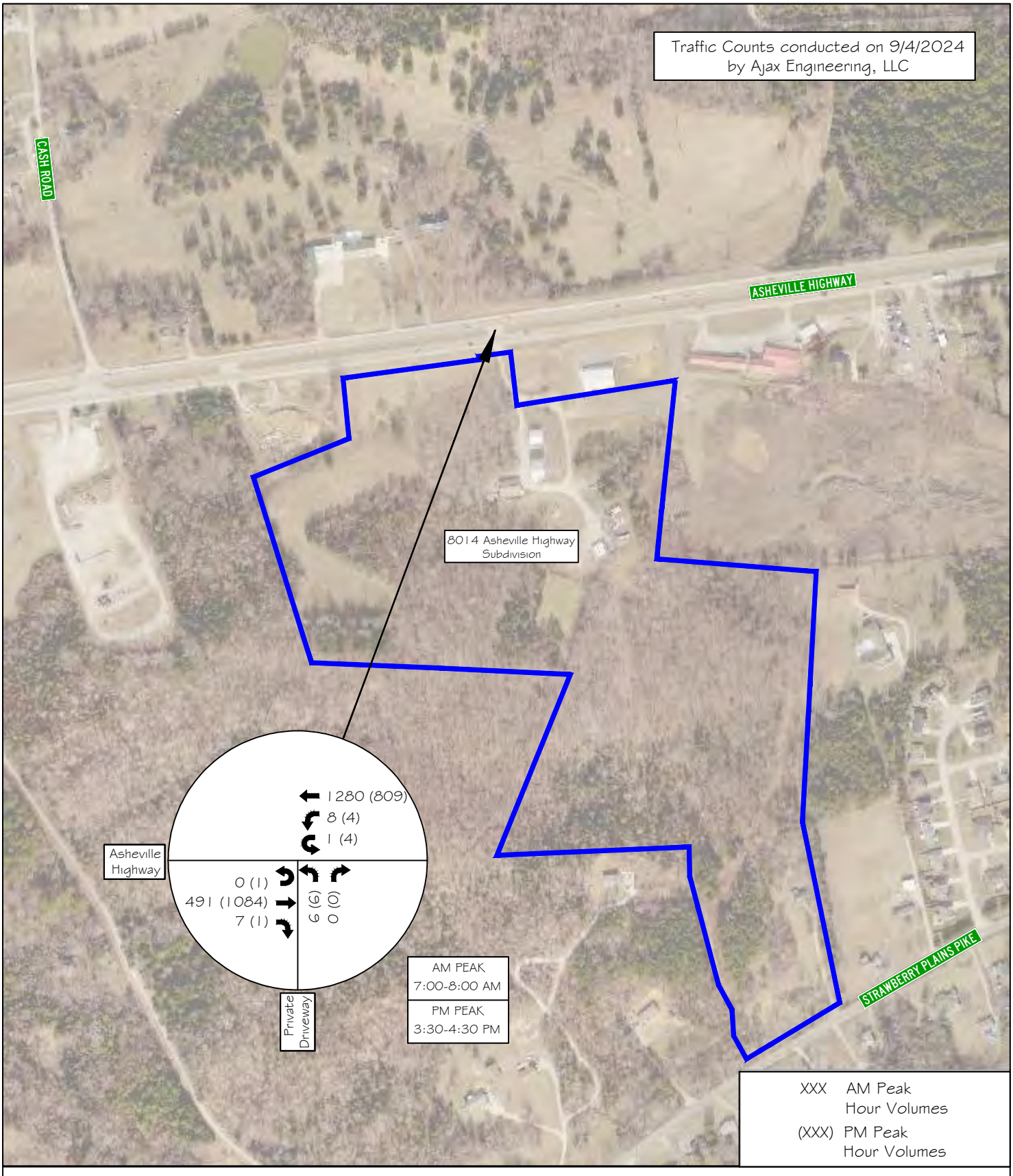


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FIGURE 4

8014 Asheville Highway Subdivision

2024 Peak Hour Traffic Volumes -
EXISTING TRAFFIC CONDITIONS

Capacity analyses were undertaken to determine the Level of Service (LOS) for the existing 2024 intersection traffic volumes shown in Figure 4. 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.

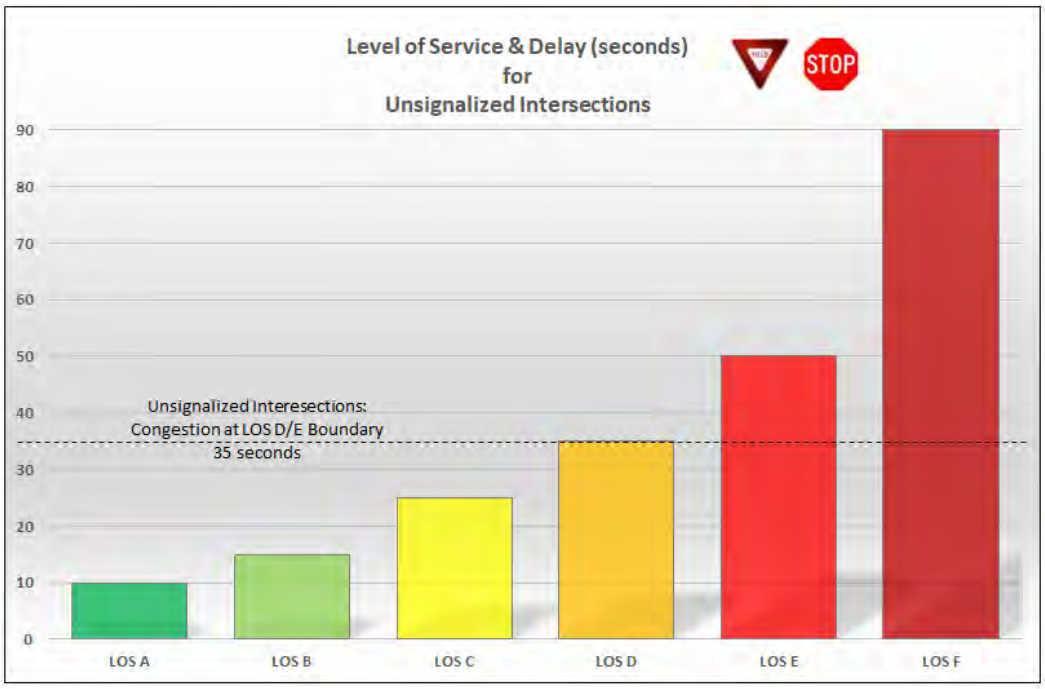
For unsignalized intersections, LOS is measured in terms of delay (in seconds). This measure attempts to quantify delay, including travel time, driver discomfort, and fuel consumption. For unsignalized intersections, the analysis assumes that the mainline thru and right-turn traffic does not stop and 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 2 lists the level of service criteria for unsignalized intersections. The analysis results of unsignalized intersections using the HCM methodologies are conservative due to the more significant vehicle gap parameters used in the method. More often, in normal road conditions, drivers are more willing to accept smaller gaps in traffic than what is modeled using the HCM methodology. The unsignalized intersection methodology also does not account for more significant gaps sometimes produced by nearby upstream and downstream signalized intersections. For unsignalized intersections, in most instances, the upper limit of acceptable delay during peak hours is the LOS D/E boundary at 35 seconds.

TABLE 2
LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS

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

Source: Highway Capacity Manual, 7th Edition



Intersection capacity results from the existing 2024 peak hour traffic are shown in Table 3. The intersection in the table is shown with a LOS designation, delay (in seconds), and v/c ratio (volume/capacity) for the AM and PM peak hours. Appendix E includes the worksheets for the existing 2024 peak hour capacity analyses.

As shown in Table 3, the intersection of Asheville Highway at the existing private driveway is calculated to operate with good to average LOS and vehicle delays in the existing peak hour 2024 conditions. The northbound approach, the existing driveway, is shown operating at LOS C and D in the AM and PM peak hours, respectively.

TABLE 3
2024 INTERSECTION CAPACITY ANALYSIS RESULTS -
EXISTING TRAFFIC CONDITIONS

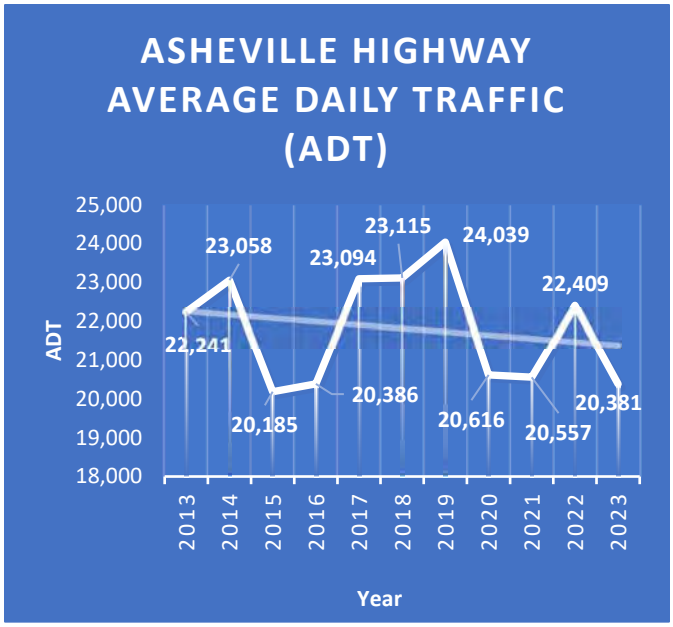
INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
Asheville Highway (WB & EB) at Private Driveway (NB)	STOP Unsignalized	Northbound Left/Right	C	19.8	0.047	D	26.9	0.088
		Westbound Left	A	9.2	0.018	C	15.3	0.022

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

- **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.

According to the nearby TDOT count station, vehicular traffic on Asheville Highway has shown negative growth over the past few years. Specifically, the TDOT data in Appendix A shows that Asheville Highway has experienced annual growth of -0.9% over the past ten years. The traffic count station showed a drop in vehicular volumes in 2020 due to the pandemic, remained lower in 2021, rebounded in 2022, but dropped again in 2023.



Nonetheless, this study used an annual growth rate of +2% to calculate future growth on Asheville Highway up to 2028. The annual growth rate was applied to the existing 2024 thru volumes on Asheville Highway to estimate the future volumes in the horizon year of 2028 without the potential additional development traffic. Figure 5 shows the projected 2028 horizon year traffic volumes at the studied intersection without the project during the AM and PM peak hours.

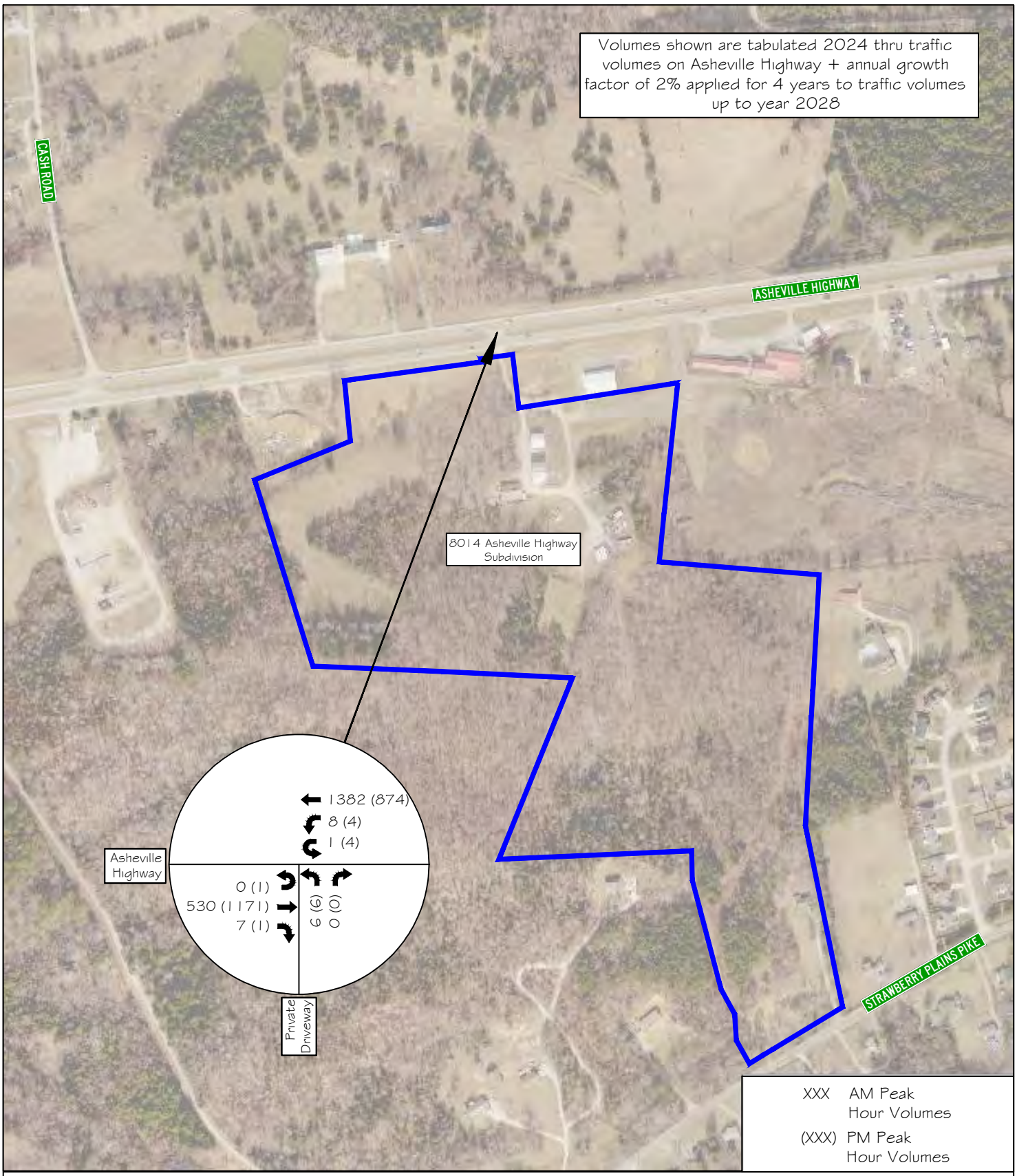


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FIGURE 5

8014 Asheville Highway Subdivision

2028 Peak Hour Traffic Volumes - PROJECTED TRAFFIC CONDITIONS WITHOUT THE PROJECT

Capacity analyses were undertaken to determine the projected LOS in 2028 without the project at the studied intersection. The results are shown in Table 4, and Appendix E includes the capacity analysis worksheets from the software.

As expected, the results in Table 4 show slightly worse vehicle delays at the intersection in the 2028 projected conditions versus the existing 2024 conditions. This result is due to the slight increase in traffic volumes on Asheville Highway due to the assumed general growth.

TABLE 4
2028 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS WITHOUT THE PROJECT

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
Asheville Highway (WB & EB) at Private Driveway (NB)	STOP Unsignalized	Northbound Left/Right	C	22.1	0.054	D	30.3	0.100
		Westbound Left	A	9.4	0.019	C	16.7	0.025

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

- **TRIP GENERATION:**

A generated trip is a single or one-direction vehicle movement entering or exiting the study site. The estimated traffic the 8014 Asheville Highway Subdivision will generate was based on the equations provided by two sources. The trips generated by the 71 single-family detached houses were calculated using rates and equations provided by the Trip Generation Manual, 11th Edition, an Institute of Transportation Engineers (ITE) publication. The trips generated by the 174 townhouses were based on equations provided by Knoxville/Knox County Planning. These equations from Knoxville/Knox County Planning were developed from an extensive local study to estimate townhouse (and apartment) trip generation in the surrounding area and were published in December 1999. For Knox County, this is the preferred rate to use for townhouses and apartments. This local rate calculates slightly higher trip rates than the similar land use in the ITE Trip Generation Manual.

The data and calculations from the ITE and local trip generation study for the proposed land uses are shown in Appendix F. A summary of this information is presented in Table 5a:

TABLE 5a
TRIP GENERATION FOR 8014 ASHEVILLE HIGHWAY SUBDIVISION
174 Attached Townhouses and 71 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
Local Trip Rate	Multi-Family Attached Townhouses	174	1,570	22%	78%		55%	45%	
				20	69	89	69	57	126
#210	Single-Family Detached Housing	71	736	26%	74%		63%	37%	
				14	41	55	45	27	72
Total New Volume Site Trips			**2,306**	**34**	**110**	**144**	**114**	**84**	**198**

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

For the proposed 8014 Asheville Highway Subdivision, it is estimated that 34 vehicles will enter and 110 will exit, for a total of 144 generated trips during the AM peak hour in the year 2028. Similarly, it is estimated that 114 vehicles will enter and 84 will exit, for a total of 198 generated trips during the PM peak hour in the year 2028. The calculated trips generated for an average

weekday are estimated to be 2,306 vehicles for the proposed development. No vehicle trip reductions were included in the calculations or analysis.

Additional trip generation calculations were also made for the adjacent, non-related, proposed Habitat for Humanity Subdivision, which is planned but has not yet been constructed. This subdivision proposes 74 multi-family attached duplexes that have not begun contributing trips to and from Asheville Highway. This subdivision will have access to the highway via Tribute Lane and will not be allowed access to the Proposed Entrance for the 8014 Asheville Highway Subdivision. The trips generated for the single-family attached duplexes in this adjacent subdivision were calculated using rates and equations provided by the Knoxville/Knox County Planning local study. The data and calculations from the local study for this other subdivision are shown in Appendix F. A summary of this information is presented in the following table:

TABLE 5b
TRIP GENERATION FOR ADJACENT HABITAT FOR HUMANITY SUBDIVISION
74 Attached Duplexes

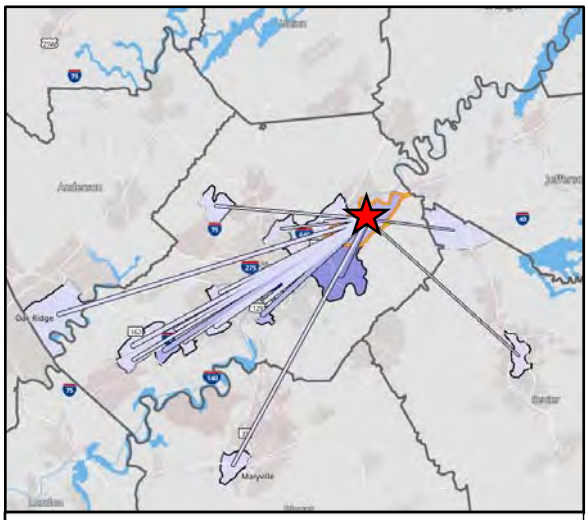
ITE LAND USE CODE	LAND USE DESCRIPTION	# OF UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Local Trip Rate	Multi-Family Attached Duplexes	74	728	22%	78%		55%	45%	
				9	32	41	33	27	60
Total New Volume Site Trips			**728**	**9**	**32**	**41**	**33**	**27**	**60**

Trips calculated by using Fitted Curve Equations from Local Trip Rates

- **TRIP DISTRIBUTION AND ASSIGNMENT:**

The projected trip distribution and assignment for the 8014 Asheville Highway 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 at the existing driveway intersection and where the Proposed Entrance will be located.

During the traffic counts, motorists on Asheville Highway showed a distinct inclination for westbound travel towards Knoxville in the morning and the opposite in the afternoon peak period.



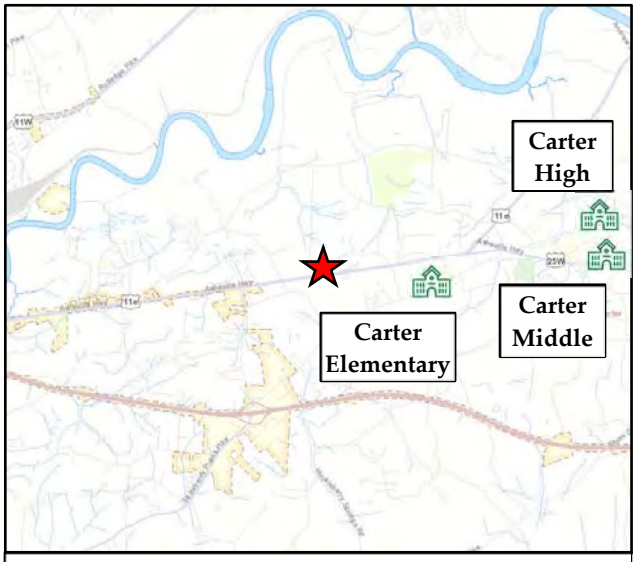
Top 25 Locations of 2021 Census Bureau Work-Based Trips to & from Census Tract 53.01

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 west and southwest. This assertion is based on data from the United States Bureau website for Census Tract 53.01, where the development property is located. Based on 2021 (latest available) census data and as presented in Appendix G, most work-based trips in the surrounding area correspond to Oak Ridge, TN, downtown Knoxville, the University of Tennessee, and areas of West Knoxville. Some of these work-based trips also correspond to Alcoa and Maryville, TN areas. Very few of these work-based trips are shown east of the proposed subdivision.

In addition to employment centers, some generated traffic will travel to and from public and private schools. Schools will be another impetus for external trip-making. The development property is currently zoned for Carter Elementary, Middle, and High School. The zoned public schools for this development property are all located east of the development site. The zoned schools are between 1.5 and 2.6 miles from the proposed subdivision by roadway. The shortest and quickest routes from the proposed subdivision to and from these schools will be made by traveling to and from the east on Asheville Highway. Carter Elementary, however, is a bit further to the south and on Strawberry Plains Pike. Traveling to and from this school will likely include

travel on South Molly Bright Road, east of the development site, which intersects Strawberry Plains Pike just southwest of the elementary school.

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. This development will be outside the PRZ for all the zoned schools, and all school-age children attending public schools in the development will be able to utilize this service if desired.



Zoned Public School Locations

Based on these factors, Figure 6 shows the projected distribution of traffic entering and exiting the proposed residential subdivision at the Proposed Entrance. Overall, the majority of traffic generated by future residents in the subdivision is expected to occur to and from the west on Asheville Highway.

Figure 7a shows the traffic assignment of the computed trips generated by the 8014 Asheville Highway Subdivision. This assignment is based on the assumed distribution of trips shown in Figure 6.

Furthermore, several other additional proposed non-related residential subdivisions are in various development stages and are expected to also impact the studied intersection due to their generated trips. These other residential subdivisions include the previously discussed Habitat for Humanity Subdivision, additional phases in the Neal's Landing and The Ridge at Neals Landing Subdivisions, and the 0 Asheville Highway Subdivision. Other than the Habitat for Humanity Subdivision, all of these known proposed residential subdivisions are a bit further to the west off Asheville Highway. The additional phases in the Neal's Landing and The Ridge at Neals Landing Subdivisions will be north of the signalized intersection of Asheville Highway at Brakebill Road and Neals Landing Road, approximately 1 mile away. The 0 Asheville Highway Subdivision will be slightly east of Cash Road, approximately 1,500 feet away.

Figure 7b shows the traffic assignment of the computed trips generated by the adjacent Habitat for Humanity Subdivision. Figure 7c shows the proposed 0 Asheville Highway Subdivision assignment. Figure 7d shows the proposed additional phases in the Neal's Landing and The Ridge at Neals Landing Subdivisions assignment. These additional future residential developments are also assumed to be fully occupied by 2028, and the trips shown in Figures 7b, 7c, and 7d are also based on the projected distribution patterns shown in Figure 6. These projected traffic volumes for the other subdivisions were obtained from the other transportation impact studies Ajax Engineering, LLC produced.

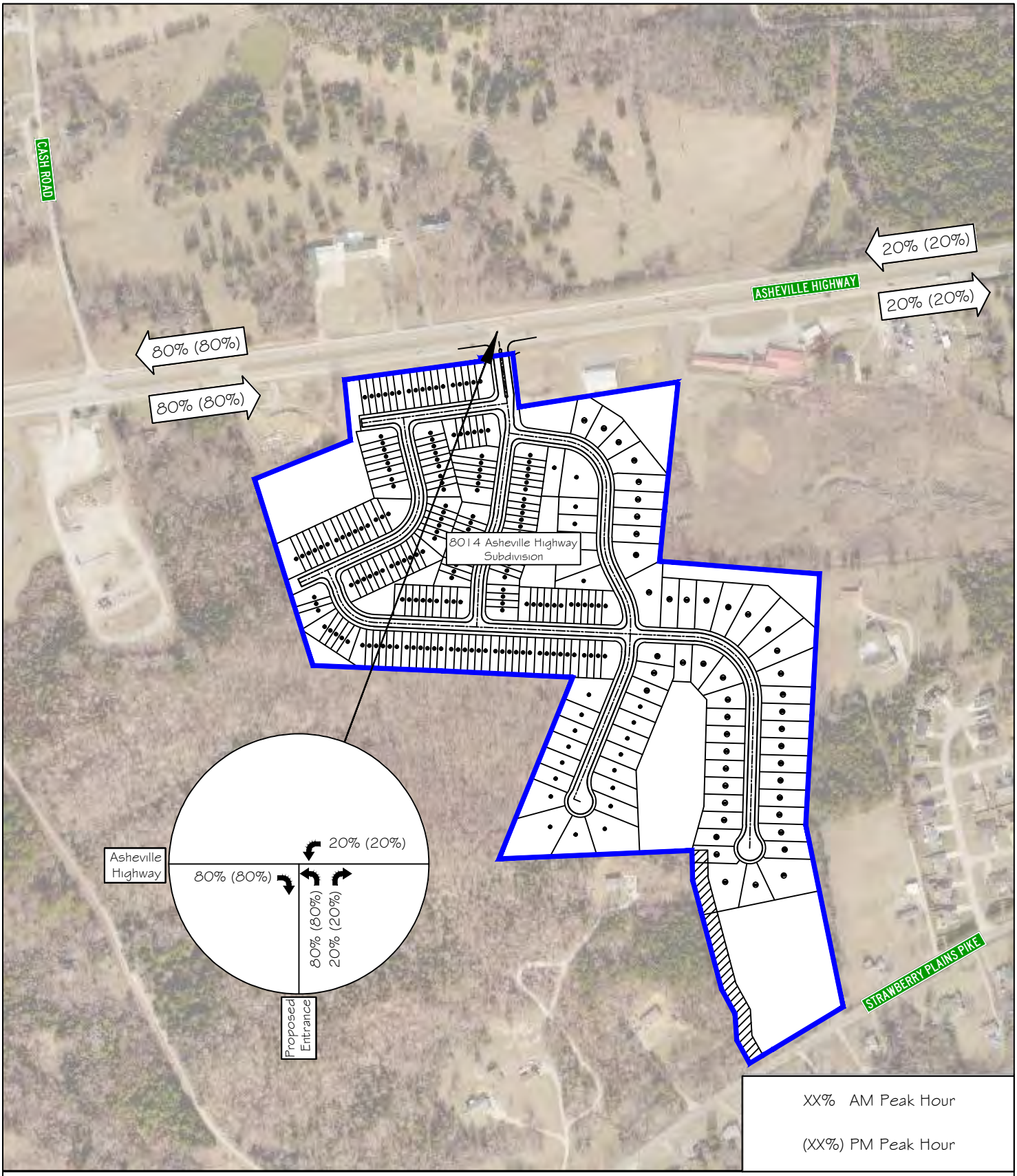


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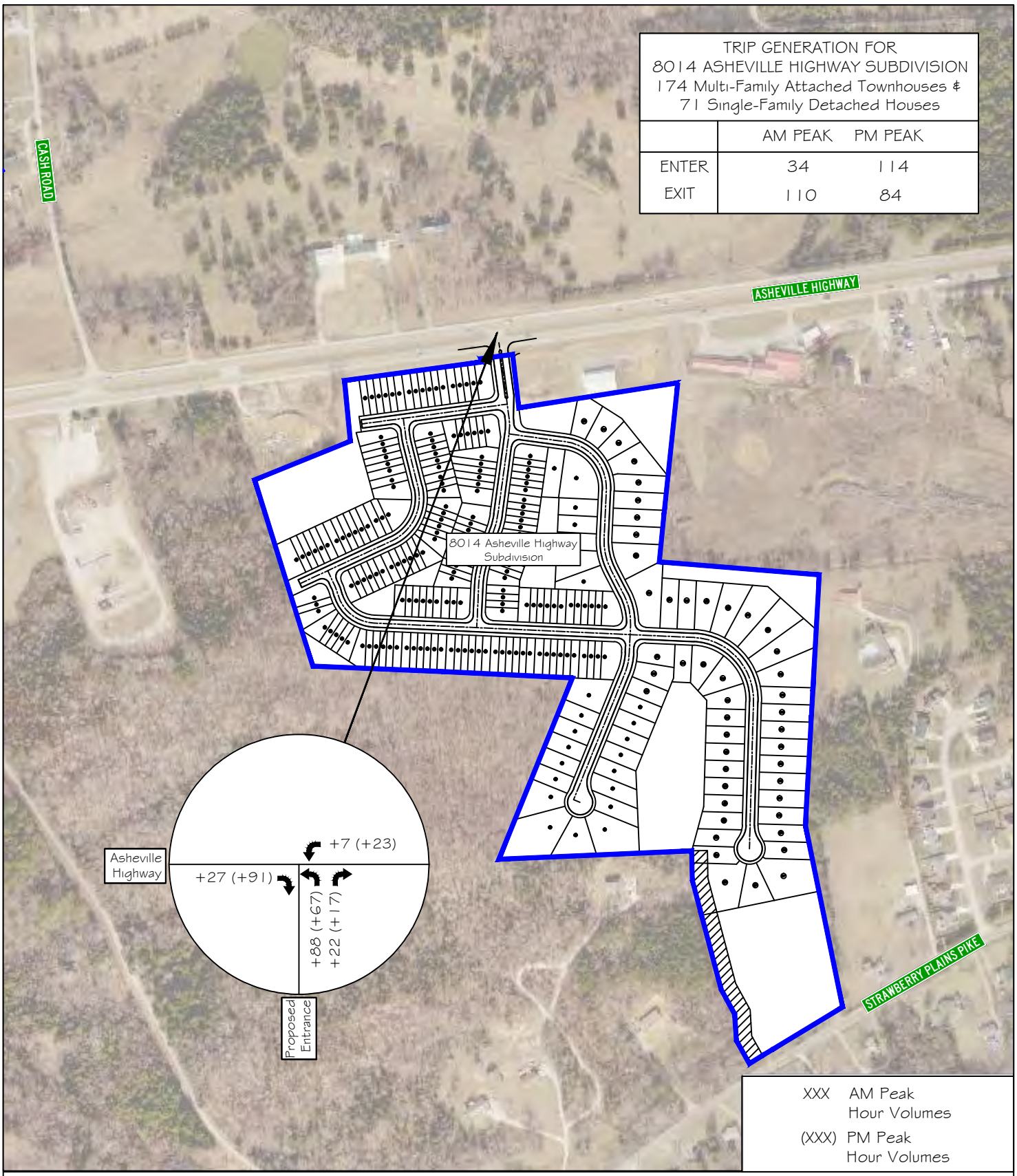
FIGURE 6

