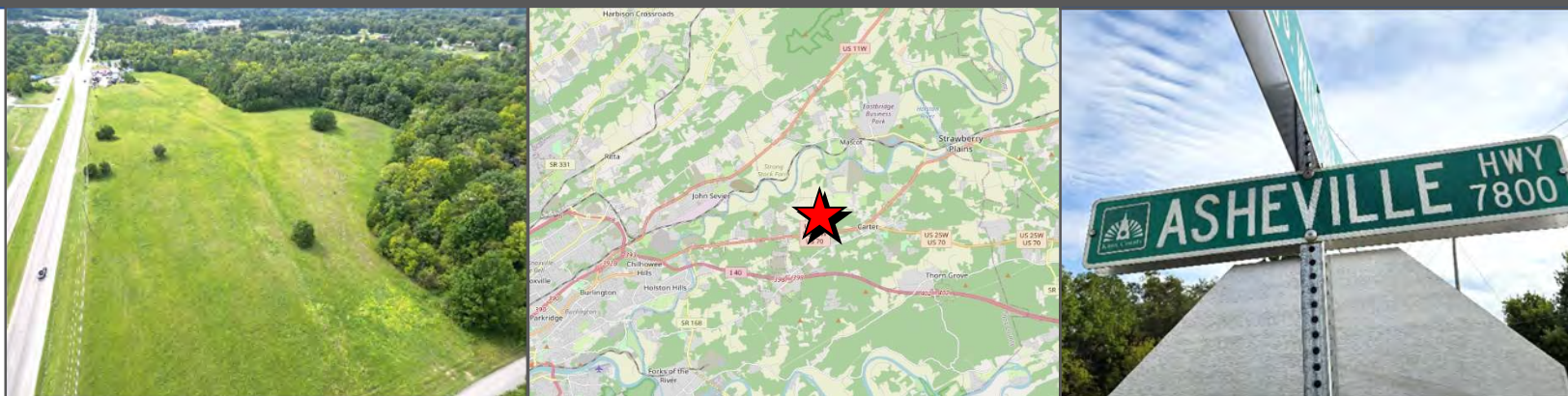


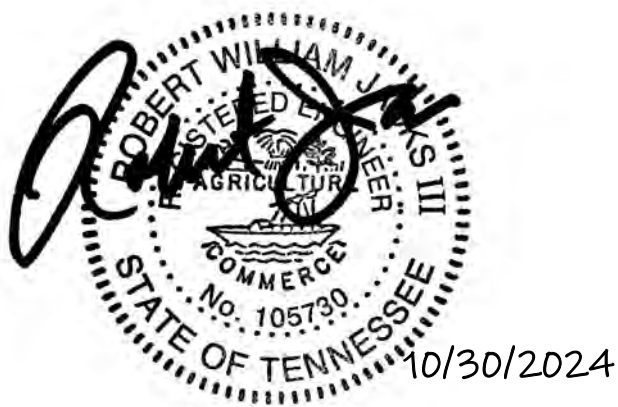


# Transportation Impact Study 0 Asheville Highway Subdivision Knox County, Tennessee



Revised October 2024

Prepared for:  
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11-SH-24-C / 11-K-24-DP  
TIS Version 2  
10/30/2024

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## **EXECUTIVE SUMMARY**

### **Preface:**

Mesana Investments, LLC proposes a residential development on the north side and adjacent to Asheville Highway in East Knox County, TN. The development will include constructing 111 multi-family attached townhouses on 10.24 +/- acres. The development is named and referenced in this study as "0 Asheville Highway Subdivision" since a name has not yet been chosen. The development proposes a single entrance from the north to Asheville Highway between North Wooddale Road and Cash Road. 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, the entrance intersection, and the existing upstream and downstream unsignalized intersections of Asheville Highway at South and North Wooddale Road and at Cash Road. 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 0 Asheville Highway Subdivision, with 111 multi-family attached townhouses, is estimated to generate 1,049 vehicle trips at full build-out and occupancy on an average weekday. Of these daily trips, 59 are estimated to occur during the AM peak hour and 85 in the PM peak hour in 2028.
- The South and North Wooddale Road approaches at the 4-way unsignalized intersection with Asheville Highway currently operate with considerable vehicle delays and are projected to operate with worse delays as traffic increases in the future.
- With the proposed 0 Asheville Highway Subdivision and the other nearby residential developments being constructed and occupied by 2028, the northbound and southbound approaches of South and North Wooddale Road at their intersection with Asheville Highway are projected to operate at LOS F during the projected AM and PM peak hours. The proposed southbound left-turn lane for the Proposed Entrance at Asheville Highway is also projected to operate at LOS

F during the projected AM and PM peak hours. These approaches on South and North Wooddale Road and the exiting lane at the proposed entrance are projected to have minimal volumes but high vehicle delays due to the large conflicting volumes on Asheville Highway during peak hours. However, despite these considerable vehicle delays, the overall vehicle queues on these approaches are expected to be minimal because of the overall low volumes attempting to enter the intersections.

### **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 South and North Wooddale Road:**

- It is recommended that TDOT monitor this intersection for further evaluation. A fatal crash occurred at this intersection in 2021. While it appears that there have not been any recorded fatalities since then, the combination of the general future traffic growth, the large expanse of the intersection, the existing established need for flashing beacons, and the high side street vehicle delays, this intersection needs to be monitored for potential improvements. The side street volumes on South and North Wooddale Road are not expected to be substantial enough to meet volume-related warrant thresholds for a traffic signal. However, vehicle crashes may necessitate the need. Additionally, any future development on South or North Wooddale Road could significantly increase side street volumes to meet threshold warrants for a potential traffic signal.

#### **Asheville Highway at Cash Road:**

- No specific recommendations are offered for this intersection.

#### **Asheville Highway at Proposed Entrance:**

- It is recommended that a median opening be permitted on Asheville Highway for the Proposed Entrance due to sight distance restrictions at Cash Road and the considerable side street delays on South and North Wooddale Road. Because of



these limitations, a median opening should be provided that would eliminate the need for U-turns occurring on Asheville Highway at these existing upstream and downstream intersections, which would otherwise be necessary for entering and exiting subdivision vehicles.

- The construction of an eastbound left-turn lane on Asheville Highway at the proposed median opening for traffic entering the proposed subdivision is warranted based on the projected 2028 traffic volumes. The recommended lengths for this proposed left-turn lane include a lane change and deceleration distance of 340 feet and a storage length of 50 feet, for a total 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.
- Due to the projected high vehicle delays for exiting southbound left turns from the proposed subdivision towards the east, separate left and right turn lanes are recommended for the Proposed Entrance approach at Asheville Highway. The left-turn lane should have a minimum vehicle storage of 75 feet, and the right-turn lane should be a continuation of the Road "A" southbound lane traveling towards the highway. 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 the recommended median opening design.
- Many regulatory signs should be installed to avoid and help prevent wrong-way vehicles on Asheville Highway at the Proposed Entrance. Figure 2.10 in TDOT's Traffic Design Manual illustrates the signage required for the Proposed Entrance at Asheville Highway.
- Intersection sight distance at the Proposed Entrance at Asheville Highway must not be impacted by future landscaping, signage, or existing or future vegetation.

#### **0 Asheville Highway Subdivision Internal Roads:**

- A 15-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the Proposed Entrance, Road "A", off Asheville Highway. Since the subdivision streets will not be public roads, a posted speed limit of less than 25-mph is acceptable. 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.
- The Stop Sign (R1-1) on the Road "A" 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, 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 Road "B", the northern end of Road "D", and the western and eastern ends of Road "E" 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 / north / east – 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 south.
- 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 15-mph in the development, the required internal intersection sight distance is 170 feet. The site designer should ensure that internal sight distance lengths are met.
- 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 location of this new residential development is shown on a map in Figure 1. This residential development will be located on the north side of Asheville Highway between North Wooddale Road and Cash Road in East Knox County, TN. The proposed entrance will be midway between North Wooddale Road and Cash Road, which are approximately 1,755 feet from each other centerline to centerline. The development will be constructed from two existing parcels and will have 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, and the upstream and downstream unsignalized intersections of Asheville Highway at South and North Wooddale Road and at Cash Road. There are no median openings on Asheville Highway between these upstream and downstream intersections.