8014 Asheville Highway Subdivision

Directional Distribution of Generated Traffic during AM and PM Peak Hour



TRIP GENERATION FOR
8014 ASHEVILLE HIGHWAY SUBDIVISION
174 Multi-Family Attached Townhouses &
71 Single-Family Detached Houses

	AM PEAK	PM PEAK
ENTER	34	114
EXIT	110	84

XXX AM Peak Hour Volumes

(XXX) PM Peak Hour Volumes

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FIGURE 7a

8014 Asheville Highway Subdivision

Traffic Assignment of Generated Traffic during AM and PM Peak Hour for 8014 Asheville Highway Subdivision

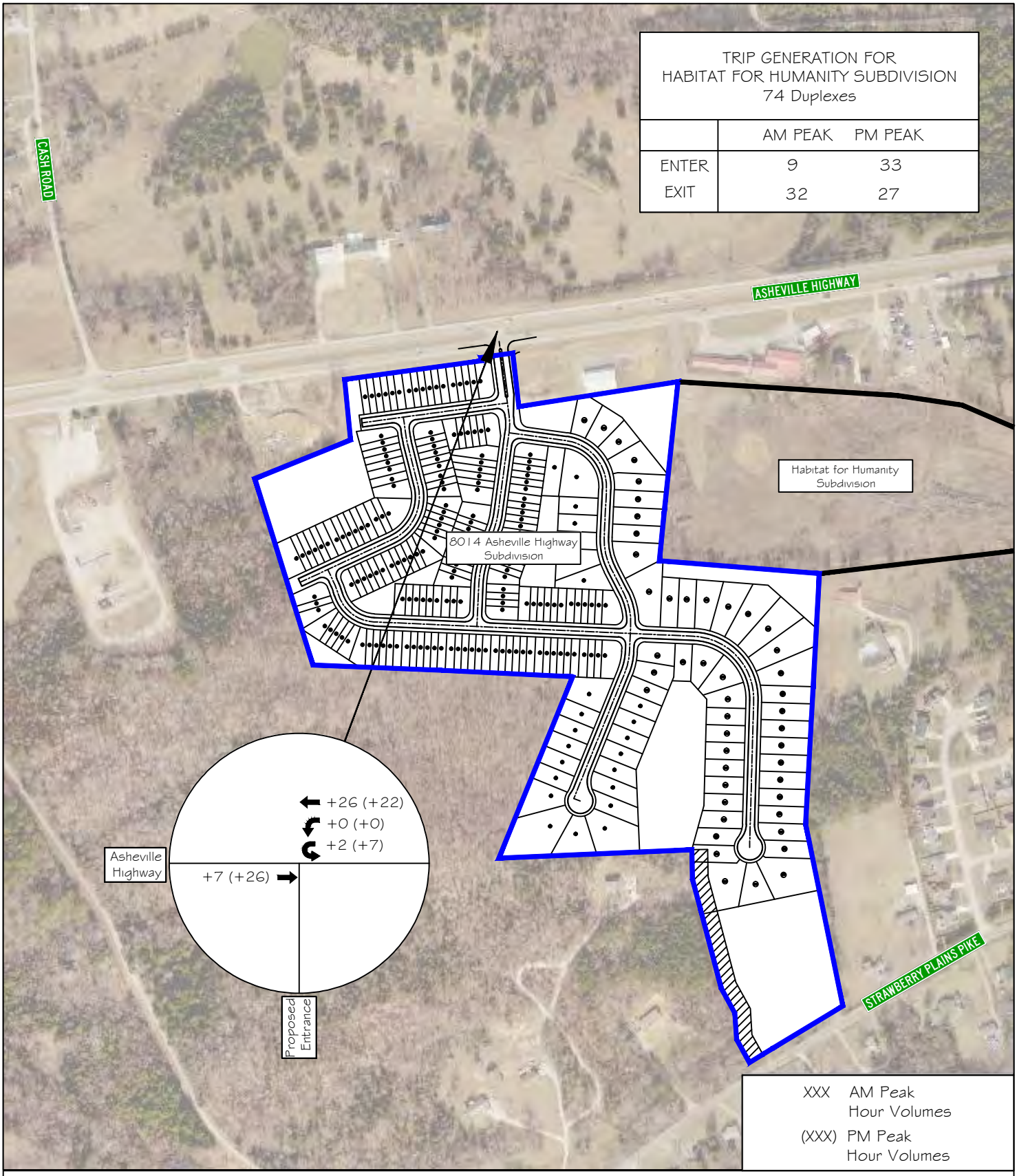

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FIGURE 7b

8014 Asheville Highway Subdivision

Traffic Assignment of Generated Traffic during AM and PM Peak Hour for Habitat for Humanity Subdivision

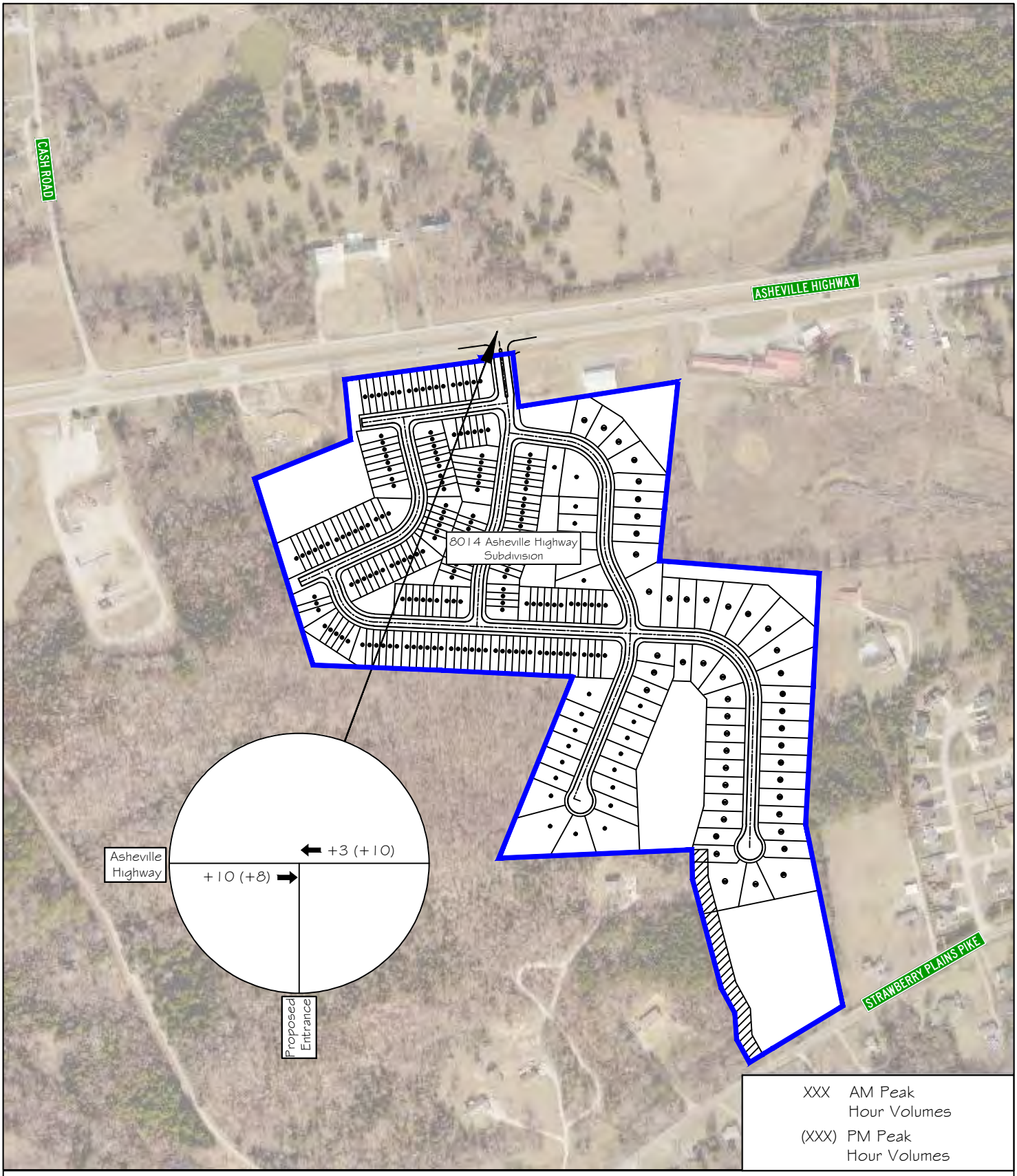

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FIGURE 7c

8014 Asheville Highway Subdivision

Traffic Assignment of Generated Traffic during AM and PM Peak Hour for 0 Asheville Highway Subdivision

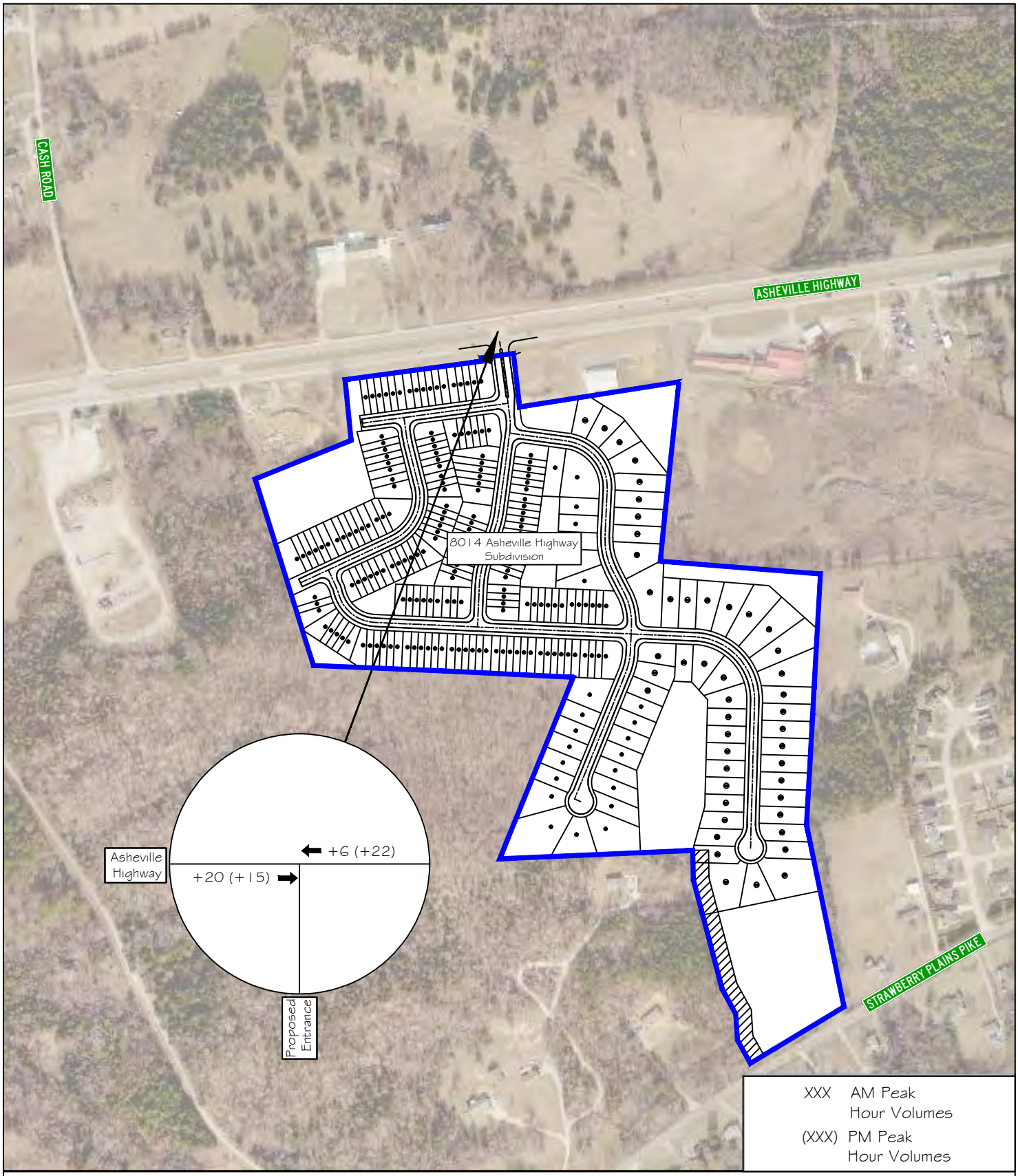

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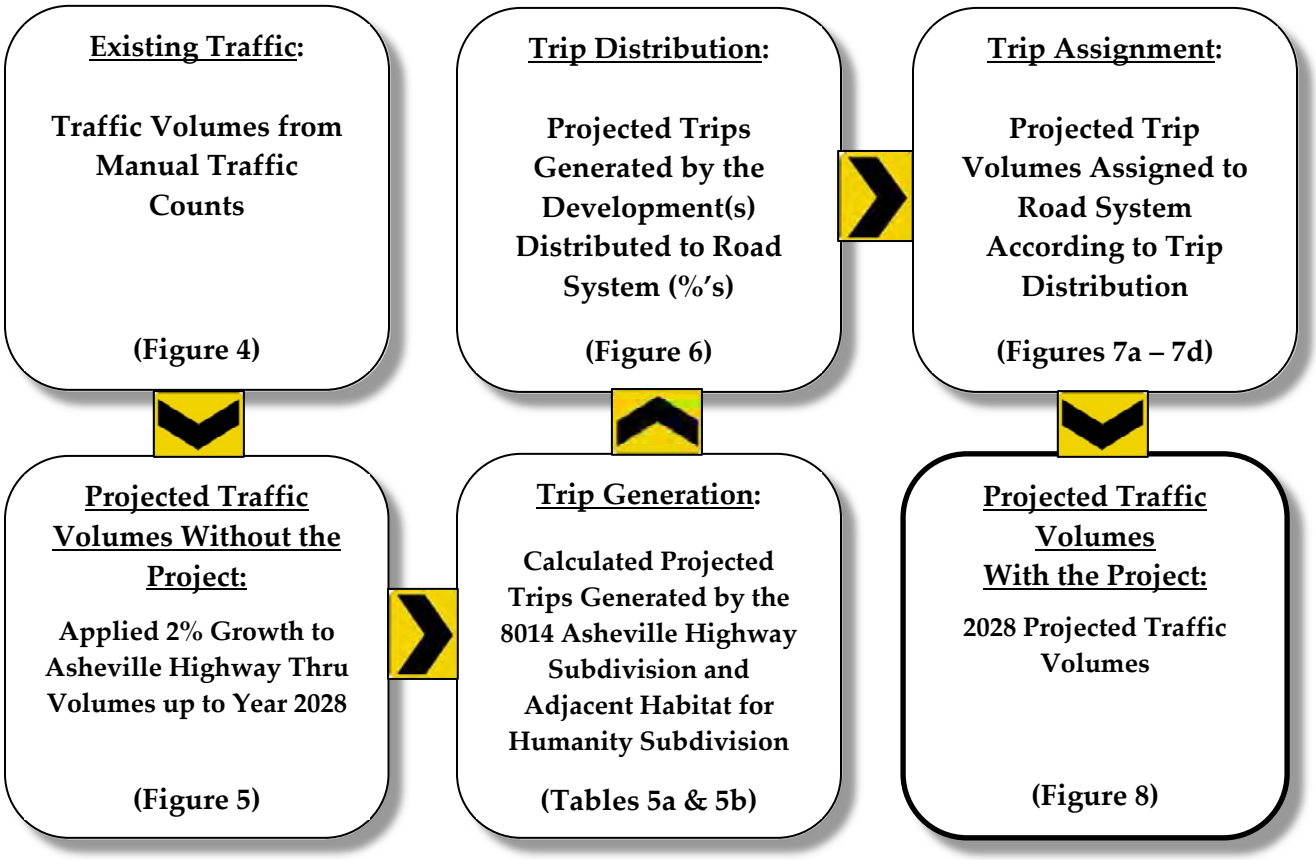
FIGURE 7d

8014 Asheville Highway Subdivision

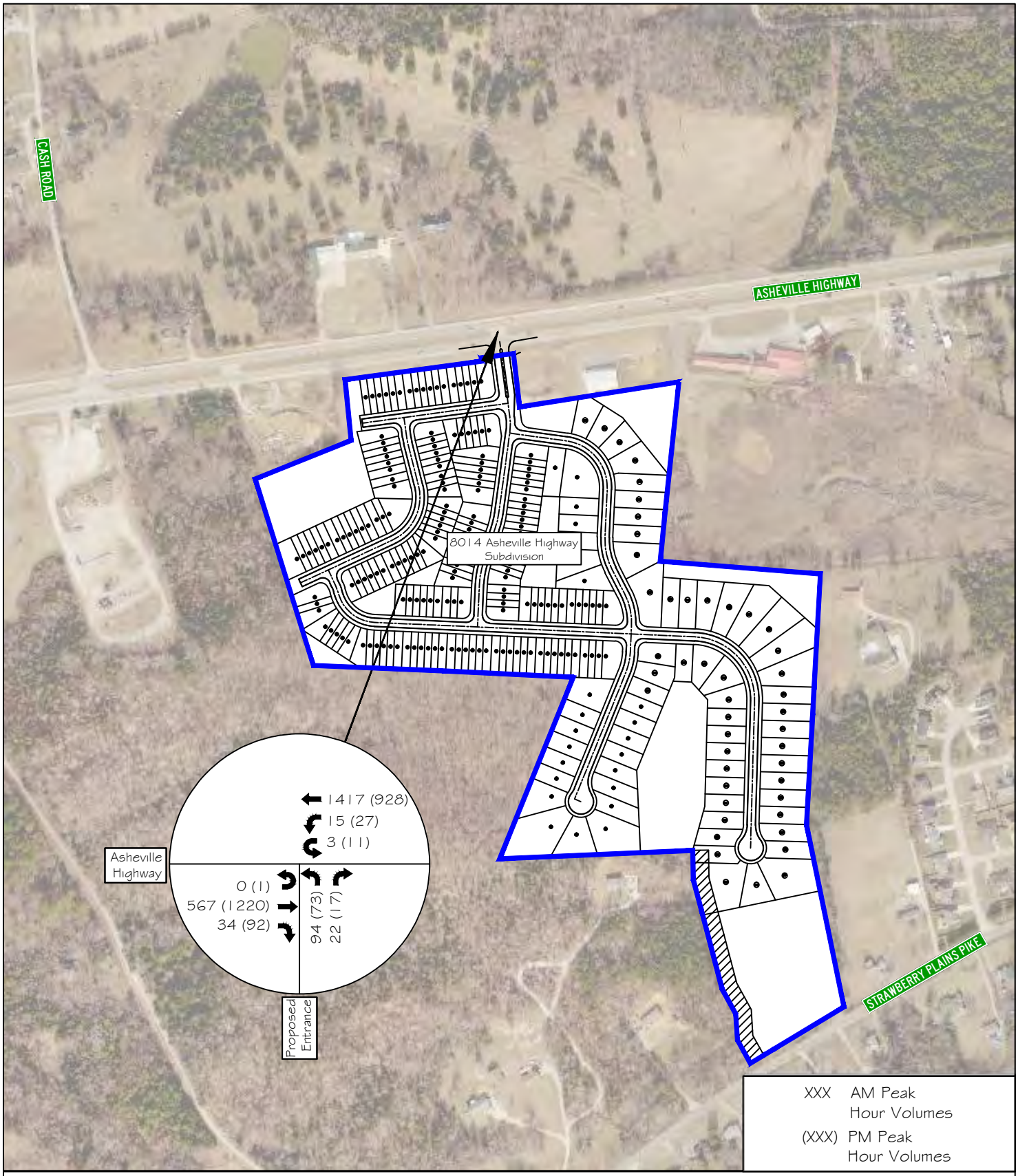
Traffic Assignment of Generated Traffic during AM and PM Peak Hour for Neals Landing Subdivisions

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

Several additive steps were taken to estimate the total projected traffic volumes at the Proposed Entrance when the 8014 Asheville Highway Subdivision and other nearby subdivisions are constructed and fully occupied in 2028. The steps are illustrated below for clarity and review:



The calculated peak hour traffic generated by the 8014 Asheville Highway 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 Proposed Entrance when the 8014 Asheville Highway Subdivision is fully built and occupied in 2028. In addition to the 8014 Asheville Highway Subdivision trips, projected 2028 volumes also included the additional trips by the other known proposed residential developments, including the Neals Landing Subdivisions phases, 0 Asheville Highway, and Habitat for Humanity Subdivisions. Figure 8 shows the projected 2028 AM and PM peak hour volumes for the 8014 Asheville Highway Subdivision trips at the Proposed Entrance, including the trips from the other proposed non-related residential developments that are expected to be fully built and occupied by 2028.



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

NOT TO SCALE

NORTH

FIGURE 8

8014 Asheville Highway Subdivision

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

Capacity analyses were conducted to determine the projected LOS at the Proposed Entrance with all the development traffic in 2028, shown in Figure 8. Intersection capacity results from the projected 2028 peak hour traffic are shown in Table 6. Appendix E includes the worksheets for the projected 2028 peak hour capacity analyses.

As shown in Table 6, the northbound left-turn lane at the Proposed Entrance is projected to operate at LOS F with substantial delays in the PM peak hour. Note: The Proposed Entrance was modeled in the software with two northbound lanes: one for exiting right turns towards the east and one for exiting left turns towards the west. The entrance was also modeled with an exclusive westbound left lane in the median of Asheville Highway and an exclusive eastbound right-turn lane on Asheville Highway. These lanes are discussed further in the following sections of the report.

TABLE 6
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
Asheville Highway (WB & EB) at Proposed Driveway (NB)	STOP Unsignalized	Northbound Left	F	67.4	0.824	F	301.6	1.452
		Northbound Right	B	10.6	0.036	B	14.1	0.046
		Westbound Left	B	10.2	0.057	C	20.6	0.248

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:**

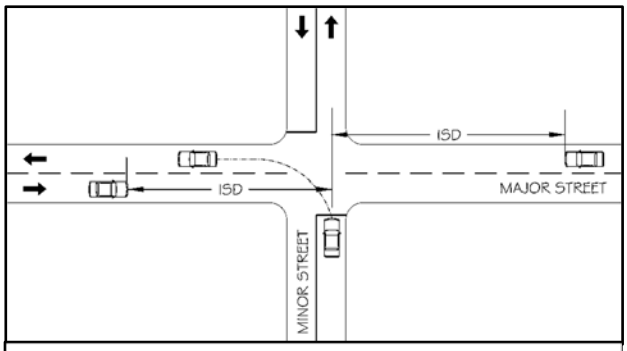
The study area was investigated for potential existing and future safety issues when the development is constructed. These transportation features are discussed in the following pages.

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



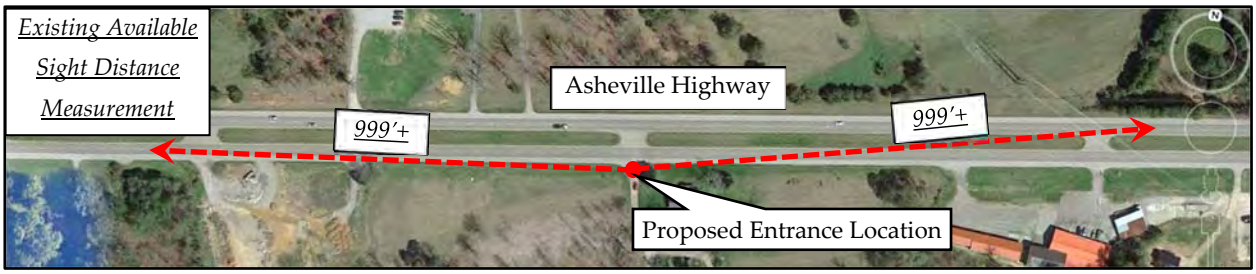
Intersection Sight Distance Diagram

With a posted speed limit of 55 mph on Asheville Highway with four lanes and a 30-foot median, the ISD is 750 feet for left turns exiting the development site. This value is calculated based on

AASHTO's (American Association of State Highway Transportation Officials) and TDOT's guidance. This distance is required for a motorist to safely exit to the left (westbound) onto Asheville Highway from the Proposed Entrance. The ISD for a right-turn movement from the Proposed Entrance is 530 feet.

Visual observations of the sight distances at the location of the Proposed Entrance were undertaken. Using a Nikon Laser Rangefinder at the Proposed Entrance location, the available sight distance was visually estimated to be 999'+ (limit of the rangefinder) to the east and west. Based on these visual observations, the available sight distances from the Proposed Entrance are expected to be adequate for motorists exiting the subdivision.