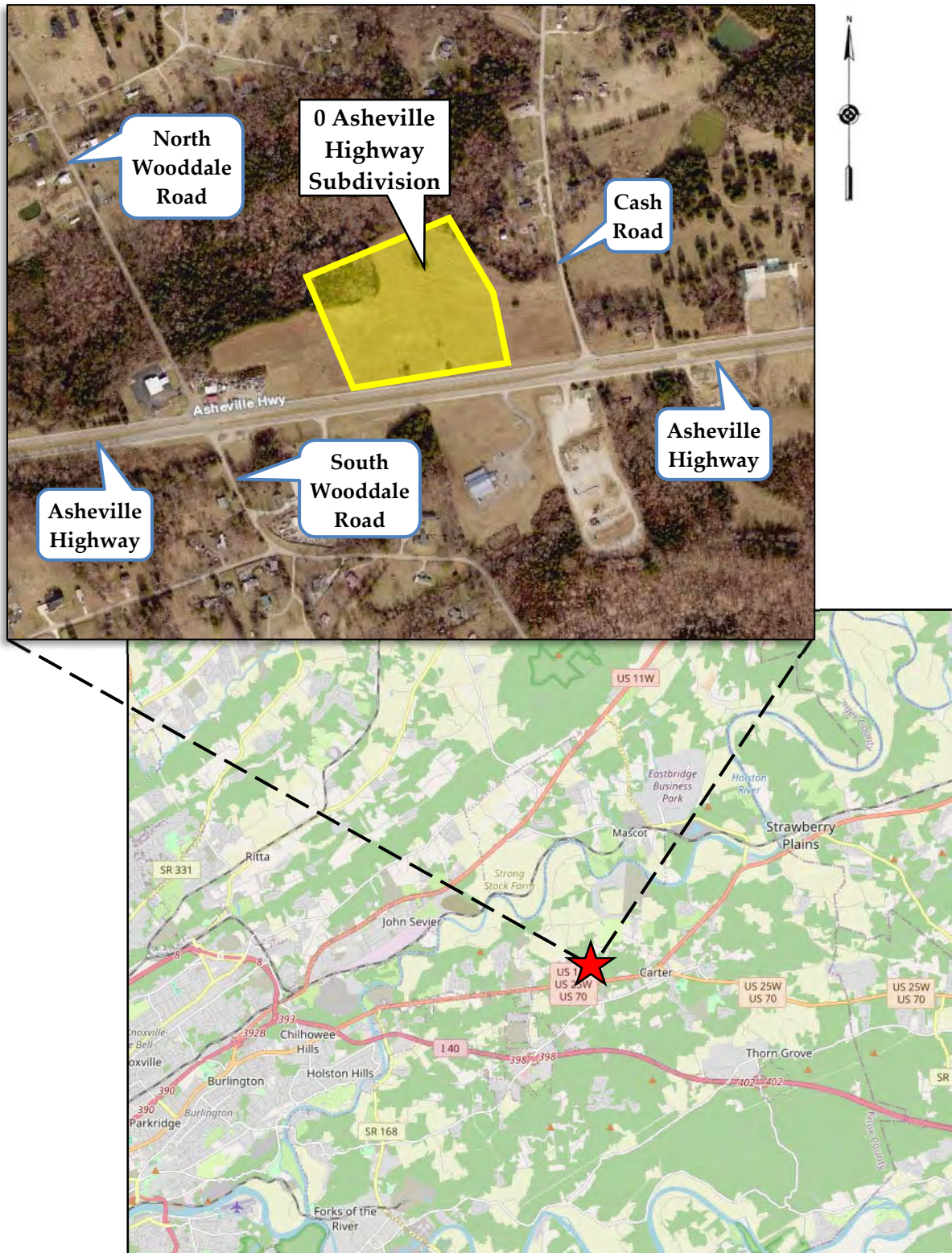


The proposed development property is in a formerly rural area, slowly transitioning to a more suburban area of East Knox County, TN. There are many residential subdivisions and stand-alone homes in the surrounding area, as well as commercial development along Asheville Highway. The nearby commercial properties include a bank, a pontoon and trailer sales business, a church, an electrical contractor, and another trailer sales establishment in the initial stages of opening for business. There are also many unoccupied properties nearby as well. The 0 Asheville Highway Subdivision property is cleared except for a few trees and is currently maintained as an

open field. The topography is mild, with a slight drainage swale adjacent to Asheville Highway, running east to west.