Images of the existing sight distance at the Proposed Entrance location are labeled below with the required ISD and rangefinder-measured sight distances.



View of Sight Distance on Asheville Highway at the Proposed Entrance (Looking West)

View of Sight Distance on Asheville Highway at the Proposed Entrance (Looking East)

- **EVALUATION OF TURN LANE THRESHOLDS**

The need for separate left and right-turn lanes was evaluated in the projected 2028 conditions for the Proposed Entrance at Asheville Highway.

The criteria used for the turn lane evaluation at the Proposed Entrance on Asheville Highway was based on TDOT's "Highway System Access Manual" since it is located on a State Route. The evaluation was based on the posted speed limit of 55 mph on Asheville Highway. This design policy relates vehicle volume thresholds based on prevailing speeds for two- and four-lane roadways.

According to TDOT's guidelines and based on the projected 2028 peak hour traffic volumes, the warrant threshold for a separate eastbound right-turn lane on Asheville Highway at the Proposed Entrance was met in the AM and PM peak hours. The threshold for a separate westbound left-turn lane was also fully met in the AM and PM 2028 projected conditions. The worksheets for these evaluations are provided in Appendix H.

- **PROJECTED VEHICLE QUEUES**

The Synchro traffic software also calculates the 95th percentile vehicle queues. The 95th percentile vehicle queue is the recognized measurement in the transportation engineering profession as the design standard used when considering vehicle queue lengths. Vehicle queues are another component of an intersection's assessment. A 95th percentile vehicle queue length means 95% certainty that the vehicle queue will not extend beyond that point. The assessment results are shown in Table 8 and provided within the Synchro capacity result worksheets in Appendix E.

In most instances, SimTraffic, a companion software to Synchro, is used to simulate traffic and generate vehicle queue lengths. However, SimTraffic cannot accurately model intersections with center medians and truly reflect the effects of vehicle gap acceptance. SimTraffic will only model/allow a vehicle to turn left when a gap in both directions of traffic is sufficient (i.e., the vehicles are not allowed to cross halfway into the center median and wait for another gap to enter the opposite lane traffic stream). Due to this limitation, the Synchro 95th percentile vehicle queue results are included since they account for two-stage left turns when the median is sufficient to store a vehicle temporarily. With a median width of 30 feet on Asheville Highway, Synchro was used to measure the 95th percentile queues since adequate storage space for a single vehicle will

be available in the median as a temporary refuge before completing its entire movement. This maneuver was observed in the existing conditions.

As noted in the table, the long vehicle queue results obtained during the AM and PM peak hours for the northbound left lane at the Proposed Entrance should be taken under advisement. This warning is due to this movement operating with high vehicle delays that lead to unstable conditions. As a result, the vehicle queue reported could be longer due to the large volumes on Asheville Highway. The other reportable vehicle queue lengths are shown to be quite minimal in the projected 2028 AM and PM peak hours.

TABLE 7
TURN LANE STORAGE & VEHICLE QUEUE SUMMARY -
2028 PROJECTED PEAK HOUR TRAFFIC WITH THE PROJECT

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	PROVIDED STORAGE LENGTH (ft)	SYNCHRO 95th PERCENTILE QUEUE LENGTH (ft) [1]		ADEQUATE LENGTH?
				AM PEAK HOUR	PM PEAK HOUR	
Asheville Highway (WB & EB) at Proposed Driveway (NB)	STOP Unsignalized	Northbound Left	TBD	158 *	325 *	✔
		Northbound Right	TBD	3	3	✔
		Eastbound U-Turn/Left	TBD	5	25	n/a

[1] Distances listed are based on vehicle length = 25 feet
* Actual vehicle queue result could be longer due to unstable conditions
TBD = To be determined

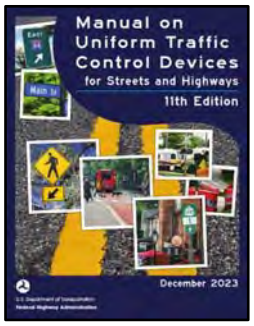
CONCLUSIONS & RECOMMENDATIONS

The following is an overview of recommendations to minimize the transportation impacts of the 8014 Asheville Highway Subdivision on the adjacent transportation system while attempting to achieve an acceptable traffic flow and safety level. The recommendations also take into account the nearby non-related proposed residential subdivisions along Asheville Highway.

Asheville Highway at Proposed Entrance: This intersection is projected to operate with average vehicle delays and minimal vehicle queues for all movements except for exiting northbound left turns towards the west. This lane will experience considerable vehicle delays and queues in the AM and PM peak hours.

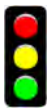
1a) Due to this significant, calculated vehicle delay and queues for the northbound left-turn lane at the Proposed Entrance, a further investigation was made to determine if this intersection could potentially meet traffic signal warrants in the projected 2028 conditions. The overall methodology of determining whether an intersection could be signalized is presented in the following:

Methodology:



The Manual on Uniform Traffic Control Devices – 11th Edition (MUTCD) presents nine different warrants the traffic engineering profession has developed to determine whether a traffic signal is warranted. These warrants cover a broad range of minimum elements required to indicate whether a traffic signal is justified for any particular location. These elements include traffic volumes, pedestrian volumes, crash history, and other factors. The MUTCD explicitly states that a traffic control signal should not be installed unless one or more of the Manual's signal warrants are met. However, the satisfaction of a warrant does not entirely in itself justify the need for a traffic signal. Sometimes, further engineering studies and judgments must be applied before justifying the need for a traffic signal installation. These additional studies ensure that a traffic signal's installation will not degrade safety and efficiency.

The MUTCD defines nine different warrants, four are listed below, and two of which are potentially applicable for this intersection at this time based on TDOT's preference and are explained in the following:



Warrant #1, Eight-Hour Vehicular Volume:

Warrant #1 is comprised of 2 conditions – A and B. The Minimum Vehicular Volume, Condition A, is intended for applications where the volume of intersecting traffic is the principal reason for consideration of signal installation. The Interruption of Continuous Traffic, Condition B, is intended for use at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

Warrant #2, Four-Hour Vehicular Volume:

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Warrant #3, Peak Hour:

The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. This warrant has two conditions, A and B, and if either is satisfied, can be used to justify a traffic signal. This warrant is used for unique situations.

Warrant #7, Crash Experience

The Crash Experience signal warrant conditions are intended for applications where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

Even though nine warrants are offered to justify a traffic signal, according to the TDOT Traffic Signal Manual, the agency heavily emphasizes Warrant #1 (Eight Hour Vehicular Volume) and Warrant #7 (Crash Experience). Even though Warrant #2 and 3 are not primary warrants used by TDOT, they are included in this study.

The intersection of Asheville Highway at the Proposed Entrance was evaluated in the projected 2028 conditions to determine whether a traffic signal could be justified based on the MUTCD Warrants listed above. Road "A" was used as the minor side street for the warrant analysis, and Asheville Highway was the major street. Warrant #7 was not analyzed at this intersection for this study and was omitted because one of the primary criteria for an intersection to meet the warrant is an "Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency…" Furthermore, the TDOT crash data discussed previously in the report did not show any vehicle crashes at this intersection over the past three calendar years.

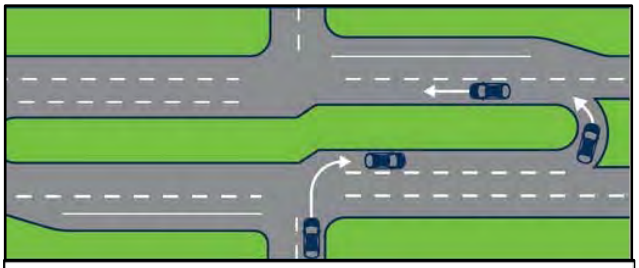
A spreadsheet was developed and used to calculate the potential 2028 traffic volumes generated by the new subdivisions being added to the intersection during the highest 8 hours of traffic based on the assumed trip distribution, and it is included in Appendix I. This analysis determined that Warrants #1, #2, and #3 are not expected to be met in the projected 2028 conditions with the newly generated volumes. Appendix I includes the traffic signal warrant spreadsheet for this intersection evaluation in the projected 2028 conditions.

In conclusion, concerning traffic signal warrants, this intersection is not expected to meet signalization warrants based on the projected 2028 traffic volumes. However, once and if the 8014 Asheville Highway Subdivision is entirely constructed as proposed, it is recommended that a traffic count be re-conducted to ensure that the actual, realized traffic volumes do not exceed what has been estimated in this study.

Since it is apparent that the intersection will likely not meet warrants for signalization in the projected 2028 conditions and is calculated to operate with very poor conditions for the northbound exiting left-turn lane traffic, other remaining potential alternatives would include one of the following:

- Developing an additional entrance to Asheville Highway to the north with a median opening
- Reducing the number of proposed lots.
- Eliminate northbound left turns at the Proposed Entrance by constructing a J-Turn Crossing in the median of Asheville Highway further to the east. This restriction would force exiting westbound motorists to first turn east and then perform a U-turn downstream to travel back towards the west. J-Turns would prevent direct

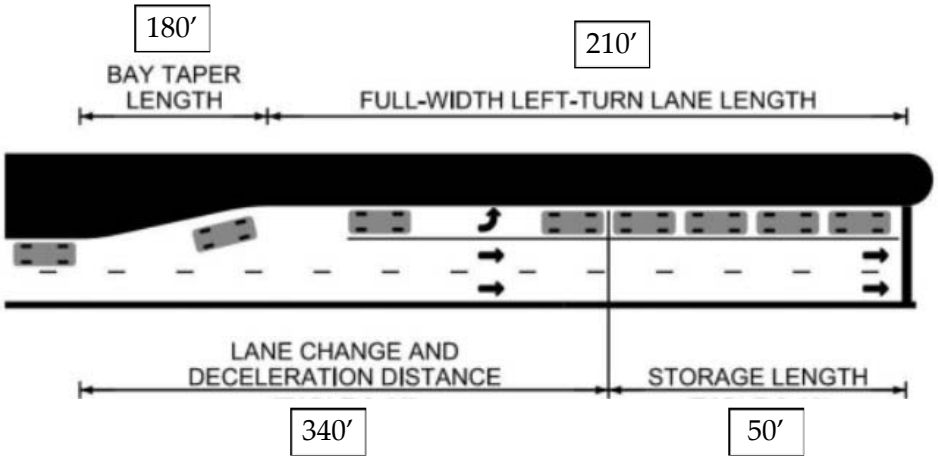
left-turn movements from the entrance road and provide additional safety for exiting left-turn motorists by reducing vehicle conflicts. Overall, a J-Turn could at least equal or take less time than a standard left turn, requiring a motorist to wait for a sufficient gap to cross two lanes of traffic and enter the opposite stream with numerous vehicle conflict points. This alternative would require additional investigation for appropriateness, permission from TDOT, and construction would require additional pavement on the northern edge of Asheville Highway for larger vehicles to perform a U-turn maneuver without tracking off the pavement.



J-Turn Layout Example from MNDOT

1b) The construction of a westbound left-turn lane on Asheville Highway at the Proposed Entrance for entering traffic into the proposed subdivision is warranted based on the projected 2028 traffic volumes and TDOT's thresholds. The recommended lengths for this proposed left-turn lane in the center median include a lane change and deceleration distance of 415 feet and a storage length of 50 feet, for a total length of 465 feet. The bay taper length within the lane change and deceleration distance is recommended to be 180 feet (15:1). With a 180-foot bay taper, the full-width left-turn lane will be 285 feet long.

According to TDOT's Highway System Access Manual, the functional area for an exclusive turn lane includes the "lane change and deceleration distance" and the storage length. The bay taper length is included in the lane change and deceleration distance, as shown in the following TDOT diagram:



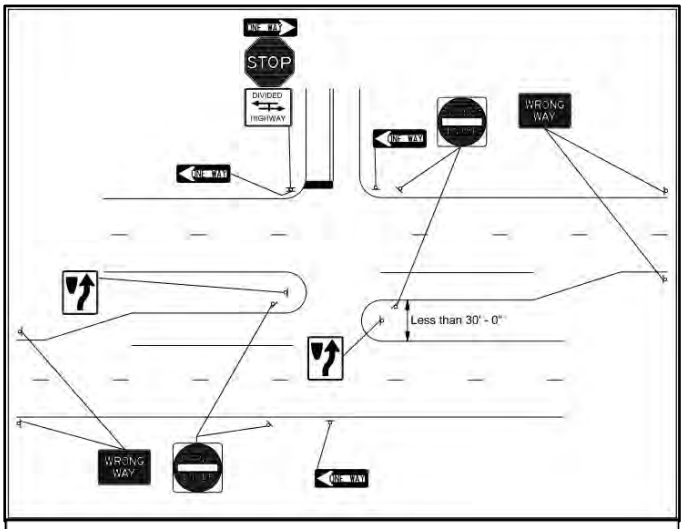
The lane change and deceleration distance are a function of vehicle speeds, and the designer can assume some deceleration before the lane change. A speed of 10 mph less than the posted speed was assumed for this location. For this proposed left-turn lane on Asheville Highway, a vehicle speed of 45 mph was assumed, with vehicle speeds slightly reduced due to some deceleration occurring before the lane change. The longest 95th percentile vehicle queue length for the eastbound left-turn lane on Asheville Highway at the Proposed Entrance was calculated to be 5 and 25 feet in the AM and PM peak hours, respectively, in 2028 and will be fully contained within a storage length of 50 feet. The bay taper length within the lane change and deceleration distance is recommended to be 180 feet (15:1). With a 180-foot bay taper, the full-width left-turn lane will be 210 feet long.

1c) Based on TDOT's warrant thresholds and the projected 2028 traffic volumes, an eastbound right turn lane is also warranted and recommended to be constructed for the Proposed Entrance. This lane should have a lane change and deceleration distance of 340 feet. The bay taper length within the lane change and deceleration distance is recommended to be 180 feet (15:1), and these distances will provide a full-width lane length of 160 feet.

1d) If northbound left turns are allowed from the subdivision towards the east at the Proposed Entrance, separate left and right turn lanes are recommended for the Road "A" approach at Asheville Highway since substantial left-turning vehicle queues are anticipated. It is recommended that the left-turn lane at the Proposed Entrance be the continuation of Road "A" and that the right-turn lane have a separate lane with a minimum vehicle storage of 150 feet. A distance of 150 feet would be approximately the length between the Proposed Entrance stop bar at Asheville Highway to the first intersecting internal street to the south, Road "B". The separate left and right exiting lanes for the development at Asheville Highway should be marked on the pavement with the appropriate white turn arrows and delineated with white lane lines.

1e) The construction of the Proposed Entrance on Asheville Highway will require a TDOT Highway Entrance Permit. The developer will need to apply for this permit and coordinate with TDOT regarding their specific requirements for this entrance and any other proposed median modifications.

1f) Due to the proposed median opening and divided lanes on Asheville Highway, many regulatory signs should be posted to reduce the possibility of wrong-way vehicles. The following image from Figure 2.10 in TDOT's Traffic Design Manual illustrates the signage required for the Proposed Entrance at Asheville Highway.

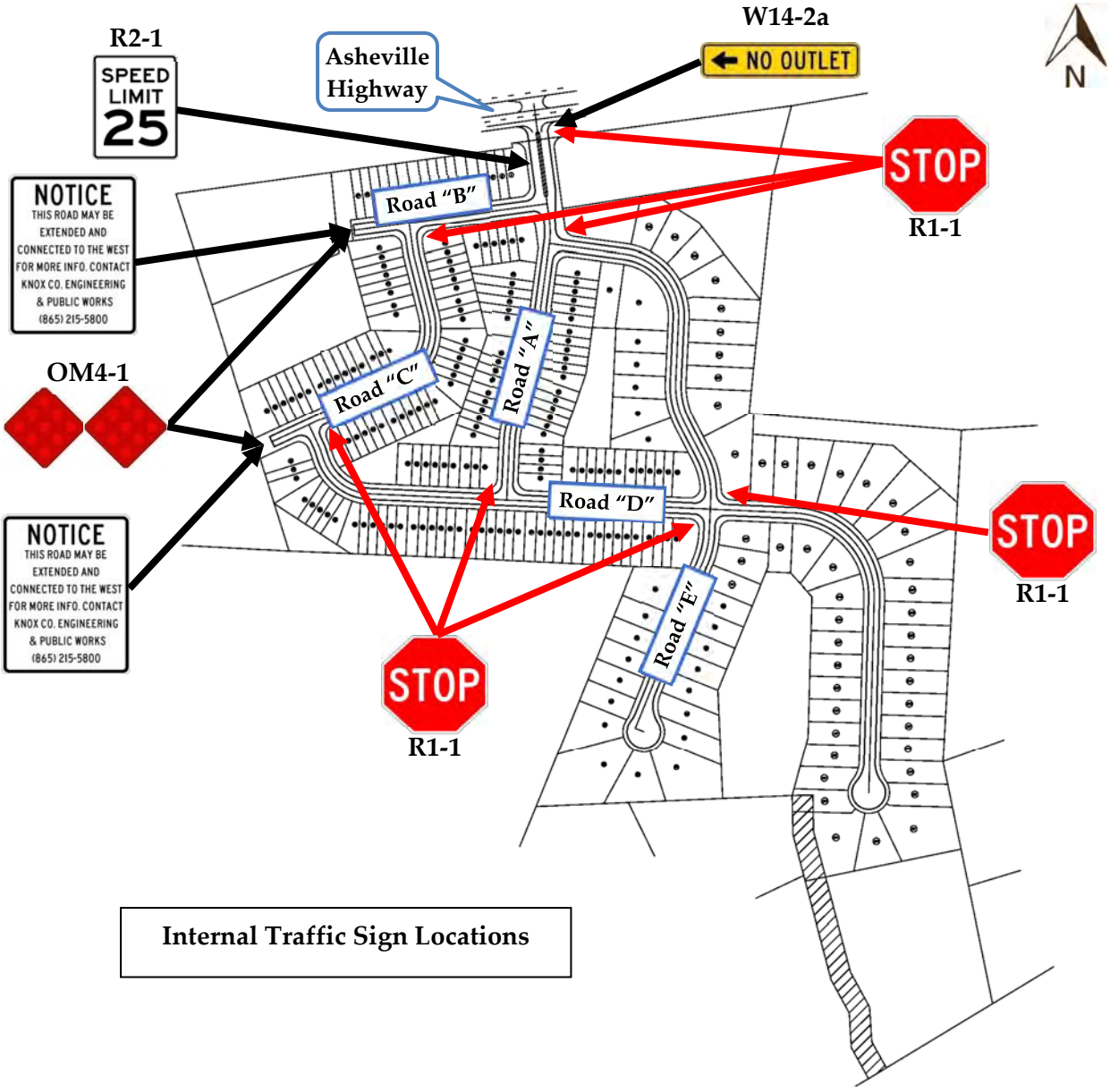


TDOT Traffic Design Manual – Figure 2.10

8014 Asheville Highway Subdivision Internal Roads: The layout plan shows five new private streets, as shown in Figure 3.

2a) A 25-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the Proposed Entrance, Road "A", off Asheville Highway. It is also recommended that a "No Outlet" Sign (W14-2a) be posted at the front of the subdivision. This sign can be posted above or below the street name sign.

2b) Stop Signs (R1-1) with 24" white stop bars are recommended to be installed at the internal road locations, as shown in the image below.



Internal Traffic Sign Locations

At the internal intersection of Road "D" and "E", a four-way intersection is proposed. The above image shows stop Signs (R1-1) on the Road "D" approaches. However, it is recommended that a mini-roundabout with the appropriate signage at this intersection be considered. If a mini-roundabout is not feasible, further discussion with Knox County Engineering in the detailed design phase should include whether this intersection should include Stops Signs (R1-1) on all approaches, the reverse as shown, or as proposed in the image.

2c) The Stop Sign (R1-1) on the entrance approach to Asheville Highway should include a One-Way Sign (R6-1) and a Divided Highway Sign (R6-3), as shown in Figure 2.10 in the TDOT Traffic Design Manual.

2d) Dual end-of-roadway object markers (OM4-1) should be installed at the end of the subdivision's internal roads that end abruptly, which include Roads "B" and "C", as shown in the report. The ends of these internal roads should include hammerhead turnarounds to facilitate motorists' ability to turn around. Furthermore, additional signs should be posted internally at the western end of Roads "B" and "C" to follow Knoxville-Knox County Subdivision regulations. These signs are for notification of possible future street connections. They should state, "NOTICE – This road may be extended and connected to the west – for more info. contact Knox Co. Engineering & Public Works (865) 215-5800".

2e) The proposed lots within the development adjacent to Asheville Highway should not be allowed direct access to the north.

2f) 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 internal intersection sight distance is 250 feet. The required stopping sight distance is 155 feet for a level road grade. The site designer should ensure that internal sight distance lengths are met and account for different proposed road grades.

2g) If directed by the local post office, the site designer should include a parking area and a centralized mail delivery center within the development for the subdivision residents.

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

2i) Several internal roads in the proposed subdivision will have 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.

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

APPENDIX A

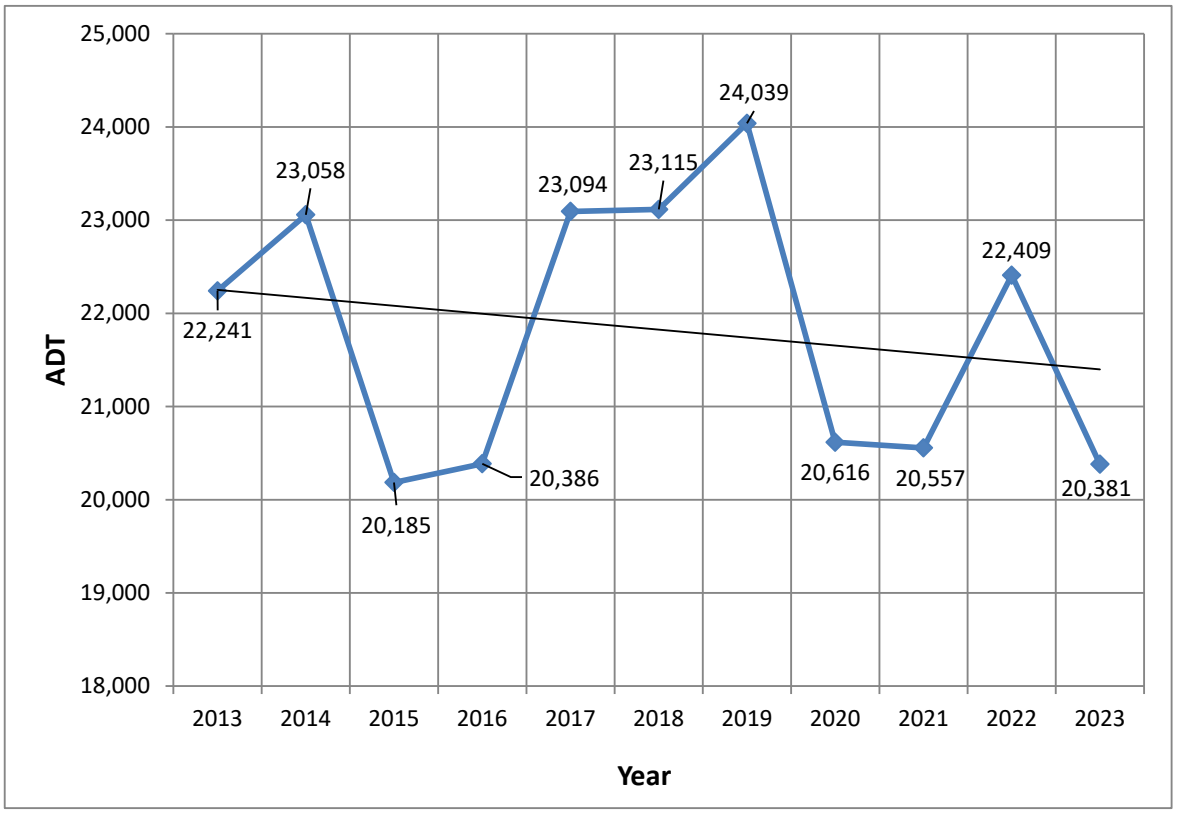
HISTORICAL TRAFFIC COUNT DATA

Historical Traffic Counts

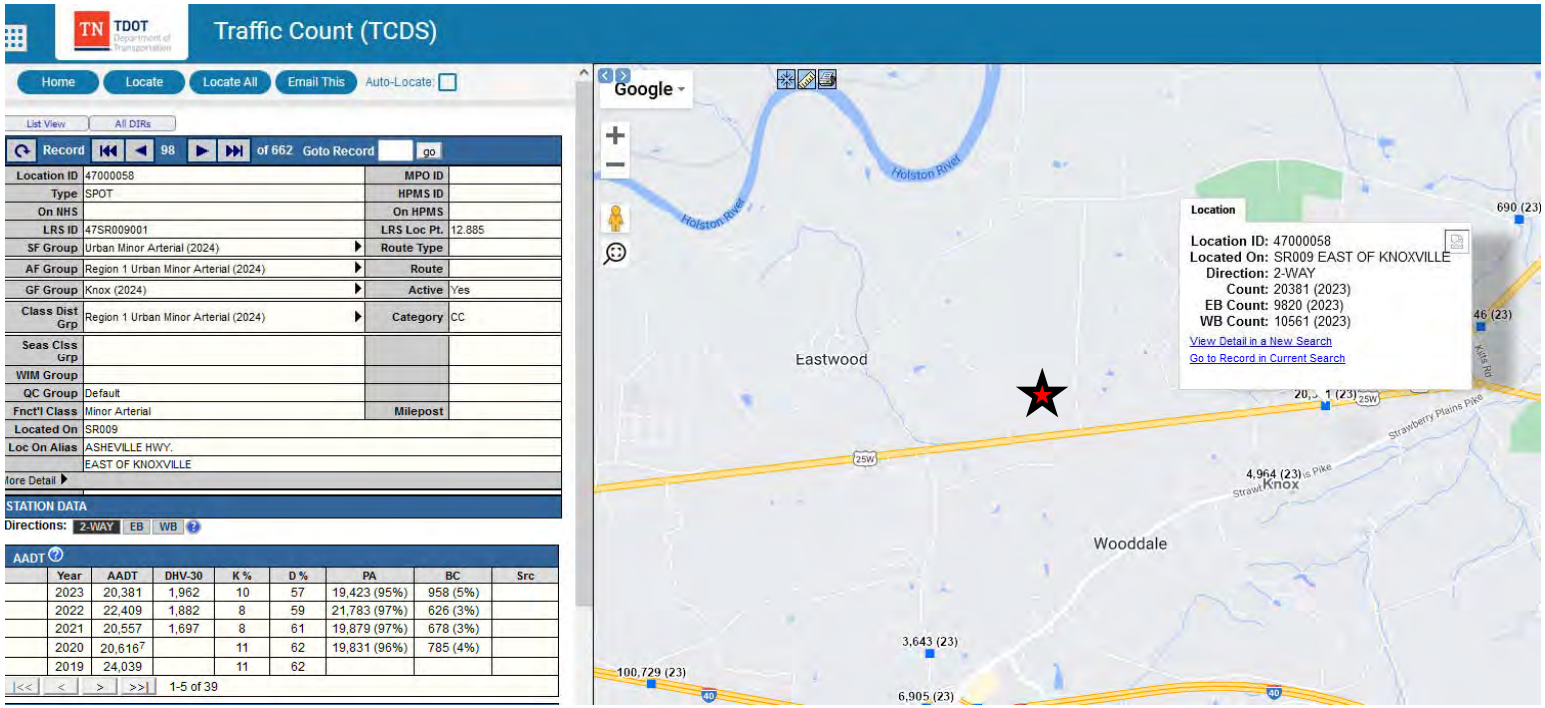
Organization: TDOT
Station ID #: 47000058
Location: Asheville Highway, east of Molly Bright Road