Main 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.





▪ **EXISTING ROADWAYS:**

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

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

NAME	CLASSIFICATION <sup>1</sup>	SPEED LIMIT	LANES	ROAD WIDTH <sup>2</sup>	TRANSIT <sup>3</sup>	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
South and North Wooddale Road	Local Street	30 mph	2 lanes undivided	19 feet	None	No sidewalks along roadway	No bike lanes
Cash Road	Local Street	30 mph	2 lanes undivided	18 feet	None	No sidewalks along roadway	No bike lanes

<sup>1</sup> 2018 Major Road Plan by Knoxville/Knox County Planning & TDOT Functional Classification Map (9.14.18)

<sup>2</sup> From edges of pavement near project site

<sup>3</sup> 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. Separate left-turn lanes are provided for westbound and eastbound traffic on Asheville Highway for turns onto South Wooddale Road and North Wooddale Road, respectively. The westbound left-turn lane has 250 feet of vehicle storage, and the eastbound left-turn lane has 225 feet. A separate left-turn lane with 95 feet of vehicle storage is provided for eastbound traffic on Asheville Highway for turns onto Cash Road.

In both directions, grooved pavement rumble strips are located just outside the white edge lines along the shoulder of Asheville Highway. Each approach at the 4-way intersection of Asheville Highway at South and North Wooddale Road is delineated with two single flashing beacons. The beacons on the mainline approaches of Asheville Highway flash yellow, and the beacons on the minor approaches of South and North Wooddale Road flash red. 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 0 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.

**South and North Wooddale Road** each have two lanes, are classified as Local Streets, and generally traverse in a northwest-to-southeast direction. Both roads are posted with 30 mph speed limits and are controlled by Stop Signs (R1-1) and red flashing beacons at Asheville Highway.

The intersection of these roads at Asheville Highway is quite expansive, with the center of the highway having separate westbound and eastbound left-turn lanes. These turn lanes on Asheville Highway have a neutral offset provided by delineated white stripe/gore areas on the pavement.



The northbound approach of South Wooddale Road at Asheville Highway has a single lane for left, thru, and right turn vehicle movements. The southbound approach of North Wooddale Road at Asheville Highway has a single lane for left and thru vehicle movements and a raised small channelized island that separates right turns. This intersection has commercial development on its north side with a First Horizon Bank to the northwest and a pontoon and trailer sales business to the northeast, which includes an accumulation of items on display along and near the roadway.

North Wooddale Road has a length of 0.9 miles and connects to North Ruggles Ferry Pike to the northwest after several notable horizontal curves. Most land uses along this road are single-family detached houses, with several forested and undeveloped areas. South Wooddale Road has a length of 0.8 miles and connects to Strawberry Plains Pike to the southeast. Other than a property at the southeast corner with Asheville Highway and a few single-family detached houses, the majority of South Wooddale Road traverses through undeveloped forested property.

The property at the southeast corner of Asheville Highway at South Wooddale Road has several large buildings and is occupied by an electrical contractor.

**Cash Road** is a Local Street 1.1 miles long with a north-south alignment. Besides a slight horizontal change on its southern end, Cash Road has a very straight horizontal alignment and ends at a t-intersection with North Ruggles Ferry Pike to the north. Cash Road is mainly populated by single-family detached houses, undeveloped properties, and farm properties. Cash Road intersects Asheville Highway at an unsignalized t-intersection. As the aerial photo shows, the center median nose at this intersection's east side is quite intrusive for southbound left turns towards the east.