YEAR	AADT
2013	22,241
2014	23,058
2015	20,185
2016	20,386
2017	23,094
2018	23,115
2019	24,039
2020	20,616
2021	20,557
2022	22,409
2023	20,381

Trendline



2013 - 2023 Growth Rate = -8.4%
Average Annual Growth Rate = -0.9%


TN TDOT
Traffic Count (TCDS)
Home
Locate
Locate All
Email This
Auto-Locate:
List View
All DIRs
Record
98
of 662
Goto Record
go
Location ID 47000058
Type SPOT
On NHS
LRS ID 47SR009001
SF Group Urban Minor Arterial (2024)
AF Group Region 1 Urban Minor Arterial (2024)
GF Group Knox (2024)
Class Dist Grp Region 1 Urban Minor Arterial (2024)
Seas Clss Grp
WIM Group
QC Group Default
Fnct'l Class Minor Arterial
Located On SR009
Loc On Alias ASHEVILLE HWY.
EAST OF KNOXVILLE
More Detail
MPO ID
HPMS ID
On HPMS
LRS Loc Pt. 12.885
Route Type
Route
Active Yes
Category CC
Milepost
STATION DATA
Directions: 2-WAY EB WB
AADT
Year AADT DHV-30 K % D % PA BC Src
2023 20,381 1,962 10 57 19,423 (95%) 958 (5%)
2022 22,409 1,882 8 59 21,783 (97%) 626 (3%)
2021 20,557 1,697 8 61 19,879 (97%) 678 (3%)
2020 20,616[7] 11 62 19,831 (96%) 785 (4%)
2019 24,039 11 62
1-5 of 39
Google
Holston River
Eastwood
Wooddale
Knox
Strawberry Plains Pike
25W
40
Location
Location ID: 47000058
Located On: SR009 EAST OF KNOXVILLE
Direction: 2-WAY
Count: 20381 (2023)
EB Count: 9820 (2023)
WB Count: 10561 (2023)
View Detail in a New Search
Go to Record in Current Search
690 (23)
46 (23)
4,964 (23)
3,643 (23)
100,729 (23)
6,905 (23)

APPENDIX B

KNOXVILLE AREA TRANSIT MAP AND INFORMATION

Route 34: Burlington Shopper

How to Read this Schedule

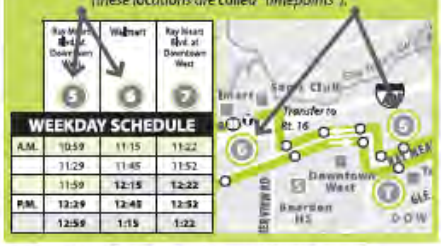
SATURDAY

Going away from downtown			Going toward downtown			
Knoxville Station Bay H	Austin East High	Kirkwood St Superstop WB	Walmart	Kirkwood St Superstop EB	MLK at Beal Bourne Street (Austin-East High School)	Knoxville Station Bay H
		Transfer to Rts. 31 & 32	Transfer to Rt. 23	Transfer to Rts. 31 & 32		
1	2	3	4	5	6	7
			6:55 AM	7:15 AM	7:20 AM	7:35 AM
			7:25 AM	7:45 AM	7:50 AM	8:05 AM
7:15 AM	7:35 AM	7:38 AM	7:55 AM	8:15 AM	8:20 AM	8:35 AM
7:45 AM	8:05 AM	8:08 AM	8:25 AM	8:45 AM	8:50 AM	9:05 AM
8:15 AM	8:35 AM	8:38 AM	8:55 AM	9:15 AM	9:20 AM	9:35 AM
8:45 AM	9:05 AM	9:08 AM	9:25 AM	9:45 AM	9:50 AM	10:05 AM
9:15 AM	9:35 AM	9:38 AM	9:55 AM	10:15 AM	10:20 AM	10:35 AM
9:45 AM	10:05 AM	10:08 AM	10:25 AM	10:45 AM	10:50 AM	11:05 AM
10:15 AM	10:35 AM	10:38 AM	10:55 AM	11:15 AM	11:20 AM	11:35 AM
10:45 AM	11:05 AM	11:08 AM	11:25 AM	11:45 AM	11:50 AM	12:05 PM
11:15 AM	11:35 AM	11:38 AM	11:55 AM	12:15 PM	12:20 PM	12:35 PM
11:45 AM	12:05 PM	12:08 PM	12:25 PM	12:45 PM	12:50 PM	1:05 PM
12:15 PM	12:35 PM	12:38 PM	12:55 PM	1:15 PM	1:20 PM	1:35 PM
12:45 PM	1:05 PM	1:08 PM	1:25 PM	1:45 PM	1:50 PM	2:05 PM
1:15 PM	1:35 PM	1:38 PM	1:55 PM	2:15 PM	2:20 PM	2:35 PM
1:45 PM	2:05 PM	2:08 PM	2:25 PM	2:45 PM	2:50 PM	3:05 PM
2:15 PM	2:35 PM	2:38 PM	2:55 PM	3:15 PM	3:20 PM	3:35 PM
2:45 PM	3:05 PM	3:08 PM	3:25 PM	3:45 PM	3:50 PM	4:05 PM
3:15 PM	3:35 PM	3:38 PM	3:55 PM	4:15 PM	4:20 PM	4:35 PM
3:45 PM	4:05 PM	4:08 PM	4:25 PM	4:45 PM	4:50 PM	5:05 PM
4:15 PM	4:35 PM	4:38 PM	4:55 PM	5:15 PM	5:20 PM	5:35 PM
4:45 PM	5:05 PM	5:08 PM	5:25 PM	5:45 PM	5:50 PM	6:05 PM
5:15 PM	5:35 PM	5:38 PM	5:55 PM	6:15 PM	6:20 PM	6:35 PM
5:45 PM	6:05 PM	6:08 PM	6:25 PM	6:45 PM	6:50 PM	7:05 PM
6:15 PM	6:35 PM	6:38 PM	6:55 PM	7:15 PM	7:20 PM	7:35 PM
6:45 PM	7:05 PM	7:08 PM	7:25 PM	7:45 PM	7:50 PM	8:05 PM
7:15 PM	7:35 PM	7:38 PM	7:55 PM	8:15 PM	8:20 PM	8:35 PM
7:45 PM	8:05 PM	8:08 PM	8:25 PM	8:45 PM	8:50 PM	9:05 PM
8:15 PM	8:35 PM	8:38 PM	8:55 PM	9:15 PM	9:20 PM	9:35 PM
8:45 PM	9:05 PM	9:08 PM	9:25 PM	9:45 PM	9:50 PM	10:05 PM
9:15 PM	9:35 PM	9:38 PM	9:55 PM	10:15 PM	10:20 PM	10:35 PM
9:45 PM	10:05 PM	10:08 PM	10:25 PM	10:45 PM	10:50 PM	11:05 PM
10:15 PM	10:35 PM	10:38 PM	10:55 PM	11:15 PM	11:20 PM	
11:15 PM	11:35 PM	11:38 PM	11:55 PM			

SUNDAY

			8:25 AM	8:45 AM	8:50 AM	9:05 AM
8:15 AM	8:35 AM	8:38 AM	8:55 AM	9:15 AM	9:20 AM	9:35 AM
8:45 AM	9:05 AM	9:08 AM	9:25 AM	9:45 AM	9:50 AM	10:05 AM
9:15 AM	9:35 AM	9:38 AM	9:55 AM	10:15 AM	10:20 AM	10:35 AM
9:45 AM	10:05 AM	10:08 AM	10:25 AM	10:45 AM	10:50 AM	11:05 AM
10:15 AM	10:35 AM	10:38 AM	10:55 AM	11:15 AM	11:20 AM	11:35 AM
10:45 AM	11:05 AM	11:08 AM	11:25 AM	11:45 AM	11:50 AM	12:05 PM
11:15 AM	11:35 AM	11:38 AM	11:55 AM	12:15 PM	12:20 PM	12:35 PM
11:45 AM	12:05 PM	12:08 PM	12:25 PM	12:45 PM	12:50 PM	1:05 PM
12:15 PM	12:35 PM	12:38 PM	12:55 PM	1:15 PM	1:20 PM	1:35 PM
12:45 PM	1:05 PM	1:08 PM	1:25 PM	1:45 PM	1:50 PM	2:05 PM
1:15 PM	1:35 PM	1:38 PM	1:55 PM	2:15 PM	2:20 PM	2:35 PM
1:45 PM	2:05 PM	2:08 PM	2:25 PM	2:45 PM	2:50 PM	3:05 PM
2:15 PM	2:35 PM	2:38 PM	2:55 PM	3:15 PM	3:20 PM	3:35 PM
2:45 PM	3:05 PM	3:08 PM	3:25 PM	3:45 PM	3:50 PM	4:05 PM
3:15 PM	3:35 PM	3:38 PM	3:55 PM	4:15 PM	4:20 PM	4:35 PM
3:45 PM	4:05 PM	4:08 PM	4:25 PM	4:45 PM	4:50 PM	5:05 PM
4:15 PM	4:35 PM	4:38 PM	4:55 PM	5:15 PM	5:20 PM	5:35 PM
4:45 PM	5:05 PM	5:08 PM	5:25 PM	5:45 PM	5:50 PM	6:05 PM
5:15 PM	5:35 PM	5:38 PM	5:55 PM	6:15 PM	6:20 PM	6:35 PM
5:45 PM	6:05 PM	6:08 PM	6:25 PM	6:45 PM	6:50 PM	7:05 PM
6:15 PM	6:35 PM	6:38 PM	6:55 PM	7:15 PM	7:20 PM	7:35 PM
6:45 PM	7:05 PM	7:08 PM	7:25 PM	7:45 PM	7:50 PM	8:05 PM
7:15 PM	7:35 PM	7:38 PM	7:55 PM	8:15 PM	8:20 PM	
7:45 PM	8:05 PM	8:08 PM	8:25 PM			
8:15 PM	8:35 PM	8:38 PM	8:55 PM			

*To determine when the bus serves a location, **match the numbers on the timetable to the numbers on the map** (these locations are called "timepoints").*



WEEKDAY SCHEDULE

A.M.	10:59	11:15	11:22
	11:29	11:45	11:52
	11:59	12:15	12:22
P.M.	12:29	12:45	12:52
	12:59	1:15	1:22

To determine when the bus serves a stop in between timepoints, look at when it is due at the timepoint before your stop and the timepoint after your stop, and you can estimate when it will arrive. Always be at your stop 5 minutes early!

These symbols indicate transfer points or Superstops, which are specific stops where you can transfer to a different route. Routes serving a transfer point or Superstop are indicated at the top of the times schedule, just above the name of the stop.

Cómo leer este horario

Conecte el número dentro del círculo en el mapa con la columna del horario con el mismo número para ver cuándo el bus para en ese lugar (esos lugares se llaman "timepoints").

Para determinar cuándo un bus atiende una parada entre timepoints, mire a qué hora debería llegar al timepoint antes de su parada y el timepoint después de su parada, y podrá estimar la hora de llegada. ¡Siempre llegue a su parada con 5 minutos de antelación!

Estos símbolos indican puntos de trasbordo Superstops que son paradas específicas donde puedes trasbordar a una ruta diferente. Las rutas que atienden un punto de trasbordo o Superstop están indicadas en la parte superior del horario, justo encima del nombre de la parada.

ACCESSIBILITY
All KAT buses are lift-equipped. Paratransit service is also available to those who qualify. For more information, visit katbus.com or call 865-637-3000.

Bike racks are available on all KAT buses. Bikes ride free.

All buses have FREE Wi-Fi.

katbus.com • Customer Service: 865-637-3000

Rider Tools and Tips

Fare Information

Fare Type	Regular Fare	Discounted Fare
1-Ride pass	$1.00	$.50
1-Day pass	$2.00	$1.00
20-Ride pass	$15.00	$7.50
30-Day Pass	$30.00	$15.00

Discounted fare for seniors 65+, Medicare cardholders, and persons with disabilities. KAT ID or Medicare card required.

Children 4 and under ride free.

Knox County School Students also ride free with the Youth Freedom Pass.

To learn more about our fares, the Youth Freedom Pass, and how to buy tickets, visit katbus.com.

Riding Tips

- Plan your trip using this map, the free Transit app, or our homepage trip planner on katbus.com.
- Always arrive at your bus stop 5 minutes early.
- When you see your bus coming, wave to the operator so they know you want to board.
- Have your fare ready when the bus arrives.
- When nearing your destination, pull the cord next to the windows to alert the operator that you want to get off at the next stop.
- View our Passenger Ride Guide at katbus.com.

KAT Holidays

KAT Services do not operate on the following holidays: New Year's Day, Independence Day, Thanksgiving & Christmas.

KAT buses run on a Sunday schedule on the following holidays: Martin Luther King, Jr. Day, Memorial Day, Juneteenth, Labor Day, day after Thanksgiving, day before Christmas.

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

Go paperless!

PLAN your trip, PAY your fare, and SCAN your ticket, all in our FREE official app:

transit

Scan QR code to download Transit

Download on the App Store · GET IT ON Google Play

Herramientas y consejos para los pasajeros

Información sobre tarifas

Tipo de tarifa	Tarifa regular	Tarifa con descuento
Pase de 1 viaje	$1.00	$.50
Pase de 1 día	$2.00	$1.00
Pase de 20 viajes	$15.00	$7.50
Pase de 30 días	$30.00	$15.00

Tarifa descontada para mayores de 65 años, personas con tarjeta de Medicare y personas con discapacidades. Se necesita el ID de KAT o tarjeta de Medicare.

Los niños menores de 4 años viajan gratis.

Los estudiantes de las escuelas públicas del Condado de Knox también viajan gratis con el pase Youth Freedom Pass.

Visite katbus.com para averiguar más sobre nuestras tarifas, el pase para jóvenes y para comprar boletos.

Consejos para viajar

- Planifique su trayecto con este mapa, la aplicación gratuita Transit o el planificador en katbus.com.
- Siempre llegue a la parada del autobús 5 minutos antes.
- Cuando vea que llega el autobús, haga una seña al operador para que sepa que quiere subir.
- Tenga su pago listo cuando llega el autobús.
- Cuando se acerque a su destino, jale del cordón cercano a la ventana para alertar al operador de que quiere bajarse en la siguiente parada.
- Repase nuestra Guía del Pasajero en katbus.com.

Los servicios de KAT no funcionan en los siguientes días feriados: Año Nuevo, Día de la Independencia, Acción de Gracias y Navidad.

Los autobuses de KAT siguen los horarios de los domingos en los siguientes feriados: día de Martin Luther King Jr., Día de los Caídos (Memorial Day), Juneteenth, Día del Trabajador, día después del Día de Acción de Gracias, día antes de Navidad.

Las oficinas de KAT estarán cerradas en todos esos días feriados.

¡Haga todo sin papel!

PLANIFIQUE su viaje, PAGUE la tarifa y ESCANEE su boleto, todo en Transit, ¡nuestra aplicación oficial gratuita! La aplicación se configura en el mismo idioma de su teléfono. Escanee el código QR para descargar Transit.

Accesibilidad

Todos los autobuses de KAT van equipados con un elevador. También existe servicio de paratránsito para quienes cualifiquen. Para más información, visite katbus.com o llame a KAT al 865-637-3000.

34 Burlington Shopper

(Weekdays & Weekends)

Información en español en el interior

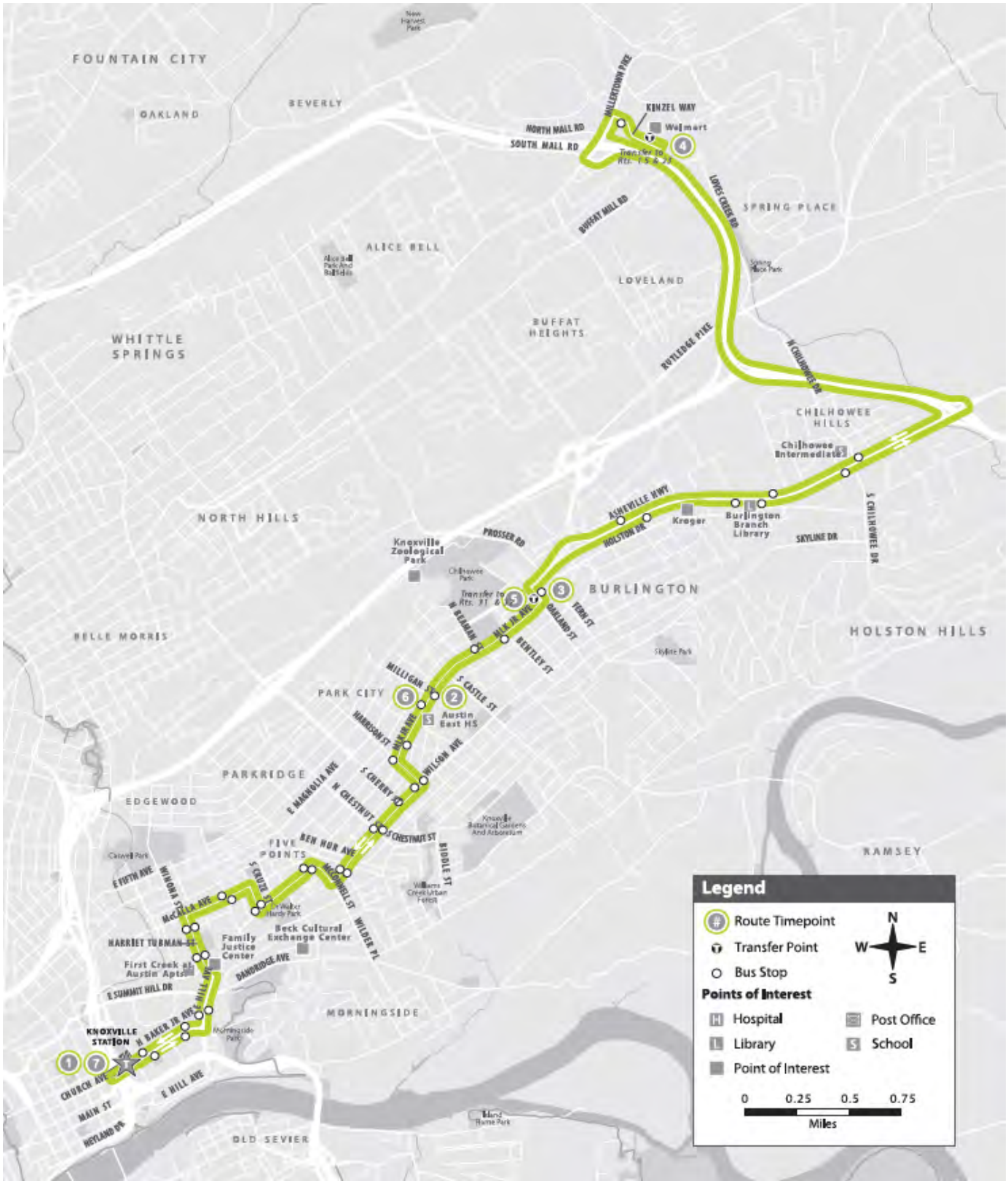
Serves/ Servir:

- Austin-East High School
- Burlington
- Chilhowee Intermediate School
- Chilhowee Park/ Jacob Building
- Civic Auditorium and Coliseum
- Dr. Walter Hardy Park
- First Creek at Austin
- Five Points Neighborhood
- Harriet Tubman Park
- Knoxville Family Justice Center
- Knoxville Station/ Downtown
- Kroger
- The Change Center
- Vine Middle Magnet School
- Walmart

KAT Reimagined

Effective Date: August 26, 2024

kat KNOXVILLE AREA TRANSIT

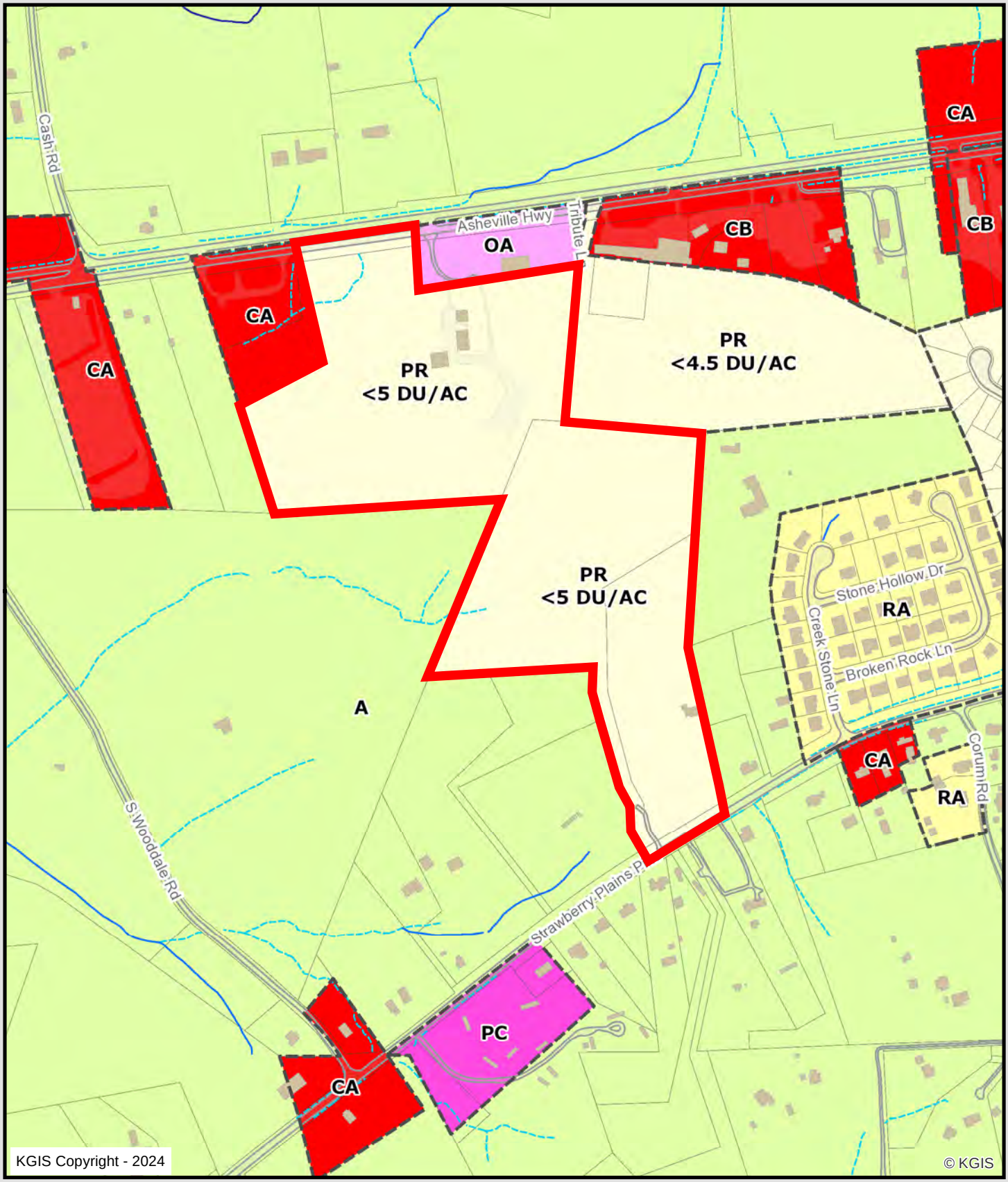

FOUNTAIN CITY
OAKLAND
BEVERLY
ALICE BELL
WHITTLE SPRINGS
LOVELAND
BUFFAT HEIGHTS
SPRING PLACE
CHILHOWEE HILLS
NORTH HILLS
BURLINGTON
HOLSTON HILLS
BELLE MORRIS
PARK CITY
PARKRIDGE
EDGEWOOD
FIVE POINTS
MORNINGSIDE
OLD SEVIER
RAMSEY
KNOXVILLE STATION
Walmart
Kroger
Austin East HS
Chilhowee Intermediate
Burlington Branch Library
Knoxville Zoological Park
Family Justice Center
Beck Cultural Exchange Center
First Creek at Austin Apts
Legend
Route Timepoint
Transfer Point
Bus Stop
Points of Interest
Hospital
Library
Point of Interest
Post Office
School
N
W
E
S
0
0.25
0.5
0.75
Miles

Route 34: Burlington Shopper

WEEKDAY						
Going away from downtown			*Going toward downtown*			
Knoxville Station Bay H	**Austin East High**	**Kirkwood St Superstop WB**	**Walmart**	**Kirkwood St Superstop EB**	**MLK at Beal Bourne Street (Austin-East High School)**	**Knoxville Station Bay H**
		Transfer to Rts. 31 & 32	*Transfer to Rt. 23*	*Transfer to Rts. 31 & 32*		
1	2	3	4	5	6	7
			5:25 AM	5:45 AM	5:50 AM	6:05 AM
			5:55 AM	6:15 AM	6:20 AM	6:35 AM
			6:25 AM	6:45 AM	6:50 AM	7:05 AM
6:15 AM	6:35 AM	6:38 AM	6:55 AM	7:15 AM	7:20 AM	7:35 AM
6:45 AM	7:05 AM	7:08 AM	7:25 AM	7:45 AM	7:50 AM	8:05 AM
7:15 AM	7:35 AM	7:38 AM	7:55 AM	8:15 AM	8:20 AM	8:35 AM
7:45 AM	8:05 AM	8:08 AM	8:25 AM	8:45 AM	8:50 AM	9:05 AM
8:15 AM	8:35 AM	8:38 AM	8:55 AM	9:15 AM	9:20 AM	9:35 AM
8:45 AM	9:05 AM	9:08 AM	9:25 AM	9:45 AM	9:50 AM	10:05 AM
9:15 AM	9:35 AM	9:38 AM	9:55 AM	10:15 AM	10:20 AM	10:35 AM
9:45 AM	10:05 AM	10:08 AM	10:25 AM	10:45 AM	10:50 AM	11:05 AM
10:15 AM	10:35 AM	10:38 AM	10:55 AM	11:15 AM	11:20 AM	11:35 AM
10:45 AM	11:05 AM	11:08 AM	11:25 AM	11:45 AM	11:50 AM	12:05 PM
11:15 AM	11:35 AM	11:38 AM	11:55 AM	12:15 PM	12:20 PM	12:35 PM
11:45 AM	12:05 PM	12:08 PM	12:25 PM	12:45 PM	12:50 PM	1:05 PM
12:15 PM	12:35 PM	12:38 PM	12:55 PM	1:15 PM	1:20 PM	1:35 PM
12:45 PM	1:05 PM	1:08 PM	1:25 PM	1:45 PM	1:50 PM	2:05 PM
1:15 PM	1:35 PM	1:38 PM	1:55 PM	2:15 PM	2:20 PM	2:35 PM
1:45 PM	2:05 PM	2:08 PM	2:25 PM	2:45 PM	2:50 PM	3:05 PM
2:15 PM	2:35 PM	2:38 PM	2:55 PM	3:15 PM	3:20 PM	3:35 PM
2:45 PM	3:05 PM	3:08 PM	3:25 PM	3:45 PM	3:50 PM	4:05 PM
3:15 PM	3:35 PM	3:38 PM	3:55 PM	4:15 PM	4:20 PM	4:35 PM
3:45 PM	4:05 PM	4:08 PM	4:25 PM	4:45 PM	4:50 PM	5:05 PM
4:15 PM	4:35 PM	4:38 PM	4:55 PM	5:15 PM	5:20 PM	5:35 PM
4:45 PM	5:05 PM	5:08 PM	5:25 PM	5:45 PM	5:50 PM	6:05 PM
5:15 PM	5:35 PM	5:38 PM	5:55 PM	6:15 PM	6:20 PM	6:35 PM
5:45 PM	6:05 PM	6:08 PM	6:25 PM	6:45 PM	6:50 PM	7:05 PM
6:15 PM	6:35 PM	6:38 PM	6:55 PM	7:15 PM	7:20 PM	7:35 PM
6:45 PM	7:05 PM	7:08 PM	7:25 PM	7:45 PM	7:50 PM	8:05 PM
7:15 PM	7:35 PM	7:38 PM	7:55 PM	8:15 PM	8:20 PM	8:35 PM
7:45 PM	8:05 PM	8:08 PM	8:25 PM	8:45 PM	8:50 PM	9:05 PM
8:15 PM	8:35 PM	8:38 PM	8:55 PM	9:15 PM	9:20 PM	9:35 PM
8:45 PM	9:05 PM	9:08 PM	9:25 PM	9:45 PM	9:50 PM	10:05 PM
9:15 PM	9:35 PM	9:38 PM	9:55 PM	10:15 PM	10:20 PM	10:35 PM
9:45 PM	10:05 PM	10:08 PM	10:25 PM	10:45 PM	10:50 PM	11:05 PM
10:15 PM	10:35 PM	10:38 PM	10:55 PM	11:15 PM	11:20 PM	
11:15 PM	11:35 PM	11:38 PM	11:55 PM			