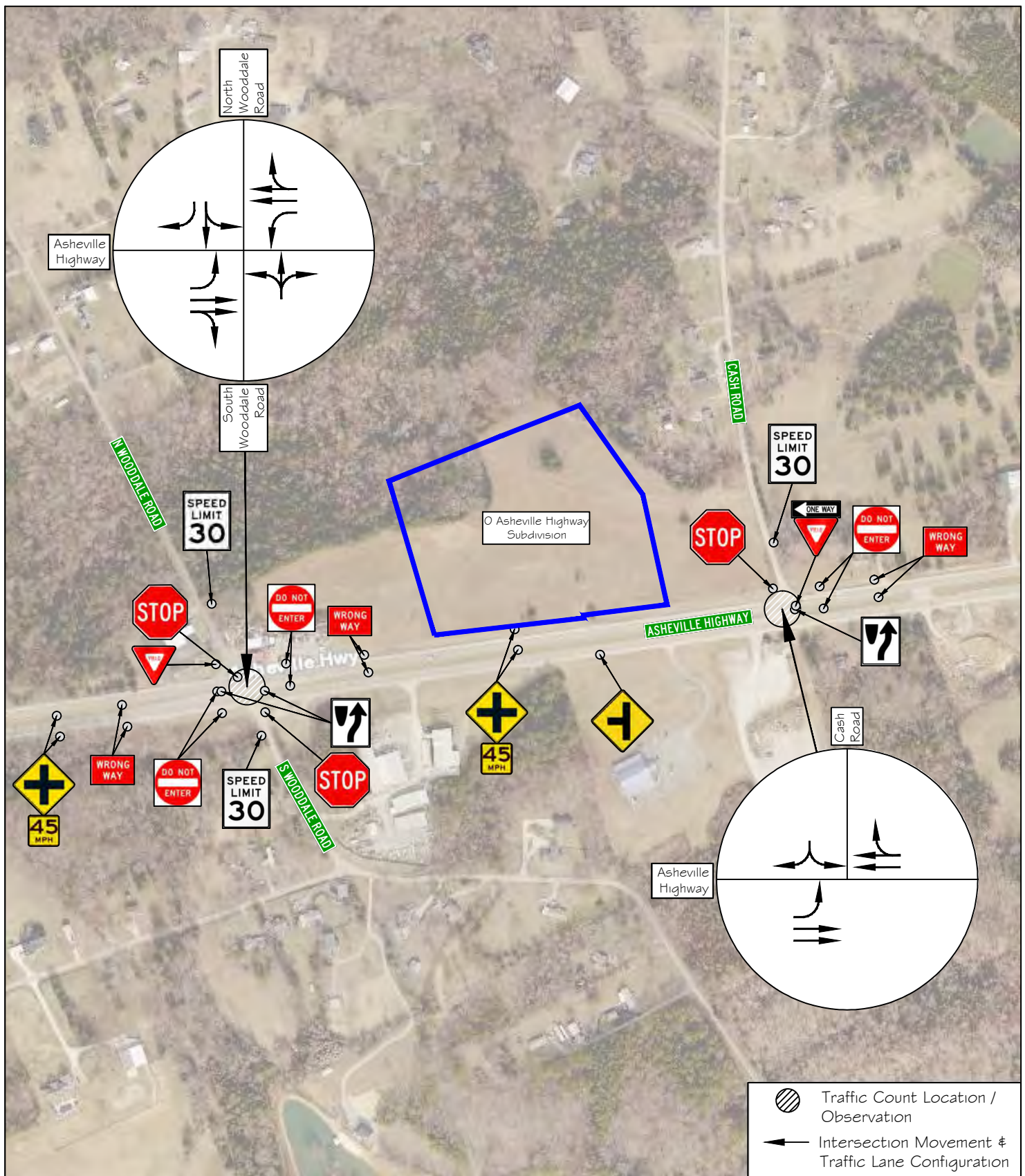


An eastbound left-turn lane is provided in the center of Asheville Highway at Cash Road with 95 feet of vehicle storage. Cash Road has a single southbound lane for left and right turn movements onto Asheville Highway.

This intersection does not currently have any commercial development on the north side. A single-family detached house occupies the northeast corner, and the southern side of the highway has a developed site recently used by TVA for storage, which is now being converted into a trailer sales business.

Figure 2 shows the existing lane configurations of the intersections examined in the study, the traffic count locations, 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.