APPENDIX C

ZONING MAP



Zoning Map

9.10.24

Knoxville - Knox County - KUB Geographic Information System

Printed: 9/10/2024 at 1:38:36 PM

0 250 500 1,000

ft

APPENDIX D

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: Asheville Highway (EB and WB)
Minor Street: Private Driveway at 8014 Asheville Highway (NB)
Traffic Control: Stop Conditions on Minor Street

9/4/2024 (Wednesday)
Partly Cloudy and Hot
Conducted by: Ajax Engineering

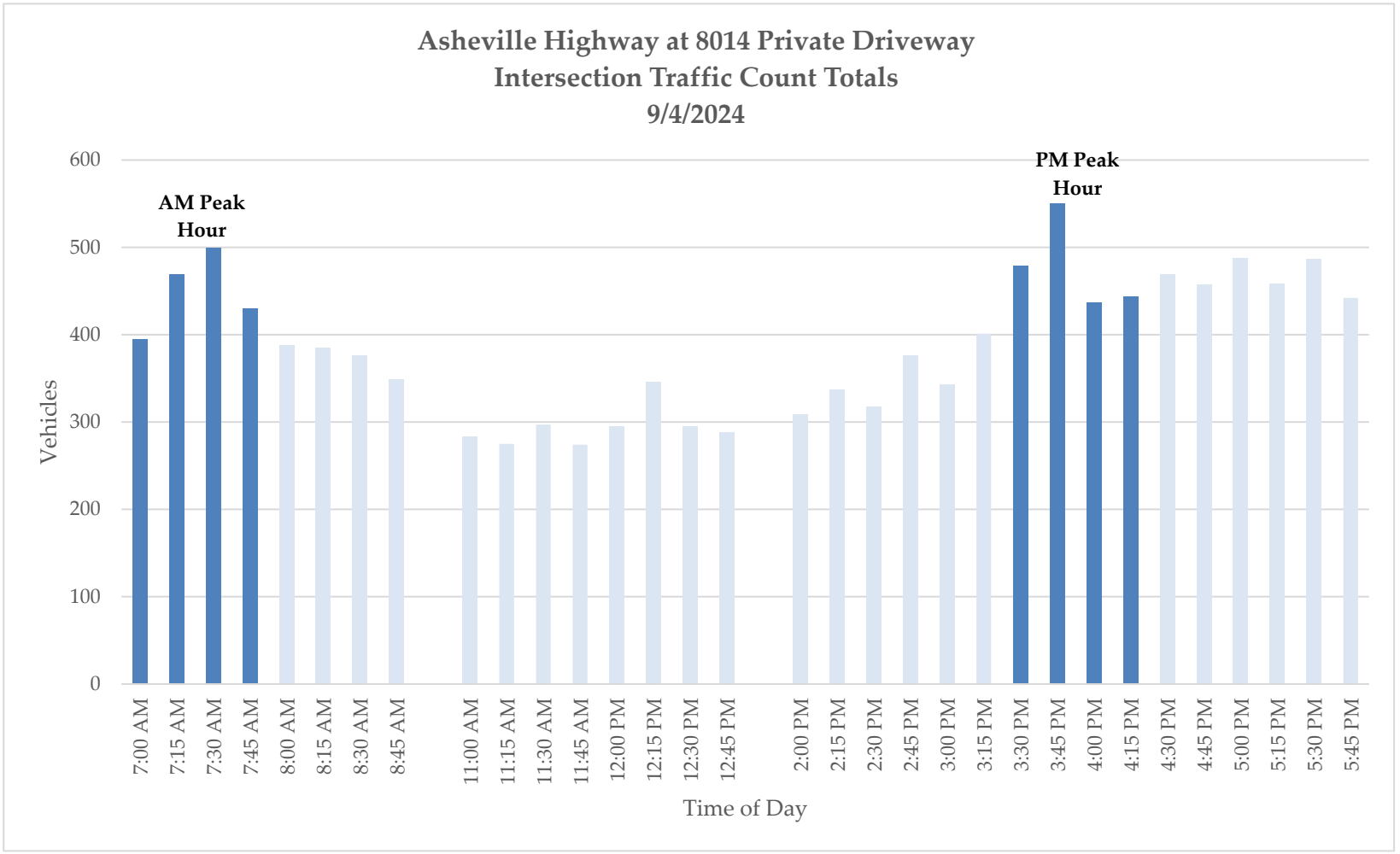
	Asheville Highway			Private Driveway		Asheville Highway				
TIME	WESTBOUND			NORTHBOUND		EASTBOUND			VEHICLE	PEAK
BEGIN	U-TURN	LT	THRU	LT	RT	U-TURN	THRU	RT	TOTAL	HOUR
7:00 AM	0	0	297	0	0	0	97	1	395	**7:00 AM - 8:00 AM**
7:15 AM	0	1	325	1	0	0	142	0	469	
7:30 AM	0	3	363	3	0	0	125	5	499	
7:45 AM	1	4	295	2	0	0	127	1	430	
8:00 AM	0	1	250	1	0	0	136	0	388	
8:15 AM	0	1	242	1	0	0	141	0	385	
8:30 AM	0	0	233	0	0	0	143	0	376	
8:45 AM	2	3	216	0	0	0	126	2	349	
TOTAL	3	13	2221	8	0	0	1037	9	3291	
11:00 AM	1	1	166	1	0	0	113	2	283	
11:15 AM	0	0	139	2	0	1	133	0	275	
11:30 AM	0	0	166	1	0	2	128	0	297	
11:45 AM	0	0	124	0	0	0	149	1	274	
12:00 PM	1	0	153	2	0	0	139	1	295	**12:00 PM - 1:00 PM**
12:15 PM	0	2	176	6	0	0	162	0	346	
12:30 PM	0	1	160	1	0	0	131	2	295	
12:45 PM	2	1	131	1	0	0	152	3	288	
TOTAL	4	5	1215	14	0	3	1107	9	2353	
2:00 PM	1	1	159	2	0	0	145	1	309	
2:15 PM	0	0	159	0	0	1	177	0	337	
2:30 PM	0	1	143	0	0	0	173	0	317	
2:45 PM	3	2	165	0	1	0	205	0	376	
3:00 PM	1	0	141	2	0	1	198	0	343	
3:15 PM	0	0	155	0	0	0	246	0	401	
3:30 PM	1	1	219	1	0	0	257	0	479	**3:30 PM - 4:30 PM**
3:45 PM	1	2	256	0	0	0	290	1	550	
4:00 PM	2	1	178	4	0	1	251	0	437	
4:15 PM	0	0	156	1	0	0	286	0	443	
4:30 PM	0	0	169	0	0	0	300	0	469	
4:45 PM	0	0	162	0	1	0	292	2	457	
5:00 PM	0	1	170	1	2	0	312	2	488	
5:15 PM	0	0	145	3	2	0	307	1	458	
5:30 PM	0	0	178	2	0	0	307	0	487	
5:45 PM	1	0	145	0	0	0	296	0	442	
TOTAL	10	9	2700	16	6	3	4042	7	6793	

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

	Asheville Highway			Private Driveway		Asheville Highway		
TIME	WESTBOUND			NORTHBOUND		EASTBOUND		
BEGIN	U-TURN	LT	THRU	LT	RT	U-TURN	THRU	RT
7:00 AM	0	0	297	0	0	0	97	1
7:15 AM	0	1	325	1	0	0	142	0
7:30 AM	0	3	363	3	0	0	125	5
7:45 AM	1	4	295	2	0	0	127	1
TOTAL	**1**	**8**	**1280**	**6**	**0**	**0**	**491**	**7**
PHF	**0.25**	**0.50**	**0.88**	**0.50**	**-**	**-**	**0.86**	**0.35**
Truck %	**0.0%**	**0.0%**	**3.8%**	**0.0%**	**0.0%**	**0.0%**	**6.1%**	**0.0%**

2024 PM Peak Hour **3:30 PM - 4:30 PM**

	Asheville Highway			Private Driveway		Asheville Highway		
TIME	WESTBOUND			NORTHBOUND		EASTBOUND		
BEGIN	U-TURN	LT	THRU	LT	RT	U-TURN	THRU	RT
3:30 PM	1	1	219	1	0	0	257	0
3:45 PM	1	2	256	0	0	0	290	1
4:00 PM	2	1	178	4	0	1	251	0
4:15 PM	0	0	156	1	0	0	286	0
TOTAL	**4**	**4**	**809**	**6**	**0**	**1**	**1084**	**1**
PHF	**0.50**	**0.50**	**0.79**	**0.38**	**-**	**0.25**	**0.93**	**0.25**
Truck %	**0.0%**	**0.0%**	**3.3%**	**0.0%**	**0.0%**	**0.0%**	**2.3%**	**0.0%**


Asheville Highway at 8014 Private Driveway
Intersection Traffic Count Totals
9/4/2024
AM Peak Hour
PM Peak Hour
Vehicles
600
500
400
300
200
100
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
11:00 AM
11:15 AM
11:30 AM
11:45 AM
12:00 PM
12:15 PM
12:30 PM
12:45 PM
2:00 PM
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2:30 PM
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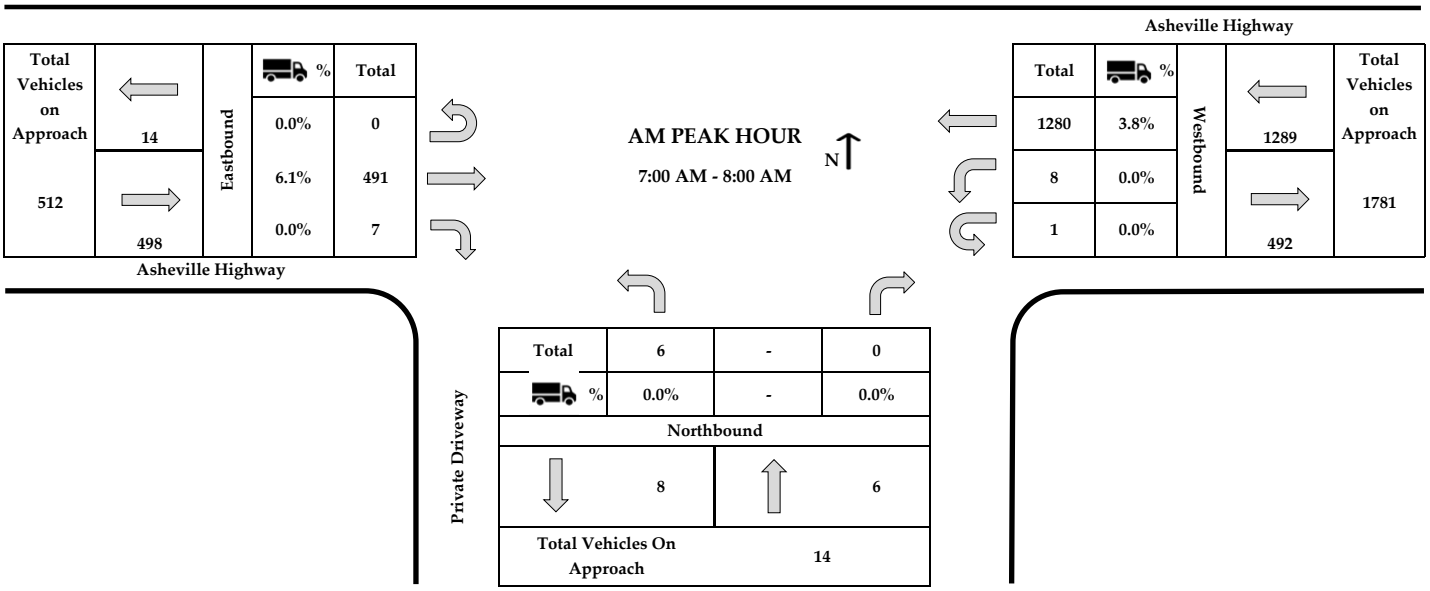
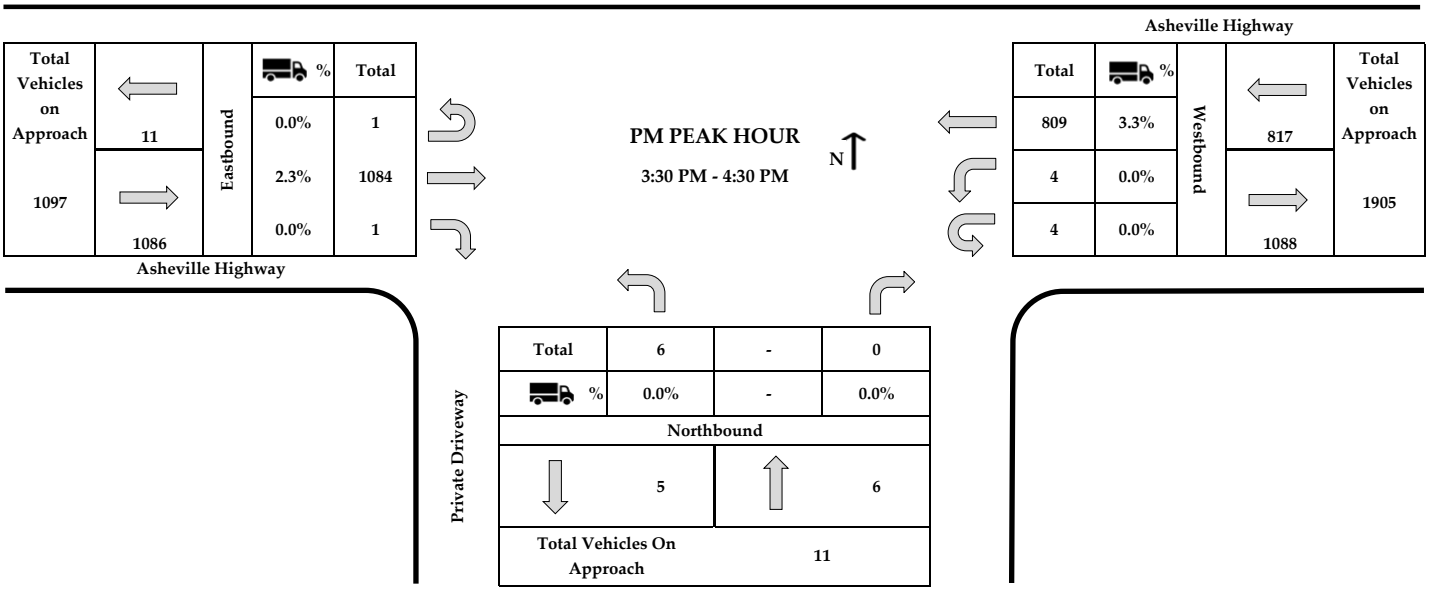
3:30 PM
3:45 PM
4:00 PM
4:15 PM
4:30 PM
4:45 PM
5:00 PM
5:15 PM
5:30 PM
5:45 PM
Time of Day

PEAK HOUR DATA

Major Street: Asheville Highway (EB and WB)
Minor Street: Private Driveway at 8014 Asheville Highway (NB)
Traffic Control: Stop Conditions on Minor Street

9/4/2024 (Wednesday)
Partly Cloudy and Hot
Conducted by: Ajax Engineering





APPENDIX E

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 12)

EXISTING CONDITIONS

Intersection	
Int Delay, s/veh	1

Movement	EBT	EBR	WBU	WBL	WBT	NBL	NBR
Lane Configurations							
Traffic Vol, veh/h	491	7	1	8	1280	6	0
Future Vol, veh/h	491	7	1	8	1280	6	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	-	None	-	None
Storage Length	-	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	-	0	1	-
Grade, %	0	-	-	-	0	0	-
Peak Hour Factor	86	35	25	50	88	50	90
Heavy Vehicles, %	6	0	0	0	4	0	0
Mvmt Flow	571	20	4	16	1455	12	0

Major/Minor	Major1		Major2			Minor1	
Conflicting Flow All	0	0	591	591	0	1349	296
Stage 1	-	-	-	-	-	581	-
Stage 2	-	-	-	-	-	768	-
Critical Hdwy	-	-	6.4	4.1	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.5	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	614	995	-	144	706
Stage 1	-	-	-	-	-	528	-
Stage 2	-	-	-	-	-	424	-
Platoon blocked, %	-	-			-		
Mov Cap-1 Maneuver	-	-	885	885	-	127	706
Mov Cap-2 Maneuver	-	-	-	-	-	255	-
Stage 1	-	-	-	-	-	528	-
Stage 2	-	-	-	-	-	374	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.2	19.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	255	-	-	885	-
HCM Lane V/C Ratio	0.047	-	-	0.018	-
HCM Control Delay (s)	19.8	-	-	9.2	1.1
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	1

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBL	NBR
Lane Configurations								
Traffic Vol, veh/h	1	1084	1	4	4	809	6	0
Future Vol, veh/h	1	1084	1	4	4	809	6	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	None
Storage Length	-	-	-	-	-	-	0	-
Veh in Median Storage, #	-	0	-	-	-	0	1	-
Grade, %	-	0	-	-	-	0	0	-
Peak Hour Factor	25	93	25	50	50	79	38	90
Heavy Vehicles, %	0	2	0	0	0	3	0	0
Mvmt Flow	4	1166	4	8	8	1024	16	0

Major/Minor	Major1			Major2			Minor1	
Conflicting Flow All	1024	0	0	1170	1170	0	1720	585
Stage 1	-	-	-	-	-	-	1176	-
Stage 2	-	-	-	-	-	-	544	-
Critical Hdwy	6.4	-	-	6.4	4.1	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.8	-
Follow-up Hdwy	2.5	-	-	2.5	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	326	-	-	263	604	-	82	459
Stage 1	-	-	-	-	-	-	260	-
Stage 2	-	-	-	-	-	-	551	-
Platoon blocked, %		-	-			-		
Mov Cap-1 Maneuver	326	-	-	366	366	-	71	459
Mov Cap-2 Maneuver	-	-	-	-	-	-	180	-
Stage 1	-	-	-	-	-	-	251	-
Stage 2	-	-	-	-	-	-	495	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	1.7	26.9
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	180	-	-	366	-
HCM Lane V/C Ratio	0.088	-	-	0.022	-
HCM Control Delay (s)	26.9	-	-	15.3	1.5
HCM Lane LOS	D	-	-	C	A
HCM 95th %tile Q(veh)	0.3	-	-	0.1	-

PROJECTED CONDITIONS WITHOUT THE PROJECT

Intersection	
Int Delay, s/veh	1.4

Movement	EBT	EBR	WBU	WBL	WBT	NBL	NBR
Lane Configurations							
Traffic Vol, veh/h	530	7	1	8	1382	6	0
Future Vol, veh/h	530	7	1	8	1382	6	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	-	None	-	None
Storage Length	-	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	-	0	1	-
Grade, %	0	-	-	-	0	0	-
Peak Hour Factor	86	35	25	50	88	50	90
Heavy Vehicles, %	6	0	0	0	4	0	0
Mvmt Flow	616	20	4	16	1570	12	0

Major/Minor	Major1		Major2			Minor1	
Conflicting Flow All	0	0	636	636	0	1451	318
Stage 1	-	-	-	-	-	626	-
Stage 2	-	-	-	-	-	825	-
Critical Hdwy	-	-	6.4	4.1	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.5	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	575	957	-	124	684
Stage 1	-	-	-	-	-	501	-
Stage 2	-	-	-	-	-	396	-
Platoon blocked, %	-	-			-		
Mov Cap-1 Maneuver	-	-	845	845	-	101	684
Mov Cap-2 Maneuver	-	-	-	-	-	222	-
Stage 1	-	-	-	-	-	501	-
Stage 2	-	-	-	-	-	322	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	22.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	222	-	-	845	-
HCM Lane V/C Ratio	0.054	-	-	0.019	-
HCM Control Delay (s)	22.1	-	-	9.4	1.7
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBL	NBR
Lane Configurations								
Traffic Vol, veh/h	1	1171	1	4	4	874	6	0
Future Vol, veh/h	1	1171	1	4	4	874	6	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	None
Storage Length	-	-	-	-	-	-	0	-
Veh in Median Storage, #	-	0	-	-	-	0	1	-
Grade, %	-	0	-	-	-	0	0	-
Peak Hour Factor	25	93	25	50	50	79	38	90
Heavy Vehicles, %	0	2	0	0	0	3	0	0
Mvmt Flow	4	1259	4	8	8	1106	16	0

Major/Minor	Major1			Major2			Minor1	
Conflicting Flow All	1106	0	0	1263	1263	0	1854	632
Stage 1	-	-	-	-	-	-	1269	-
Stage 2	-	-	-	-	-	-	585	-
Critical Hdwy	6.4	-	-	6.4	4.1	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.8	-
Follow-up Hdwy	2.5	-	-	2.5	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	289	-	-	229	557	-	67	428
Stage 1	-	-	-	-	-	-	232	-
Stage 2	-	-	-	-	-	-	526	-
Platoon blocked, %		-	-			-		
Mov Cap-1 Maneuver	289	-	-	325	325	-	56	428
Mov Cap-2 Maneuver	-	-	-	-	-	-	158	-
Stage 1	-	-	-	-	-	-	221	-
Stage 2	-	-	-	-	-	-	459	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	2.3	30.3
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	158	-	-	325	-
HCM Lane V/C Ratio	0.1	-	-	0.025	-
HCM Control Delay (s)	30.3	-	-	16.7	2.1
HCM Lane LOS	D	-	-	C	A
HCM 95th %tile Q(veh)	0.3	-	-	0.1	-

PROJECTED CONDITIONS WITH THE PROJECT

Intersection	
Int Delay, s/veh	5.1

Movement	EBT	EBR	WBU	WBL	WBT	NBL	NBR
Lane Configurations							
Traffic Vol, veh/h	567	34	3	15	1417	94	22
Future Vol, veh/h	567	34	3	15	1417	94	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	-	None	-	None
Storage Length	-	235	-	285	-	0	100
Veh in Median Storage, #	0	-	-	-	0	1	-
Grade, %	0	-	-	-	0	0	-
Peak Hour Factor	86	35	25	50	88	50	90
Heavy Vehicles, %	6	0	0	0	4	0	0
Mvmt Flow	659	97	12	30	1610	188	24

Major/Minor	Major1		Major2			Minor1	
Conflicting Flow All	0	0	659	756	0	1548	330
Stage 1	-	-	-	-	-	659	-
Stage 2	-	-	-	-	-	889	-
Critical Hdwy	-	-	6.4	4.1	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	2.5	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	556	863	-	~ 107	672
Stage 1	-	-	-	-	-	482	-
Stage 2	-	-	-	-	-	367	-
Platoon blocked, %	-	-			-		
Mov Cap-1 Maneuver	-	-	735	735	-	~ 101	672
Mov Cap-2 Maneuver	-	-	-	-	-	228	-
Stage 1	-	-	-	-	-	482	-
Stage 2	-	-	-	-	-	346	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.26	60.85
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	228	672	-	-	735	-
HCM Lane V/C Ratio	0.824	0.036	-	-	0.057	-
HCM Control Delay (s/veh)	67.4	10.6	-	-	10.2	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	6.3	0.1	-	-	0.2	-

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

Intersection	
Int Delay, s/veh	19

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBL	NBR
Lane Configurations		↑↑	↱		↰	↑↑	↰	↱
Traffic Vol, veh/h	1	1220	92	11	27	928	73	17
Future Vol, veh/h	1	1220	92	11	27	928	73	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	None
Storage Length	-	-	235	-	285	-	0	100
Veh in Median Storage, #	-	0	-	-	-	0	1	-
Grade, %	-	0	-	-	-	0	0	-
Peak Hour Factor	25	93	25	50	50	79	38	90
Heavy Vehicles, %	0	2	0	0	0	3	0	0
Mvmt Flow	4	1312	368	22	54	1175	192	19

Major/Minor	Major1			Major2			Minor1	
Conflicting Flow All	1175	0	0	1312	1680	0	2059	656
Stage 1	-	-	-	-	-	-	1320	-
Stage 2	-	-	-	-	-	-	739	-
Critical Hdwy	6.4	-	-	6.4	4.1	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.8	-
Follow-up Hdwy	2.5	-	-	2.5	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	261	-	-	213	386	-	~ 49	413
Stage 1	-	-	-	-	-	-	218	-
Stage 2	-	-	-	-	-	-	438	-
Platoon blocked, %		-	-			-		
Mov Cap-1 Maneuver	261	-	-	306	306	-	~ 36	413
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 132	-
Stage 1	-	-	-	-	-	-	211	-
Stage 2	-	-	-	-	-	-	330	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0.05	1.25	275.83
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	132	413	-	-	306	-
HCM Lane V/C Ratio	1.452	0.046	-	-	0.248	-
HCM Control Delay (s/veh)	$ 301.6	14.1	-	-	20.6	-
HCM Lane LOS	F	B	-	-	C	-
HCM 95th %tile Q(veh)	13	0.1	-	-	1	-

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

APPENDIX F

TRIP GENERATION DATA

Local Apartment
Trip Generation Study

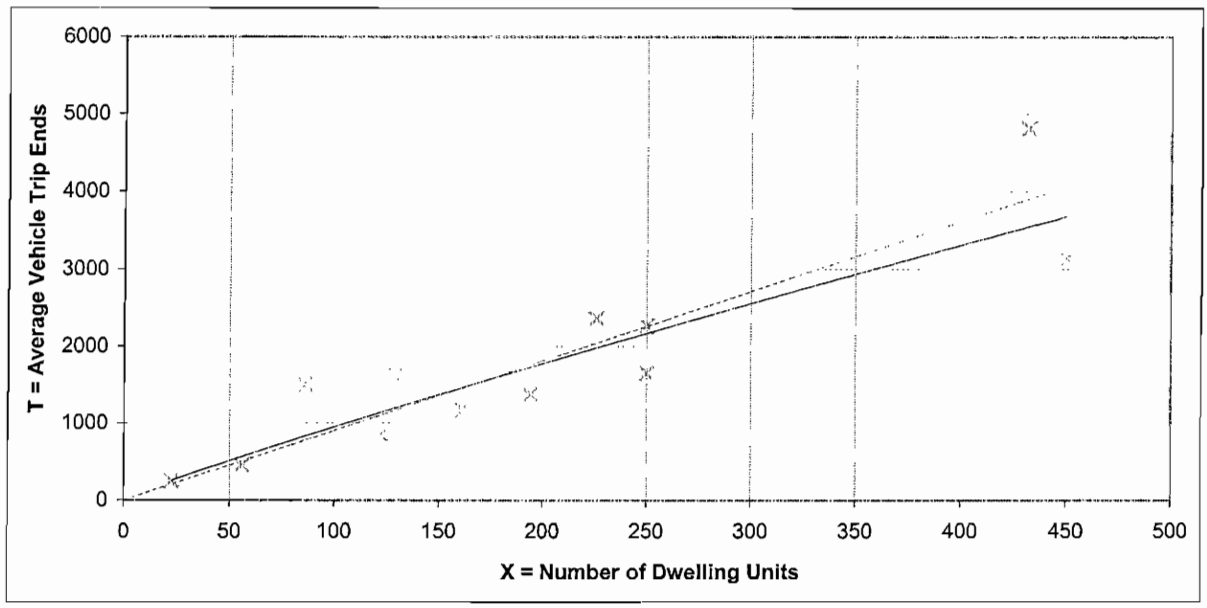
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

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

Trip Generation Per Dwelling Unit

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

Data Plot and Equation



X Actual Data Points ——— Fitted Curve Average Rate

Fitted Curve Equation: $T = 15.193(X)^{0.899}$ $R^2 = 0.88$

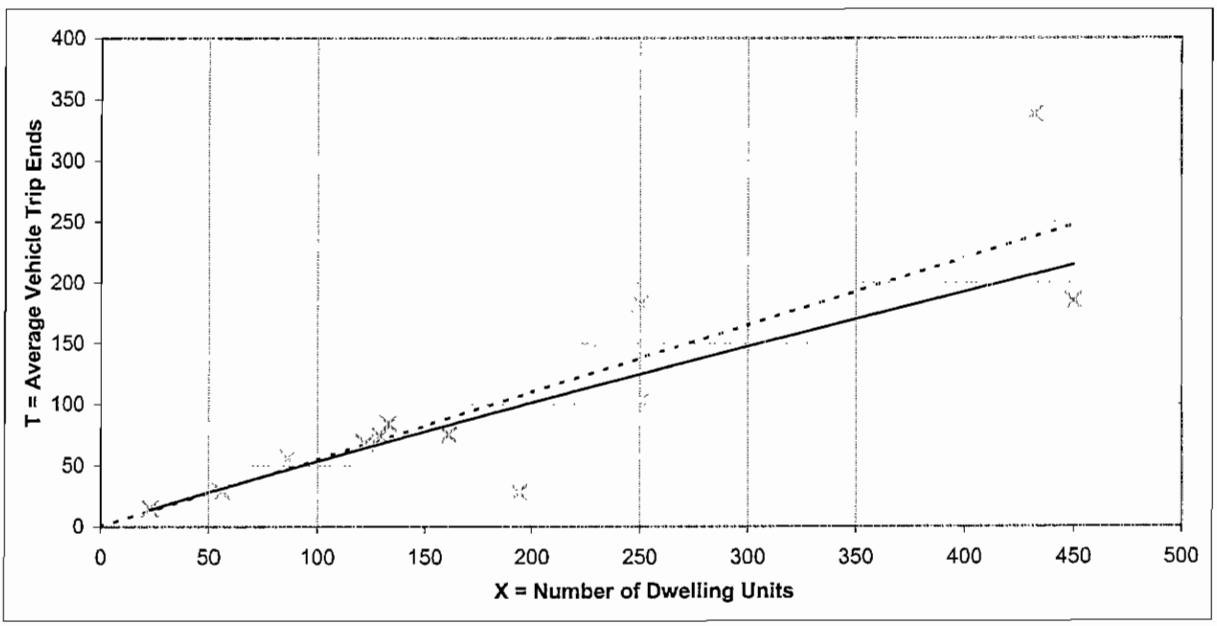
Local Apartment
Trip Generation Study

Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**
Number of Studies:	13
Average Number of Dwelling Units:	193
Directional Distribution:	22% entering, 78% exiting

Trip Generation Per Dwelling Unit

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

Data Plot and Equation



X Actual Data Points ——— Fitted Curve Average Rate

Fitted Curve Equation: $T = 0.758(X)^{0.924}$ $R^2 = 0.75$

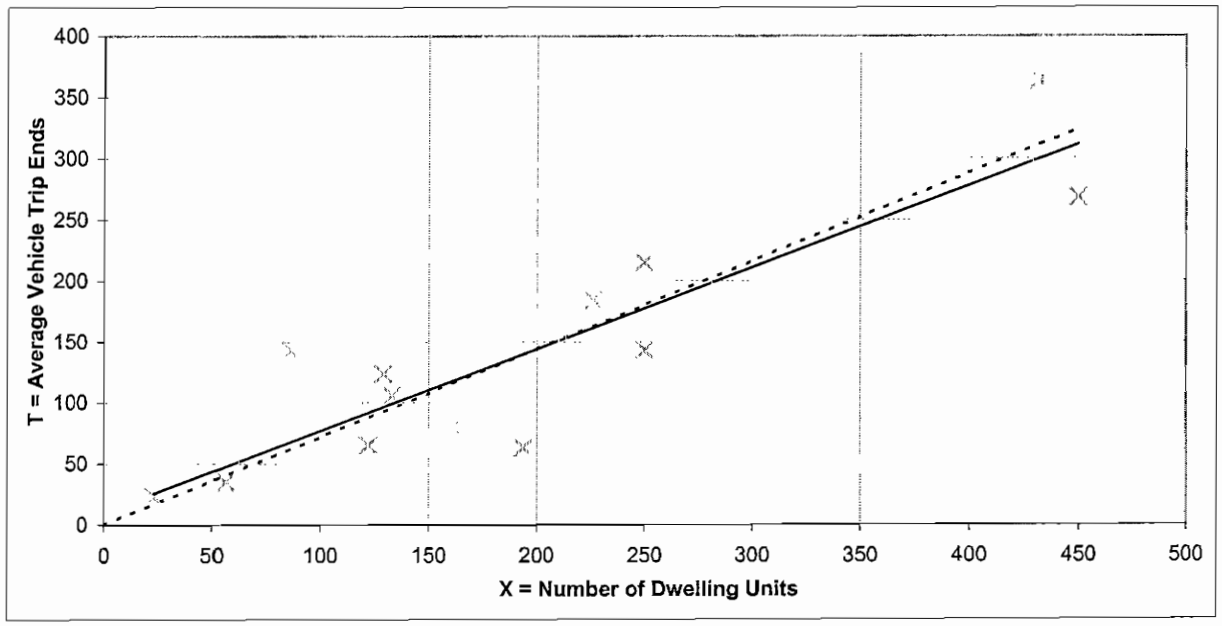
Local Apartment
Trip Generation Study

Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 4 and 6 p.m.**
Number of Studies:	13
Average Number of Dwelling Units:	193
Directional Distribution:	55% entering, 45% exiting

Trip Generation Per Dwelling Unit

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

Data Plot and Equation



X Actual Data Points ——— Fitted Curve Average Rate

Fitted Curve Equation: T = 0.669(X) + 10.069 **R^2 = 0.79**

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)

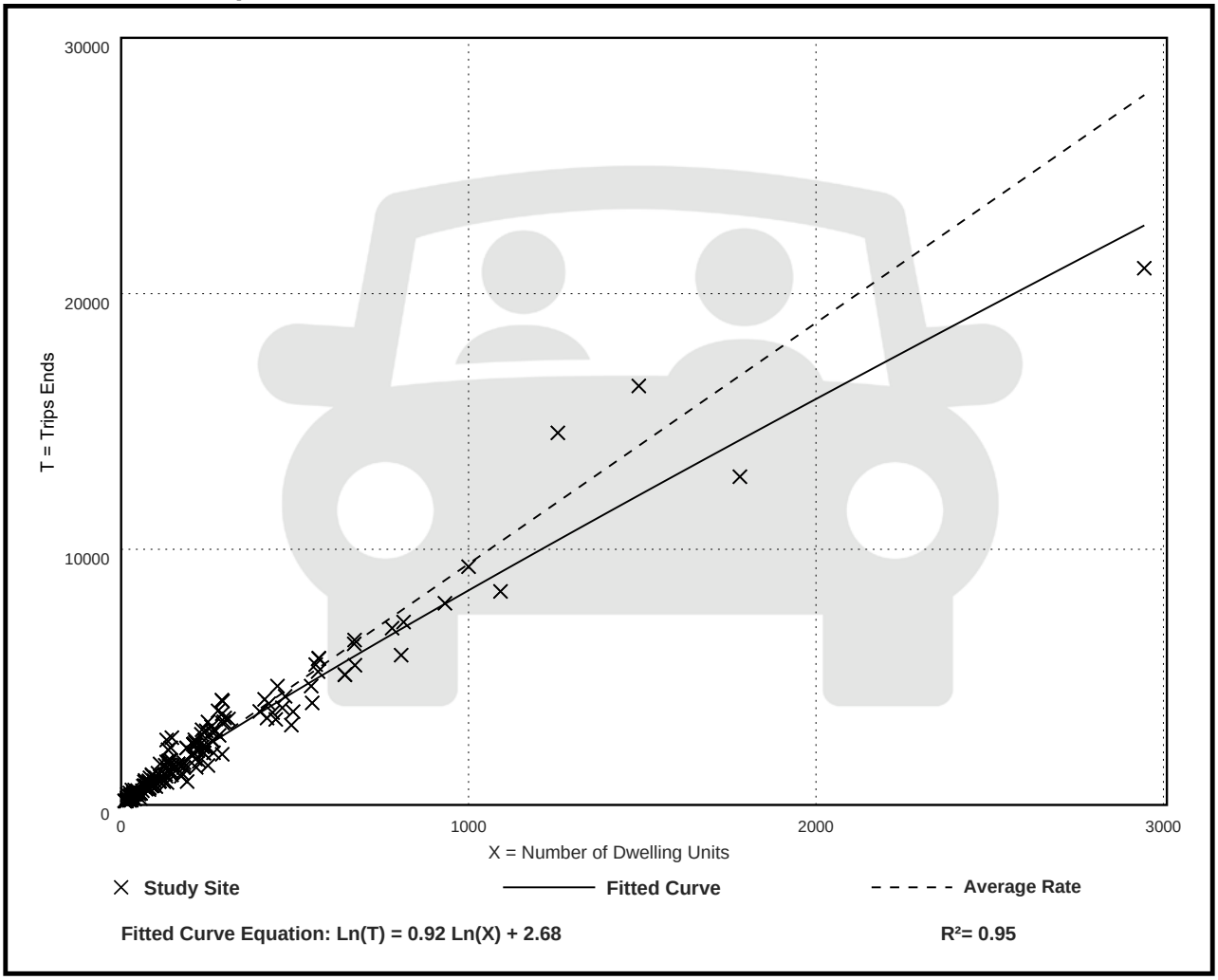
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

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

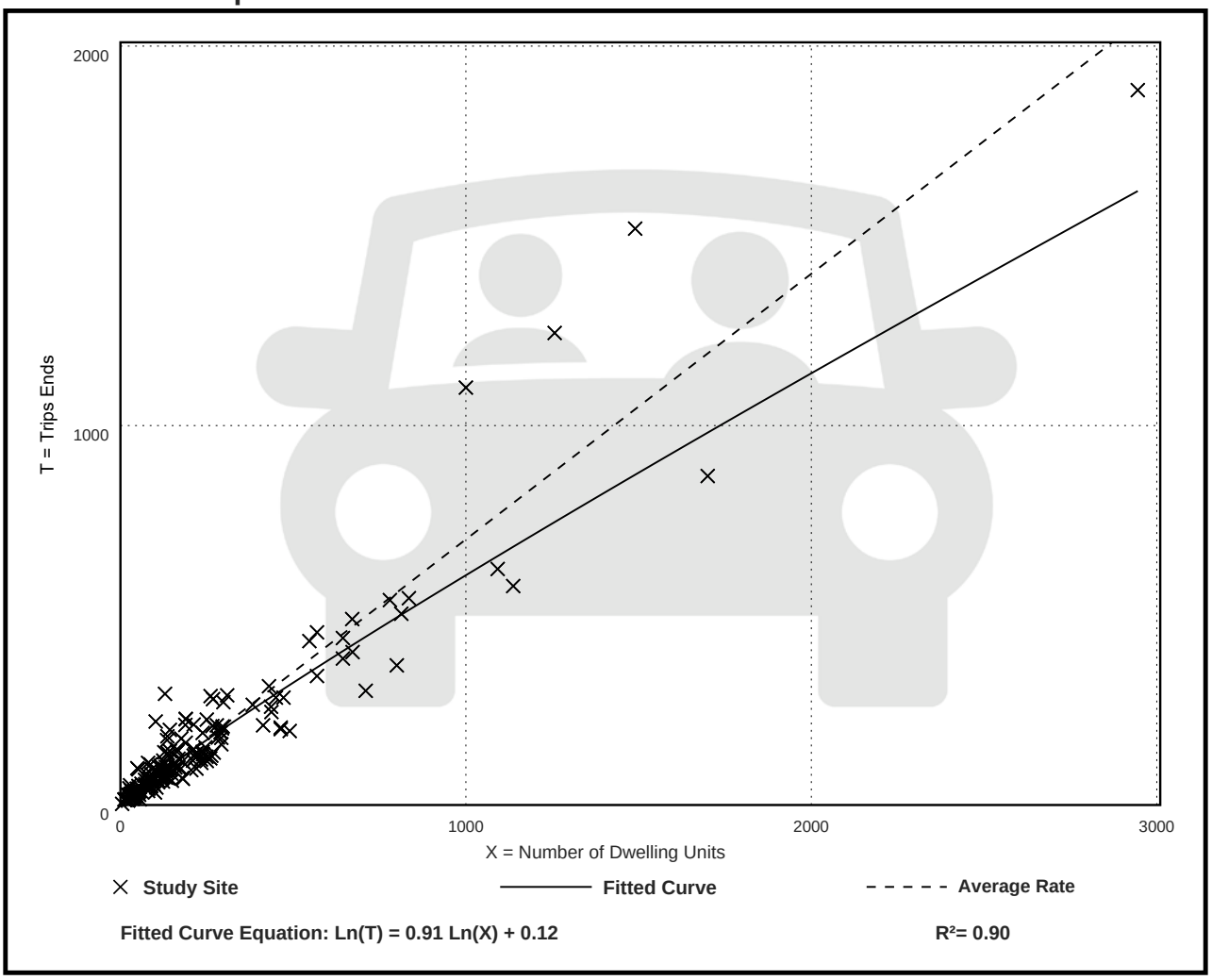
Single-Family Detached Housing
(210)

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



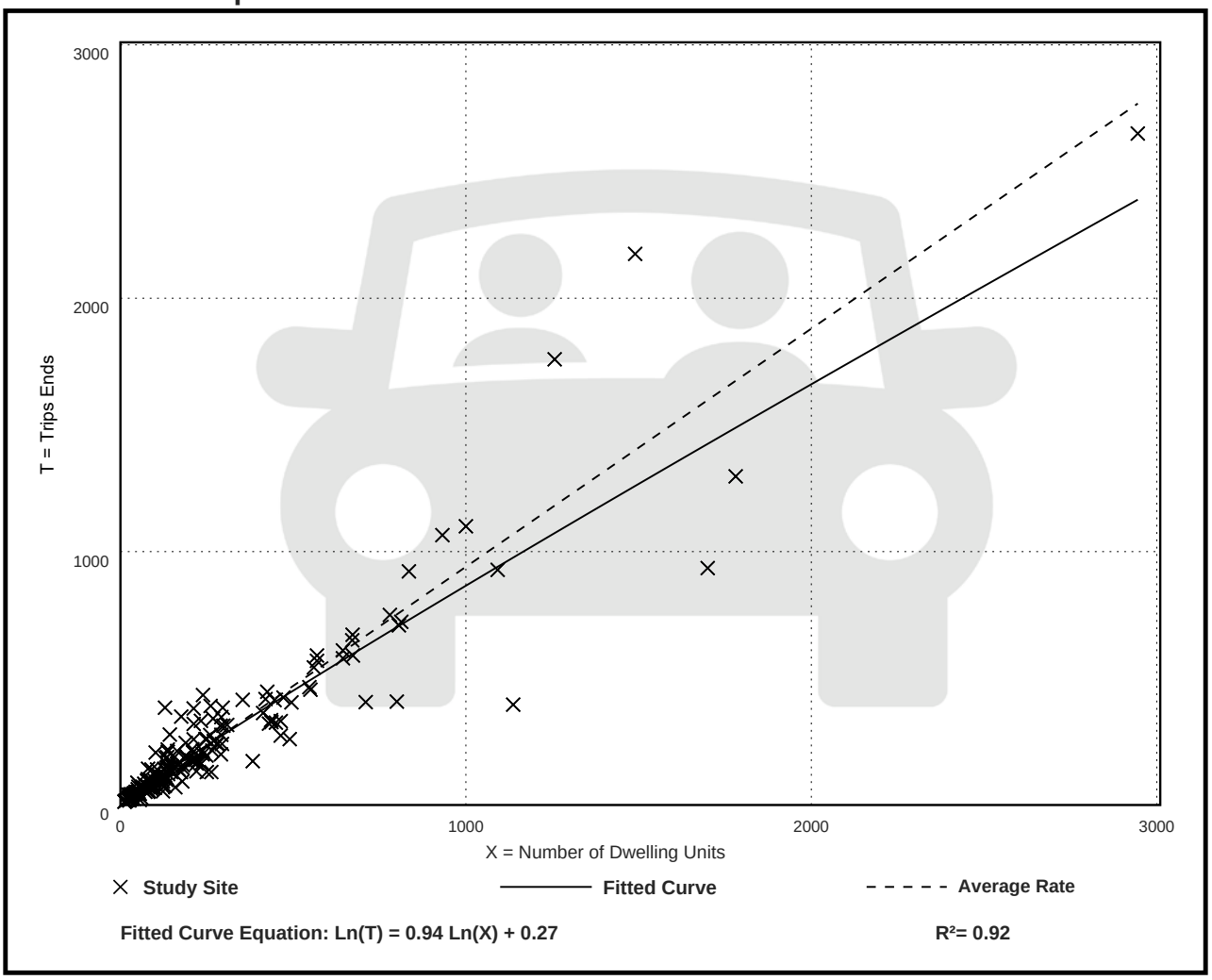
Single-Family Detached Housing
(210)

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 8014 ASHEVILLE HIGHWAY SUBDIVISION

174 Attached Townhouses and 71 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
Local Trip Rate	Multi-Family Attached Townhouses	174	1,570	22%	78%		55%	45%	
				20	69	89	69	57	126
#210	Single-Family Detached Housing	71	736	26%	74%		63%	37%	
				14	41	55	45	27	72
Total New Volume Site Trips			**2,306**	**34**	**110**	**144**	**114**	**84**	**198**

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

Trips calculated by using Fitted Curve Equations

TRIP GENERATION FOR 8014 ASHEVILLE HIGHWAY SUBDIVISION

174 Attached Townhouses

174 Units = X

Weekday:

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

T = 15 * 103.34

T = 1,570 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T = 0.758 * 118

T = 89 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

T = 0.669 * 174 + 10.07

T = 126 trips

TRIP GENERATION FOR 8014 ASHEVILLE HIGHWAY SUBDIVISION

71 Single-Family Detached Houses

71 Residential Houses = X

Weekday:

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

Ln(T) =	0.92	*	4.26	+	2.68
Ln(T) =	6.60				
T =	**736 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) =	4.00				
T =	**55 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	*	4.26	+	0.27
Ln(T) =	4.28				
T =	**72 trips**				

TRIP GENERATION FOR ADJACENT HABITAT FOR HUMANITY SUBDIVISION

74 Attached Duplexes

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
Local Trip Rate	Multi-Family Attached Duplexes	74	728	22%	78%		55%	45%	
				9	32	41	33	27	60
Total New Volume Site Trips			**728**	**9**	**32**	**41**	**33**	**27**	**60**

Trips calculated by using Fitted Curve Equations from Local Trip Rates

TRIP GENERATION FOR ADJACENT HABITAT FOR HUMANITY SUBDIVISIO
74 Attached Duplexes

74 Units = X

Weekday:

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

T = 15 * 47.91
T = 728 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T = 0.758 * 53
T = 41 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

T = 0.669 * 74 + 10.07
T = 60 trips

APPENDIX G

2021 CENSUS BUREAU DATA

OnTheMap

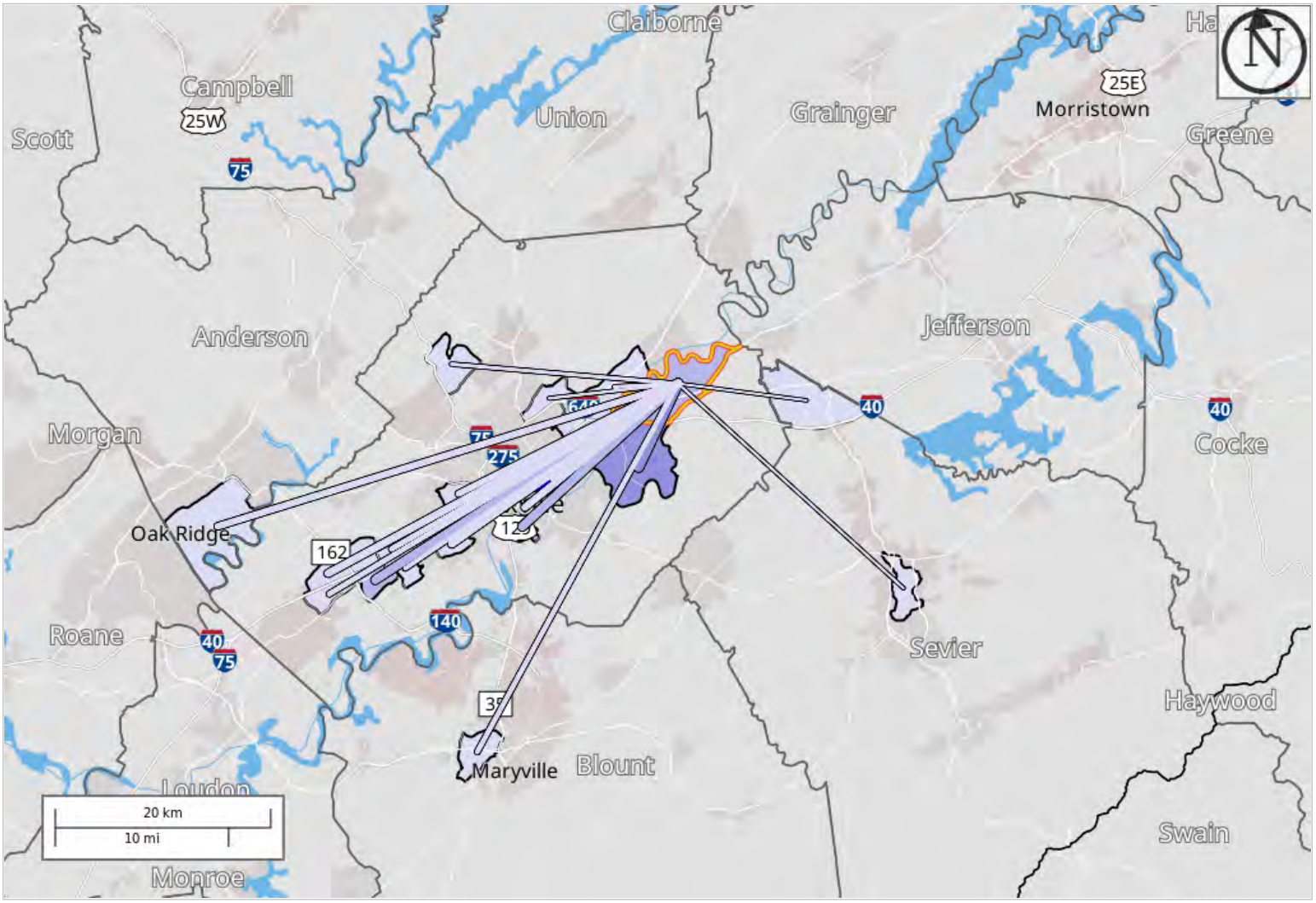
Destination Analysis

Workers: *Living in 53.01 (Knox, TN)*
Showing: *Employment locations grouped by Census Tracts*

Created by the U.S. Census Bureau's OnTheMap `https://onthemap.ces.census.gov` on 09/10/2024

Counts of All Jobs from Home Selection Area to Work Census Tracts in 2021

All Workers



Map Legend

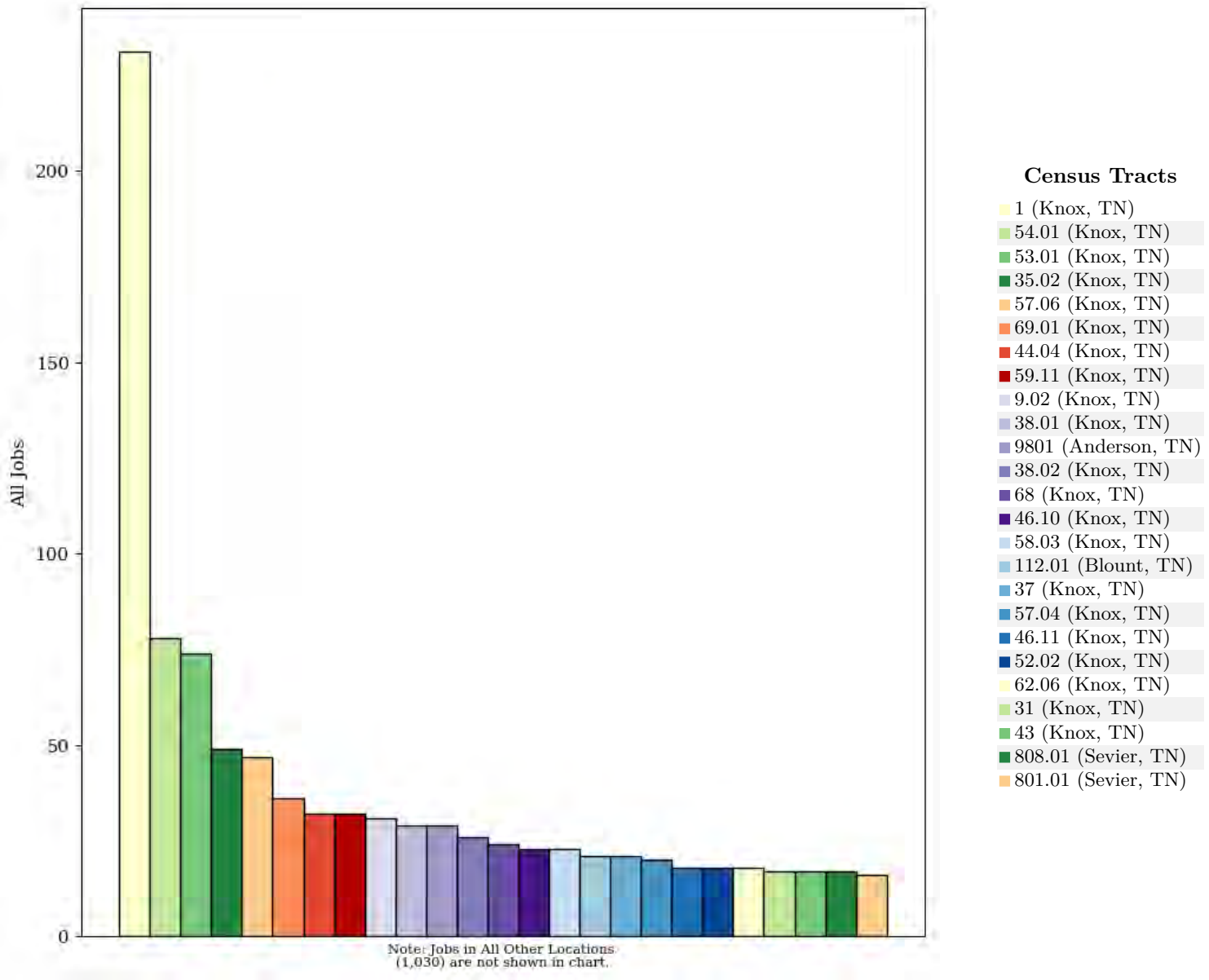
Job Count
- 201 - 231
- 170 - 200
- 139 - 169
- 109 - 138
- 78 - 108
- 47 - 77
- 16 - 46

Selection Areas
- Home Area

Job Count
- 201 - 231
- 170 - 200
- 139 - 169
- 109 - 138
- 78 - 108
- 47 - 77
- 16 - 46

All Jobs from Home Selection Area to Work Census Tracts in 2021

All Workers



All Jobs from Home Selection Area to Work Census Tracts in 2021

All Workers

Census Tracts as Work Destination Area	2021 Count	2021 Share
All Census Tracts	1,977	100.0%
1 (Knox, TN)	231	11.7%
54.01 (Knox, TN)	78	3.9%
53.01 (Knox, TN)	74	3.7%
35.02 (Knox, TN)	49	2.5%
57.06 (Knox, TN)	47	2.4%
69.01 (Knox, TN)	36	1.8%
44.04 (Knox, TN)	32	1.6%
59.11 (Knox, TN)	32	1.6%
9.02 (Knox, TN)	31	1.6%
38.01 (Knox, TN)	29	1.5%

Census Tracts as Work Destination Area	2021 Count	2021 Share
9801 (Anderson, TN)	29	1.5%
38.02 (Knox, TN)	26	1.3%
68 (Knox, TN)	24	1.2%
46.10 (Knox, TN)	23	1.2%
58.03 (Knox, TN)	23	1.2%
112.01 (Blount, TN)	21	1.1%
37 (Knox, TN)	21	1.1%
57.04 (Knox, TN)	20	1.0%
46.11 (Knox, TN)	18	0.9%
52.02 (Knox, TN)	18	0.9%
62.06 (Knox, TN)	18	0.9%
31 (Knox, TN)	17	0.9%
43 (Knox, TN)	17	0.9%
808.01 (Sevier, TN)	17	0.9%
801.01 (Sevier, TN)	16	0.8%
All Other Locations	1,030	52.1%

Additional Information

Analysis Settings

Analysis Type	Destination
Destination Type	Census Tracts
Selection area as	Home
Year(s)	2021
Job Type	All Jobs
Selection Area	53.01 (Knox, TN) from Census Tracts
Selected Census Blocks	122
Analysis Generation Date	09/10/2024 10:26 - OnTheMap 6.24.1
Code Revision	bc639735180b6b7ade65403c2bedfe53b70b1e56
LODES Data Vintage	20231016_1512

Data Sources

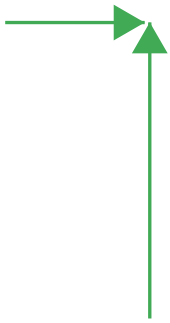
Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2021).

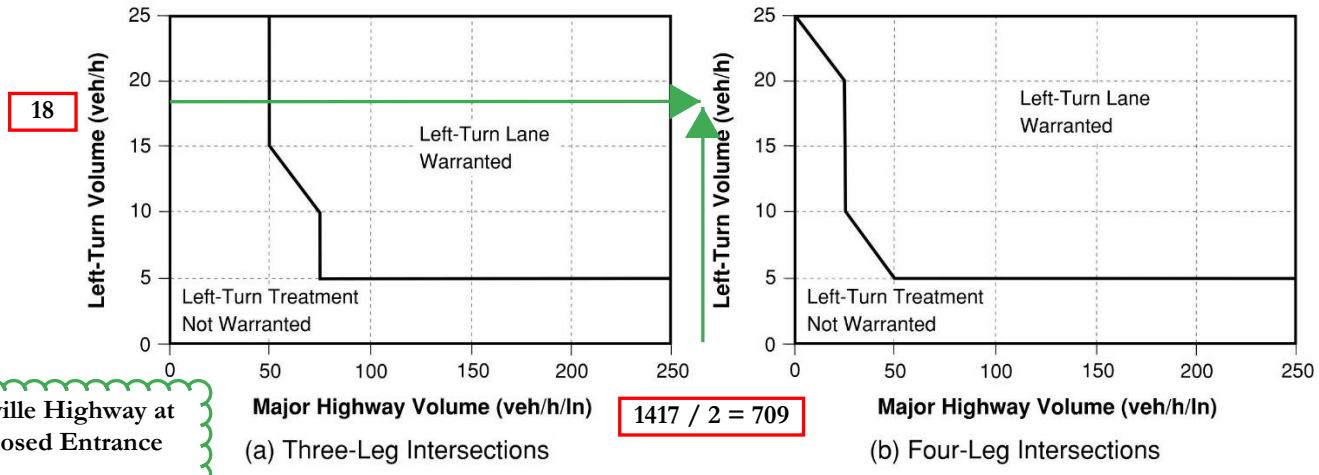
Notes

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 H

TDOT TURN LANE VOLUME THRESHOLD WORKSHEETS





Asheville Highway at Proposed Entrance

2028 Projected AM WB Left (and U-Turns) Turns = 18

WB Left Turn Lane Warranted

Figure 3-17: Left-Turn Lane Warrant for Four-Lane Rural Roadways (Unsignalized) [22, 23]

Left-Turn Lane Warrants –Signalized Intersections

Exclusive left-turn lanes at a signalized intersections should be installed where exclusive left-turn signal phasing is required. Refer to the *TDOT Traffic Design Manual, Chapter 7.3.1* for current policies for the need for left-turn phasing at a signalized intersection. Exclusive left-turn lanes at signalized intersections should be considered where left-turn volumes exceed 100 vehicles per hour (veh/h). Left-turn lanes may be provided for lower volumes as well based on the assessment of need or additional traffic analysis. Consider impacts to pedestrian crossings when analyzing turn lane benefits for these lower volume cases. When left-turn volumes exceed 300 veh/h, a dual left-turn lane should be considered. A capacity analysis will help determine the benefits of an additional lane.

On the minor road approaching an intersection where a signal is either existing or proposed, a minimum of two egress lanes from the minor road should be considered. This will help improve operations and efficiency of the minor road, even in locations where a left-turn lane may not be warranted.

[22] TRB, NCHRP Repot 745, Left-Turn Accommodations at Unsignalized Intersections (2013)
[23] AASHTO, A Policy on Geometric Design of Highways and Streets 7th Edition (2018)

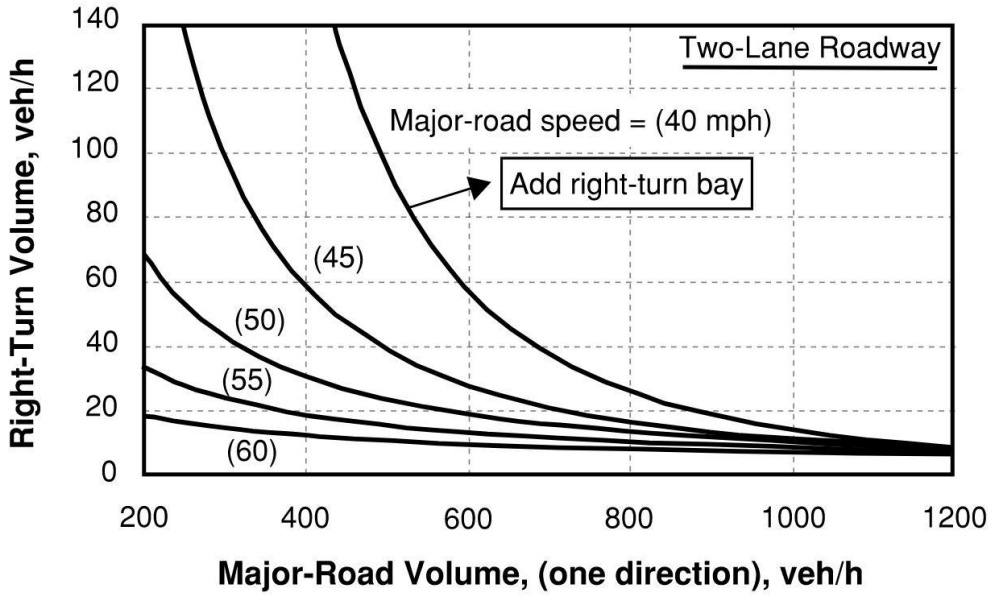


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)[24]

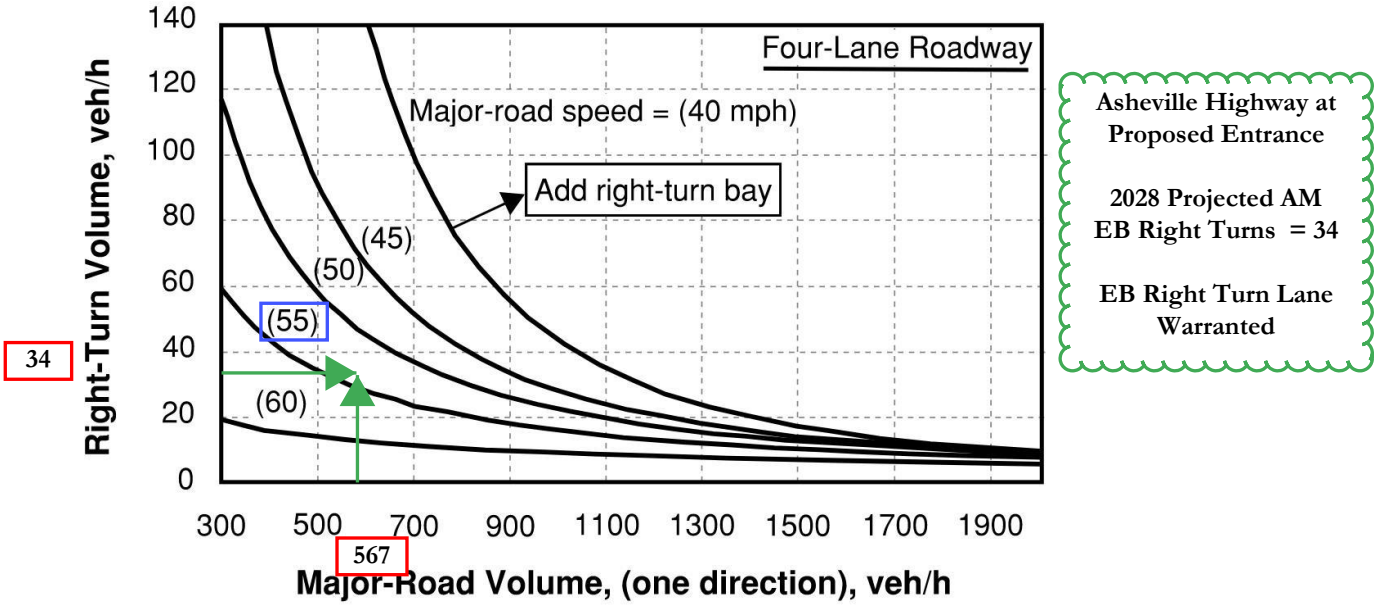
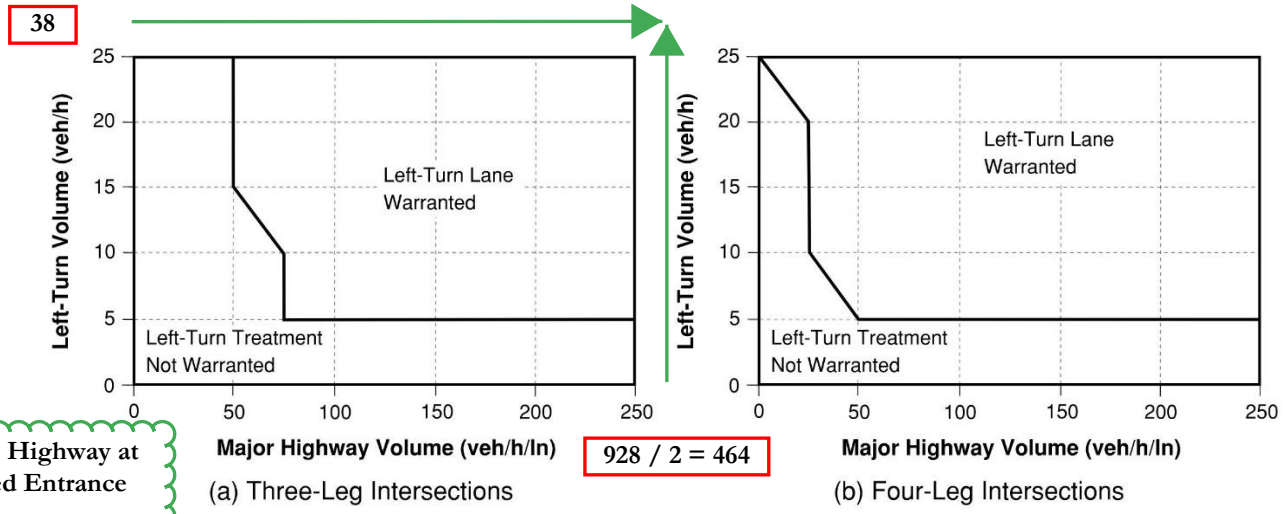


Figure 3-19: Right-Turn Lane Warrant along Four-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control) [25]

[24] TRB, NCHRP 457, Evaluating Intersection Improvements (2001)
[25] TRB, NCHRP 457, Evaluating Intersection Improvements (2001)



Asheville Highway at Proposed Entrance

2028 Projected PM WB Left (and U-Turns) Turns = 38

WB Left Turn Lane Warranted

Figure 3-17: Left-Turn Lane Warrant for Four-Lane Rural Roadways (Unsignalized) [22, 23]

Left-Turn Lane Warrants –Signalized Intersections

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On the minor road approaching an intersection where a signal is either existing or proposed, a minimum of two egress lanes from the minor road should be considered. This will help improve operations and efficiency of the minor road, even in locations where a left-turn lane may not be warranted.

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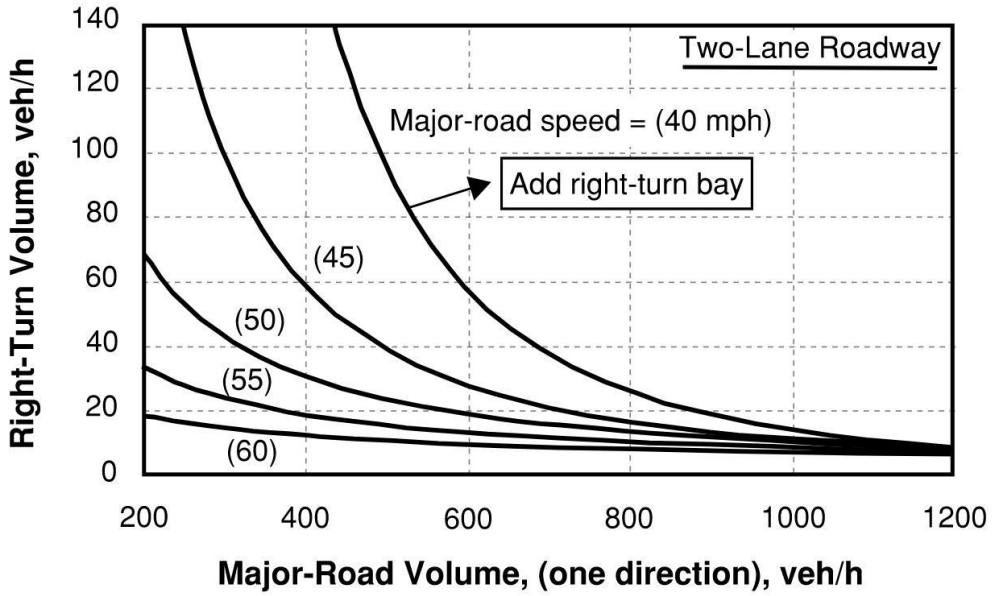


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)[24]

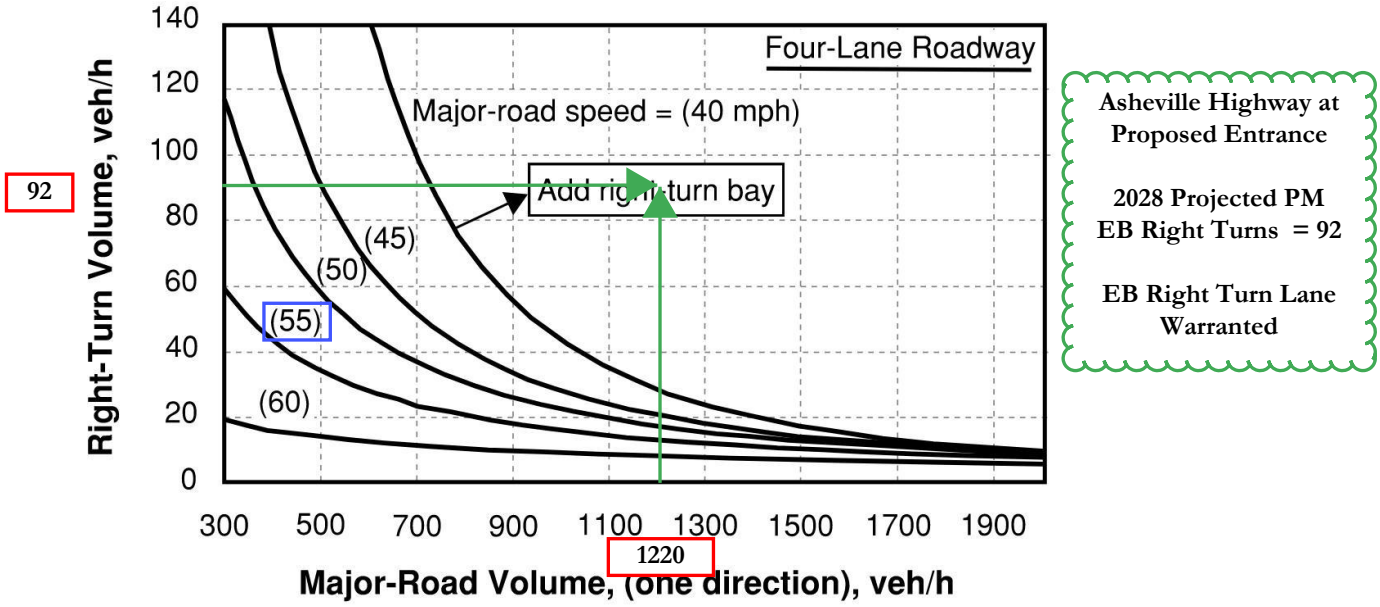


Figure 3-19: Right-Turn Lane Warrant along Four-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control) [25]

[24] TRB, NCHRP 457, Evaluating Intersection Improvements (2001)
[25] TRB, NCHRP 457, Evaluating Intersection Improvements (2001)

APPENDIX I

TRAFFIC SIGNAL WARRANT ANALYSIS

PROJECTED FUTURE VOLUMES IN 2028

WITH TRAFFIC GROWTH AND GENERATED TRAFFIC

Asheville Highway at Proposed Entrance to 8014 Asheville Highway Subdivision

	Asheville Highway			Road "A"			Asheville Highway			
TIME	WESTBOUND			NORTHBOUND			EASTBOUND			
BEGIN	LT/U-Turn	THRU	RT	LT	THRU	RT	LT	THRU	RT	
7:00 AM	0	297		0		0		97	1	Existing Volumes from Traffic Count
7:15 AM	1	325		1		0		142	0	Existing Volumes from Traffic Count
7:30 AM	3	363		3		0		125	5	Existing Volumes from Traffic Count
7:45 AM	5	295		2		0		127	1	Existing Volumes from Traffic Count
Existing Hourly Sum	9	1280		6		0		491	7	Sum
General Growth	0	102.4		0		0		39.28	0	Growth for 4 years
Trips Generated 7-8 am	8	0		101		25		0	32	Trips Generated by 8014 Asheville Highway
Habitat for Humanity Trips	2	33		0		0		9	0	Trips Generated by Habitat for Humanity
Other Subdivisions Trips	0	11		0		0		34	0	Trips Generated by Other Subdivisions
7:00 AM	3	333		25		6		118	9	15-minute Volumes: These volumes
7:15 AM	4	361		26		6		163	8	are calculated by spreading the additional
7:30 AM	6	399		28		6		146	13	hourly volumes (growth+ generated trips)
7:45 AM	8	331		27		6		148	9	into 15-minute volumes by dividing by 4
2028	21	1424		106		24		575	39	Total Sum
8:00 AM	1	250		1		0		136	0	
8:15 AM	1	242		1		0		141	0	
8:30 AM	0	233		0		0		143	0	
8:45 AM	5	216		0		0		126	2	
Sum	7	941		2		0		546	2	
General Growth	0	75.28		0		0		43.68	0	
Trips Generated 8-9 am	7	0		93		23		0	29	
Habitat for Humanity Trips	2	30		0		0		8	0	
Other Subdivisions Trips	0	10		0		0		31	0	
8:00 AM	3	279		24		6		157	7	
8:15 AM	3	271		24		6		162	7	
8:30 AM	2	262		23		6		164	7	
8:45 AM	7	245		23		6		147	9	
2028	15	1057		94		24		630	30	
11:00 AM	2	166		1		0		113	2	
11:15 AM	0	139		2		0		133	0	
11:30 AM	0	166		1		0		128	0	
11:45 AM	0	124		0		0		149	1	
Sum	2	595		4		0		523	3	
General Growth	0	47.6		0		0		41.84	0	
Trips Generated 11am-12 pm	13	0		51		13		0	51	
Habitat for Humanity Trips	4	16		0		0		16	0	
Other Subdivisions Trips	0	17		0		0		17	0	
11:00 AM	6	186		14		3		132	15	
11:15 AM	4	159		15		3		152	13	
11:30 AM	4	186		14		3		147	13	
11:45 AM	4	144		13		3		168	14	
2028	18	675		56		12		599	55	
12:00 PM	1	153		2		0		139	1	
12:15 PM	2	176		6		0		162	0	
12:30 PM	1	160		1		0		131	2	
12:45 PM	3	131		1		0		152	3	
Sum	7	620		10		0		584	6	
General Growth	0.56	49.6		0		0		46.72	0	
Trips Generated 12-1 pm	14	0		56		14		0	56	
Habitat for Humanity Trips	4	18		0		0		18	0	
Other Subdivisions Trips	0	19		0		0		19	0	
12:00 PM	6	175		16		4		160	15	
12:15 PM	7	198		20		4		183	14	
12:30 PM	6	182		15		4		152	16	
12:45 PM	8	153		15		4		173	17	
2028	27	708		66		16		668	62	
2:00 PM	2	159		2		0		145	1	
2:15 PM	0	159		0		0		177	0	
2:30 PM	1	143		0		0		173	0	
2:45 PM	5	165		0		1		205	0	
Sum	8	626		2		1		700	1	
General Growth	0	50.08		0		0		56	0	
Trips Generated 2-3 pm	17	0		48		12		0	70	
Habitat for Humanity Trips	5	17		0		0		20	0	
Other Subdivisions Trips	0	24		0		0		16	0	
2:00 PM	8	182		14		3		168	18	
2:15 PM	6	182		12		3		200	17	
2:30 PM	7	166		12		3		196	17	
2:45 PM	11	188		12		4		228	17	
2028	32	718		50		13		792	69	

3:00 PM	1	141		2		0		198	0
3:15 PM	0	155		0		0		246	0
3:30 PM	2	219		1		0		257	0
3:45 PM	3	256		0		0		290	1
Sum	6	771		3		0		991	1
General Growth	0	61.68		0		0		79.28	0
Trips Generated 3-4 pm	20	0		56		14		0	80
Habitat for Humanity Trips	6	19		0		0		24	0
Other Subdivisions Trips	0	27		0		0		19	0
3:00 PM	7	168		16		3		228	20
3:15 PM	6	182		14		3		276	20
3:30 PM	8	246		15		3		287	20
3:45 PM	9	283		14		3		320	21
2028	30	879		59		12		1111	81
4:00 PM	3	178		4		0		251	0
4:15 PM	0	156		1		0		286	0
4:30 PM	0	169		0		0		300	0
4:45 PM	0	162		0		1		292	2
Sum	3	665		5		1		1129	2
General Growth	0	53.2		0		0		90.32	0
Trips Generated 4-5 pm	23	0		64		16		0	92
Habitat for Humanity Trips	7	22		0		0		27	0
Other Subdivisions Trips	0	31		0		0		22	0
4:00 PM	10	205		20		4		286	23
4:15 PM	7	183		17		4		321	23
4:30 PM	7	196		16		4		335	23
4:45 PM	7	189		16		5		327	25
2028	31	773		69		17		1269	94
5:00 PM	1	170		1		2		312	2
5:15 PM	0	145		3		2		307	1
5:30 PM	0	178		2		0		307	0
5:45 PM	1	145		0		0		296	0
Sum	2	638		6		4		1222	3
General Growth	0	51.04		0		0		97.76	0
Trips Generated 5-6 pm	26	0		72		18		0	103
Habitat for Humanity Trips	8	25		0		0		30	0
Other Subdivisions Trips	0	35		0		0		24	0
5:00 PM	9	198		19		6		350	28
5:15 PM	8	173		21		6		345	27
5:30 PM	8	206		20		4		345	26
5:45 PM	9	173		18		4		334	26
2028	34	750		78		20		1374	107

Assumed Average Growth Rate (%)=	2.0%
Number of years =	4
Horizon Year =	2028

# of Horizon Years = 4

Note 1: The entering and exiting traffic volumes are estimated based on trip generation of the entire development, based on assumed amounts of entering and exiting traffic, assumed percentages of directional traffic, and the assumed percentage of trips based on time of day (from TDOT Table 4.2 in Traffic Design Manual)

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

8014 Asheville Highway Subdivision

Daily Trips Generated by Entire Development: 2,306
100% of trips

Daily Trips Generated from Subdivision/Year: 577 = 2,306 / 4
2,306 trips by 2028

Traffic Movement Assumed Distribution:	AM	PM
	80% to west Asheville Hwy, 20% to east Asheville Hwy	80% to west Asheville Hwy, 20% to east Asheville Hwy
	80% from west Asheville Hwy, 20% from east Asheville Hwy	80% from west Asheville Hwy, 20% from east Asheville Hwy

Assume all houses

Entering and Exiting %'s (average of ITE & local trip rate):

				Directional Distribution Assumptions:	
24%	Enter	AM Hours	EXIT	80% to west Asheville Hwy	
76%	Exit		EXIT	20% to east Asheville Hwy	
			ENTER	80% from west Asheville Hwy	
			ENTER	20% from east Asheville Hwy	
50%	Enter	Mid-Day Hours	EXIT	80% to west Asheville Hwy	
50%	Exit		EXIT	20% to east Asheville Hwy	Assume same DD as AM Peak Hour
			ENTER	80% from west Asheville Hwy	
			ENTER	20% from east Asheville Hwy	
59%	Enter	PM Hours	EXIT	80% to west Asheville Hwy	
41%	Exit		EXIT	20% to east Asheville Hwy	
			ENTER	80% from west Asheville Hwy	
			ENTER	20% from east Asheville Hwy	

HABITAT FOR HUMANITY SUBDIVISION:

Daily Trips Generated by Adjacent Development 728

Daily Trips Generated from Subdivision/Year: 182 = 728 / 4
728 trips by 2028

Traffic Movement Assumed Distribution:	AM	PM
	80% to west Asheville Hwy, 20% to east Asheville Hwy	80% to west Asheville Hwy, 20% to east Asheville Hwy
	80% from west Asheville Hwy, 20% from east Asheville Hwy	80% from west Asheville Hwy, 20% from east Asheville Hwy

Multi-family attached duplexes

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

				Directional Distribution Assumptions:	
22%	Enter	AM Hours	EXIT	80% to west Asheville Hwy via Tribute Lane to WB Thru Volume at Intersection	
78%	Exit		EXIT	20% to east Asheville Hwy via Tribute Lane - ignored	
			ENTER	80% from west Asheville Hwy via Tribute Lane from EB Thru Volume at Intersection	
			ENTER	20% from east Asheville Hwy via Tribute Lane from WB U-Turn Volume at Intersection	
50%	Enter	Mid-Day Hours	EXIT	80% to west Asheville Hwy via Tribute Lane to WB Thru Volume at Intersection	
50%	Exit		EXIT	20% to east Asheville Hwy via Tribute Lane - ignored	Assume same DD
			ENTER	80% from west Asheville Hwy via Tribute Lane from EB Thru Volume at Intersection	as AM Peak Hour
			ENTER	20% from east Asheville Hwy via Tribute Lane from WB U-Turn Volume at Intersection	
55%	Enter	PM Hours	EXIT	80% to west Asheville Hwy via Tribute Lane to WB Thru Volume at Intersection	
45%	Exit		EXIT	20% to east Asheville Hwy via Tribute Lane - ignored	
			ENTER	80% from west Asheville Hwy via Tribute Lane from EB Thru Volume at Intersection	
			ENTER	20% from east Asheville Hwy via Tribute Lane from WB U-Turn Volume at Intersection	

OTHER SUBDIVISIONS: Neals Landing and 0 Asheville Highway to the West

Daily Trips Generated by Nearby Developments	3,132	Daily Trips Generated from Subdivision/Year	783	=	3,132 / 0
			3132	trips by	2028

Traffic Movement Assumed Distribution:	AM	PM
	80% to west Asheville Hwy, 20% to east Asheville Hwy	80% to west Asheville Hwy, 20% to east Asheville Hwy
	80% from west Asheville Hwy, 20% from east Asheville Hwy	80% from west Asheville Hwy, 20% from east Asheville Hwy

Assume all houses

Entering and Exiting %'s (average of ITE & local trip rate):

				Directional Distribution Assumptions:		
24%	Enter	AM Hours	ENTER	20%	from east Asheville Hwy / added to WB Thru Volume at Intersection	
76%	Exit		EXIT	20%	to east Asheville Hwy / added to EB Thru Volume at Intersection	
50%	Enter	Mid-Day Hours	EXIT	20%	from east Asheville Hwy / added to WB Thru Volume at Intersection	
50%	Exit		EXIT	20%	to east Asheville Hwy / added to EB Thru Volume at Intersection	Assume same DD as AM Peak Hour
59%	Enter	PM Hours	EXIT	20%	from east Asheville Hwy / added to WB Thru Volume at Intersection	
41%	Exit		EXIT	20%	to east Asheville Hwy / added to EB Thru Volume at Intersection	

TDOT Traffic Engineering Office - Table 4.2 - TDOT Traffic Design Manual June 2020

Population Tier = A (Knoxville)

TDOT Region 1 Average for Multi-Lane Facilities

Time of Day	Percentage of Trips
7-8 am	7.20%
8-9 am	6.60%
11 am-Noon	5.52%
Noon-1 pm	6.11%
2-3 pm	6.39%
3-4 pm	7.34%
4-5 pm	8.48%
5-6 pm	9.50%
	57.14%

STUDY AND ANALYSIS INFORMATION

Municipality:	Knoxville, TN	**Traffic Volumes Obtained By:**	Ajax Engineering, LLC
County:		**Analysis Date:**	9/25/2024
ODOT Engineering District:		**Agency/ Company Name Performing Warrant Analysis:**	Ajax Engineering, LLC
Google map link:	Map		

Analysis Information

Data Collection Date: 9/4/2024

Day of the Week: Wednesday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: No

Total Number of Approaches at Intersection: 3

Major Street Information

Major Street Name and Route Number: Asheville Highway

Major Street Approach Direction: E-Bound / W-Bound

Number of Thru Lanes on Each Major Street Approach: 4 **LANE(S)**

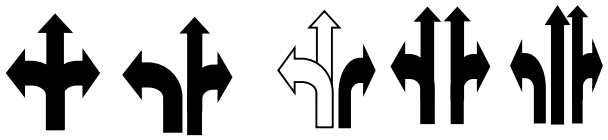
Speed Limit or 85th Percentile Speed on the Major Street*: 55 **MPH**

*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Road "A"

Minor Street Approach Configuration: 2 N-Bound / 1 S-Bound



1 2 3 4 5

Number of Thru Lanes on Each Minor Street Approach: 0 **LANE(S)**

Apply Right Turn Lane Reduction*: Yes

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Applicable?	Warrant Satisfied?	Notes and Comments:	
Warrant 1, Eight-Hour Vehicular Volume	Yes	**No**		
Warrant 2, Four-Hour Vehicular Volume	Yes	**No**		
Warrant 3, Peak Hour	Yes	**No**	Signals installed under Warrant 3 should be traffic actuated.	**Peak Hour** 7:00 AM 8:00 AM
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)				
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.	**Peak Hour** 7:00 AM 8:00 AM
Warrant 5, School Crossing	No		N/A	
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)	
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.	
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)	
Warrant 9, Intersection Near a Grade Crossing	No			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.	

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

If no warrants are satisfied, additional options may be considered:

1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks.
2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The **Modeling and Forecasting Section** should provide the projected traffic volumes.
3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. **Please fill inputs on PHB Score Sheet and submit to ODOT.**

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

Start Time	Southbound Approach						Westbound Approach						Northbound Approach						Eastbound Approach						NOTES:
	Southbound						Westbound						Nouthbound						Eastbound						
	Right	Thru	Left	U-Turn	Peds	App Total	Right	Thru	Left	U-Turn	Peds	App Total	Right	Thru	Left	U-Turn	Peds	App Total	Right	Thru	Left	U-Turn	Peds	App Total	
12:00 AM						0						0						0						0	It should be noted that if data is copied overtop of the Hourly Totals or Approach Totals, that the 'AutoSum' Formula will be lost. This should not affect the actual totals if the data was copied from a program that performs the calculations for the user.
12:15 AM						0						0						0						0	
12:30 AM						0						0						0						0	
12:45 AM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1:00 AM						0						0						0						0	
1:15 AM						0						0						0						0	
1:30 AM						0						0						0						0	
1:45 AM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:00 AM						0						0						0						0	
2:15 AM						0						0						0						0	
2:30 AM						0						0						0						0	
2:45 AM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3:00 AM						0						0						0						0	
3:15 AM						0						0						0						0	
3:30 AM						0						0						0						0	
3:45 AM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4:00 AM						0						0						0						0	
4:15 AM						0						0						0						0	
4:30 AM						0						0						0						0	
4:45 AM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5:00 AM						0						0						0						0	
5:15 AM						0						0						0						0	
5:30 AM						0						0						0						0	
5:45 AM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6:00 AM						0						0						0						0	
6:15 AM						0						0						0						0	
6:30 AM						0						0						0						0	
6:45 AM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:00 AM						0		333	3			336	6		25			31	9	118				127	
7:15 AM						0		361	4			365	6		26			32	8	163				171	
7:30 AM						0		399	6			405	6		28			34	13	146				159	
7:45 AM						0		331	8			339	6		27			33	9	148				157	
Hourly Total	0	0	0	0	0	0	0	1424	21	0	0	1445	24	0	106	0	0	130	39	575	0	0	0	614	
8:00 AM						0		279	3			282	6		24			30	7	157				164	
8:15 AM						0		271	3			274	6		24			30	7	162				169	
8:30 AM						0		262	2			264	6		23			29	7	164				171	
8:45 AM						0		245	7			252	6		23			29	9	147				156	
Hourly Total	0	0	0	0	0	0	0	1057	15	0	0	1072	24	0	94	0	0	118	30	630	0	0	0	660	
9:00 AM						0						0						0						0	
9:15 AM						0						0						0						0	
9:30 AM						0						0						0						0	
9:45 AM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10:00 AM						0						0						0						0	
10:15 AM						0						0						0						0	
10:30 AM						0						0						0						0	
10:45 AM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11:00 AM						0		186	6			192	3		14			17	15	132				147	
11:15 AM						0		159	4			163	3		15			18	13	152				165	
11:30 AM						0		186	4			190	3		14			17	13	147				160	
11:45 AM						0		144	4			148	3		13			16	14	168				182	
Hourly Total	0	0	0	0	0	0	0	675	18	0	0	693	12	0	56	0	0	68	55	599	0	0	0	654	
12:00 PM						0		175	6			181	4		16			20	15	160				175	
12:15 PM						0		198	7			205	4		20			24	14	183				197	
12:30 PM						0		182	6			188	4		15			19	16	152				168	
12:45 PM						0		153	8			161	4		15			19	17	173				190	
Hourly Total	0	0	0	0	0	0	0	708	27	0	0	735	16	0	66	0	0	82	62	668	0	0	0	730	
1:00 PM						0						0						0						0	
1:15 PM						0						0						0						0	
1:30 PM						0						0						0						0	
1:45 PM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:00 PM						0		182	8			190	3		14			17	18	168				186	
2:15 PM						0		182	6			188	3		12			15	17	200				217	
2:30 PM						0		166	7			173	3		12			15	17	196				213	
2:45 PM						0		188	11			199	4		12			16	17	228				245	
Hourly Total	0	0	0	0	0	0	0	718	32	0	0	750	13	0	50	0	0	63	69	792	0	0	0	861	
3:00 PM						0		168	7			175	3		16			19	20	228				248	
3:15 PM						0		182	6			188	3		14			17	20	276				296	
3:30 PM						0		246	8			254	3		15			18	20	287				307	
3:45 PM						0		283	9			292	3		14			17	21	320				341	
Hourly Total	0	0	0	0	0	0	0	879	30	0	0	909	12	0	59	0	0	71	81	1111	0	0	0	1192	
4:00 PM						0		205	10			215	4		20			24	23	286				309	
4:15 PM						0		183	7			190	4		17			21	23	321				344	
4:30 PM						0		196	7			203	4		16			20	23	335				358	
4:45 PM						0		189	7			196	5		16			21	25	327				352	
Hourly Total	0	0	0	0	0	0	0	773	31	0	0	804	17	0	69	0	0	86	94	1269	0	0	0	1363	
5:00 PM						0		198	9			207	6		19			25	28	350				378	
5:15 PM						0		173	8			181	6		21			27	27	345				372	
5:30 PM						0		206	8			214	4		20			24	26	345				371	
5:45 PM						0		173	9			182	4		18			22	26	334				360	
Hourly Total	0	0	0	0	0	0	0	750	34	0	0	784	20	0	78	0	0	98	107	1374	0	0	0	1481	
6:00 PM						0						0						0						0	
6:15 PM						0						0						0						0	
6:30 PM						0						0						0						0	
6:45 PM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:00 PM						0						0						0						0	
7:15 PM						0						0						0						0	
7:30 PM						0						0						0						0	
7:45 PM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8:00 PM						0						0						0						0	
8:15 PM						0						0						0						0	
8:30 PM						0						0						0						0	
8:45 PM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9:00 PM						0						0						0						0	
9:15 PM						0						0						0						0	
9:30 PM						0						0						0						0	
9:45 PM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10:00 PM						0						0						0						0	
10:15 PM						0						0						0						0	
10:30 PM						0						0						0						0	
10:45 PM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11:00 PM						0						0						0						0	
11:15 PM						0						0						0						0	
11:30 PM						0						0						0						0	
11:45 PM						0						0						0						0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	2 or More Lanes

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

**Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)*

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
											Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	100%		70%		100%		70%		80%		80%		56%		56%	
			Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+	X		600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
1:45 AM	0	0																
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4:45 AM	0	0																
5:00 AM	0	0																
5:15 AM	0	0																
5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	463	28			1										1			
6:30 AM	999	56	1				1		1		1		1				1	1
6:45 AM	1563	87																
7:00 AM	2059	116																
7:15 AM	2042	115			1										1	1		
7:30 AM	1949	113	1				1	1	1	1	1		1	1			1	1
7:45 AM	1820	108																
8:00 AM	1732	104																
8:15 AM	1286	78			1										1			
8:30 AM	843	51	1						1		1		1				1	
8:45 AM	408	26																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

10:00 AM	0	0																
10:15 AM	339	16													1			
10:30 AM	667	32	1		1				1		1						1	
10:45 AM	1017	47					1						1					
11:00 AM	1347	61																
11:15 AM	1364	64													1			
11:30 AM	1438	69	1		1				1		1						1	1
11:45 AM	1444	70					1						1					
12:00 PM	1465	73																
12:15 PM	1109	55													1			
12:30 PM	707	34	1		1				1		1						1	
12:45 PM	351	17																
1:00 PM	0	0																
1:15 PM	376	16													1			
1:30 PM	781	29	1		1				1		1		1				1	
1:45 PM	1167	42					1											
2:00 PM	1611	56																
2:15 PM	1658	58													1			
2:30 PM	1737	60	1		1				1		1		1				1	1
2:45 PM	1912	63					1											
3:00 PM	2101	64																
3:15 PM	2202	69													1			
3:30 PM	2252	72	1		1				1	1	1		1				1	1
3:45 PM	2252	73					1											
4:00 PM	2167	76																
4:15 PM	2228	76													1			
4:30 PM	2247	81	1		1				1	1	1		1	1			1	1
4:45 PM	2271	85					1											
5:00 PM	2265	86																
5:15 PM	1680	65													1			
5:30 PM	1127	42	1		1				1		1		1				1	
5:45 PM	542	20																
6:00 PM	0	0																
6:15 PM	0	0																
6:30 PM	0	0																
6:45 PM	0	0																
7:00 PM	0	0																
7:15 PM	0	0																
7:30 PM	0	0																
7:45 PM	0	0																
8:00 PM	0	0																
8:15 PM	0	0																
8:30 PM	0	0																
8:45 PM	0	0																
9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			**11**	**0**	**11**	**0**	**8**	**1**	**11**	**3**	**11**	**0**	**10**	**2**	**11**	**1**	**11**	**6**
WARRANT SATISFIED?			**NO**		**NO**		**NO**		**NO**		**NO**				**NO**			

Warrant Met: **No**

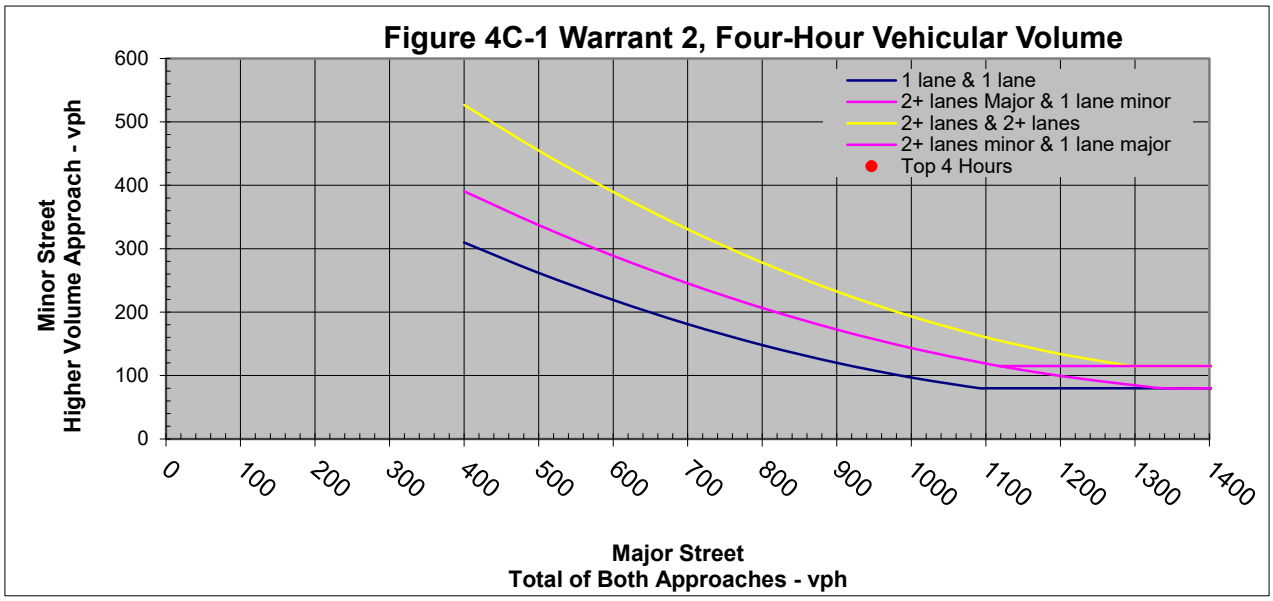
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach		Total Number of Unique Hours Met on Figure 4C-1	1
Major street:	2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	3
Minor Street:	2 or More Lanes		

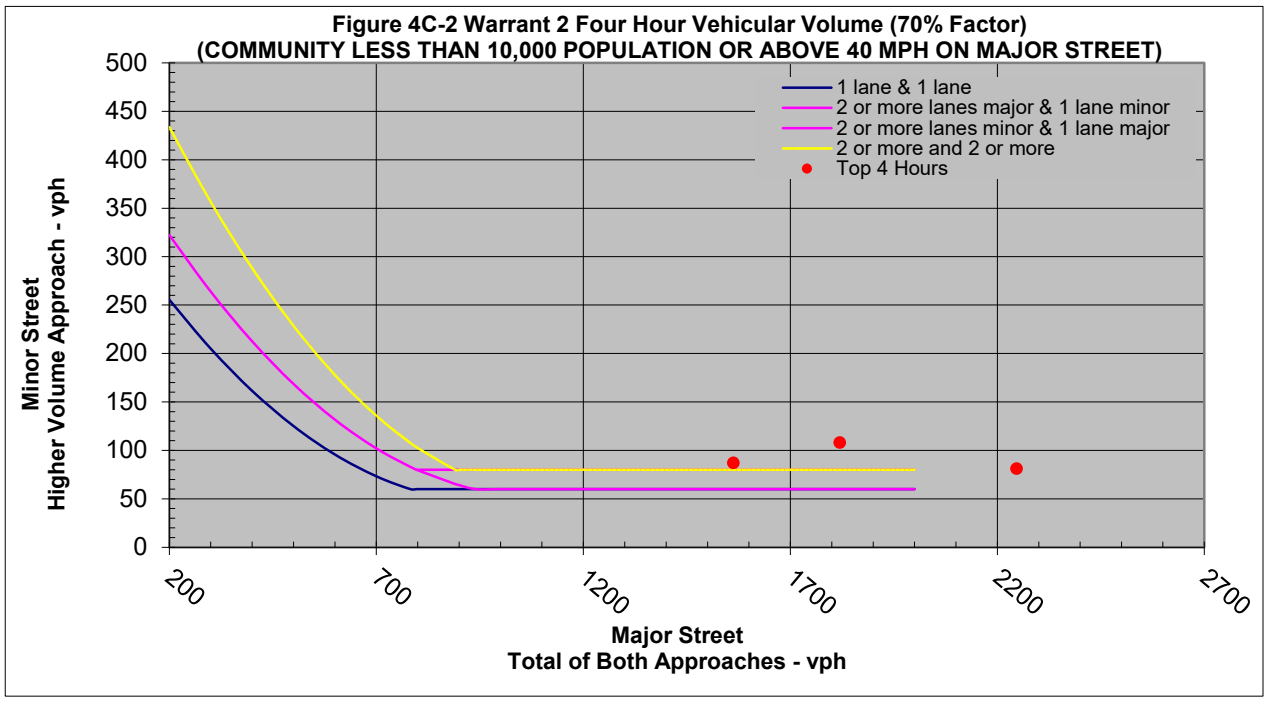
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Minor - Road "A"		Major - Asheville Highway					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	28	0	336	127	463	28		
6:30 AM	56	0	701	298	999	56		
6:45 AM	87	0	1106	457	1563	87		Met
7:00 AM	116	0	1445	614	2059	116	Met	
7:15 AM	115	0	1391	651	2042	115		
7:30 AM	113	0	1300	649	1949	113		
7:45 AM	108	0	1159	661	1820	108		Met
8:00 AM	104	0	1072	660	1732	104		
8:15 AM	78	0	790	496	1286	78		
8:30 AM	51	0	516	327	843	51		
8:45 AM	26	0	252	156	408	26		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	16	0	192	147	339	16		
10:30 AM	32	0	355	312	667	32		
10:45 AM	47	0	545	472	1017	47		
11:00 AM	61	0	693	654	1347	61		
11:15 AM	64	0	682	682	1364	64		
11:30 AM	69	0	724	714	1438	69		
11:45 AM	70	0	722	722	1444	70		
12:00 PM	73	0	735	730	1465	73		
12:15 PM	55	0	554	555	1109	55		
12:30 PM	34	0	349	358	707	34		
12:45 PM	17	0	161	190	351	17		
1:00 PM	0	0	0	0	0	0		
1:15 PM	16	0	190	186	376	16		
1:30 PM	29	0	378	403	781	29		
1:45 PM	42	0	551	616	1167	42		
2:00 PM	56	0	750	861	1611	56		
2:15 PM	58	0	735	923	1658	58		
2:30 PM	60	0	735	1002	1737	60		
2:45 PM	63	0	816	1096	1912	63		
3:00 PM	64	0	909	1192	2101	64		
3:15 PM	69	0	949	1253	2202	69		
3:30 PM	72	0	951	1301	2252	72		
3:45 PM	73	0	900	1352	2252	73		
4:00 PM	76	0	804	1363	2167	76		
4:15 PM	76	0	796	1432	2228	76		
4:30 PM	81	0	787	1460	2247	81		Met
4:45 PM	85	0	798	1473	2271	85		
5:00 PM	86	0	784	1481	2265	86		
5:15 PM	65	0	577	1103	1680	65		
5:30 PM	42	0	396	731	1127	42		
5:45 PM	20	0	182	360	542	20		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	7:00 AM	8:00 AM	2059	116
2nd Highest Hour	7:00 AM	8:00 AM	2059	116
3rd Highest Hour	8:00 AM	9:00 AM	1732	104
4th Highest Hour	5:00 PM	6:00 PM	2265	86

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	7:45 AM	8:45 AM	1820	108
2nd Highest Hour	6:45 AM	7:45 AM	1563	87
3rd Highest Hour	4:30 PM	5:30 PM	2247	81
4th Highest Hour	12:00 AM	1:00 AM	0	73



Are the requirements for Warrant 2 met?: No

OMUTCD WARRANT 3, PEAK HOUR

Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time	7:00 AM
Major Street:	2 or More Lanes	Peak Hour End Time	8:00 AM
Minor Street:	2 or More Lanes		

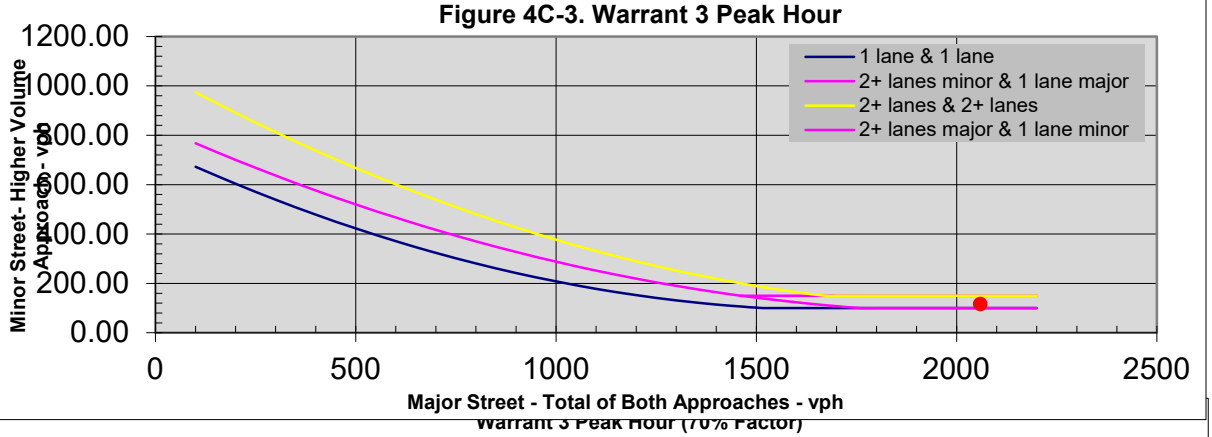
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes

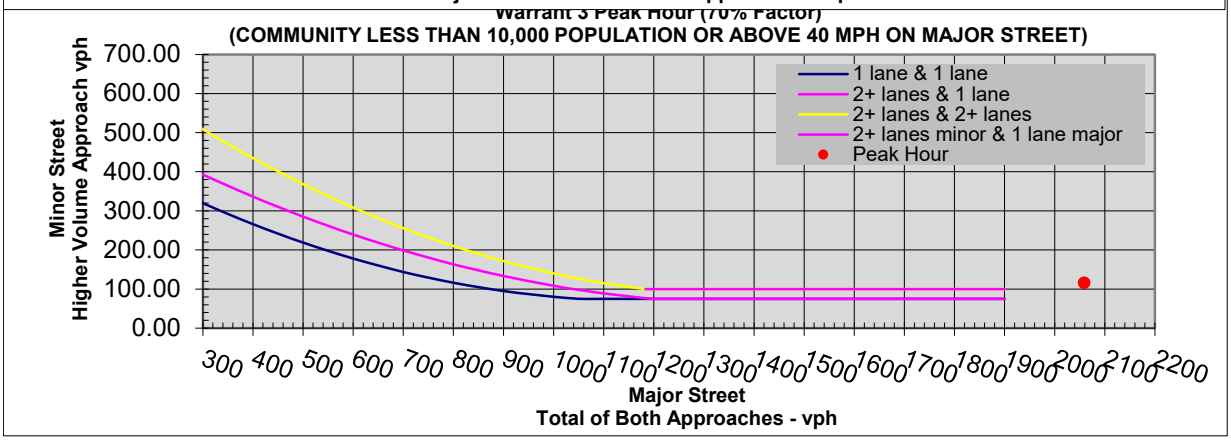
Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes
**If applicable, attach all supporting calculations and documentation.*	

Are the requirements for Warrant 3 met?: No

Figure 4C-3. Warrant 3 Peak Hour





Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	463	28	491	491
6:30 AM	999	56	1055	1055
6:45 AM	1563	87	1650	1650
7:00 AM	2059	116	2175	2175
7:15 AM	2042	115	2157	2157
7:30 AM	1949	113	2062	2062
7:45 AM	1820	108	1928	1928
8:00 AM	1732	104	1836	1836
8:15 AM	1286	78	1364	1364
8:30 AM	843	51	894	894
8:45 AM	408	26	434	434
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	339	16	355	355
10:30 AM	667	32	699	699
10:45 AM	1017	47	1064	1064
11:00 AM	1347	61	1408	1408
11:15 AM	1364	64	1428	1428
11:30 AM	1438	69	1507	1507
11:45 AM	1444	70	1514	1514
12:00 PM	1465	73	1538	1538
12:15 PM	1109	55	1164	1164
12:30 PM	707	34	741	741
12:45 PM	351	17	368	368
1:00 PM	0	0	0	0
1:15 PM	376	16	392	392
1:30 PM	781	29	810	810
1:45 PM	1167	42	1209	1209
2:00 PM	1611	56	1667	1667
2:15 PM	1658	58	1716	1716
2:30 PM	1737	60	1797	1797
2:45 PM	1912	63	1975	1975
3:00 PM	2101	64	2165	2165
3:15 PM	2202	69	2271	2271
3:30 PM	2252	72	2324	2324
3:45 PM	2252	73	2325	2325
4:00 PM	2167	76	2243	2243
4:15 PM	2228	76	2304	2304
4:30 PM	2247	81	2328	2328
4:45 PM	2271	85	2356	2356
5:00 PM	2265	86	2351	2351
5:15 PM	1680	65	1745	1745
5:30 PM	1127	42	1169	1169
5:45 PM	542	20	562	562
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
2059	116	150	100

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