11812 Black Road  
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Email: ajaxengineering@gmail.com

NOT TO SCALE



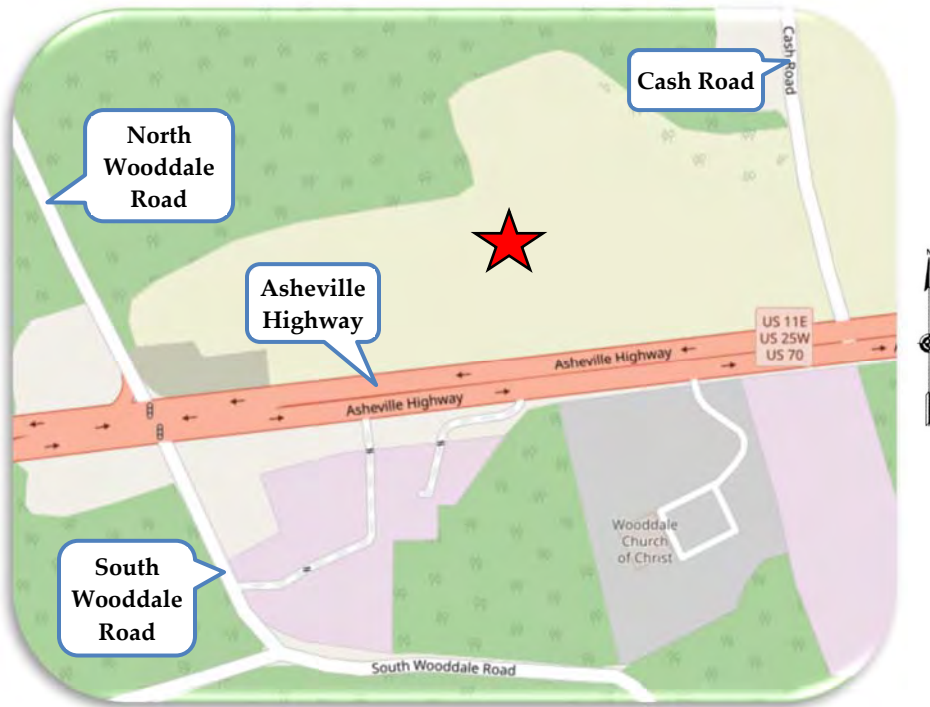
FIGURE 2

O Asheville Highway Subdivision

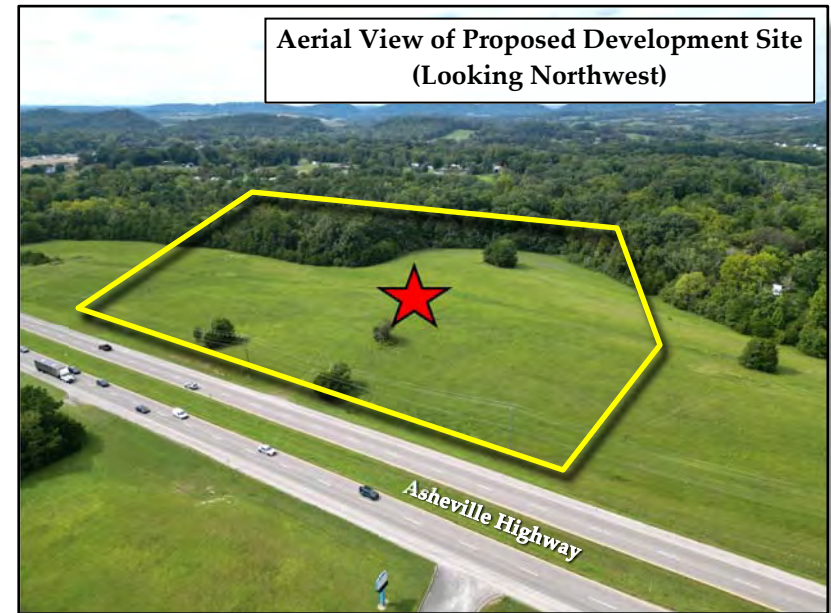
Traffic Count Locations, Traffic Signage & Existing Lane Configurations

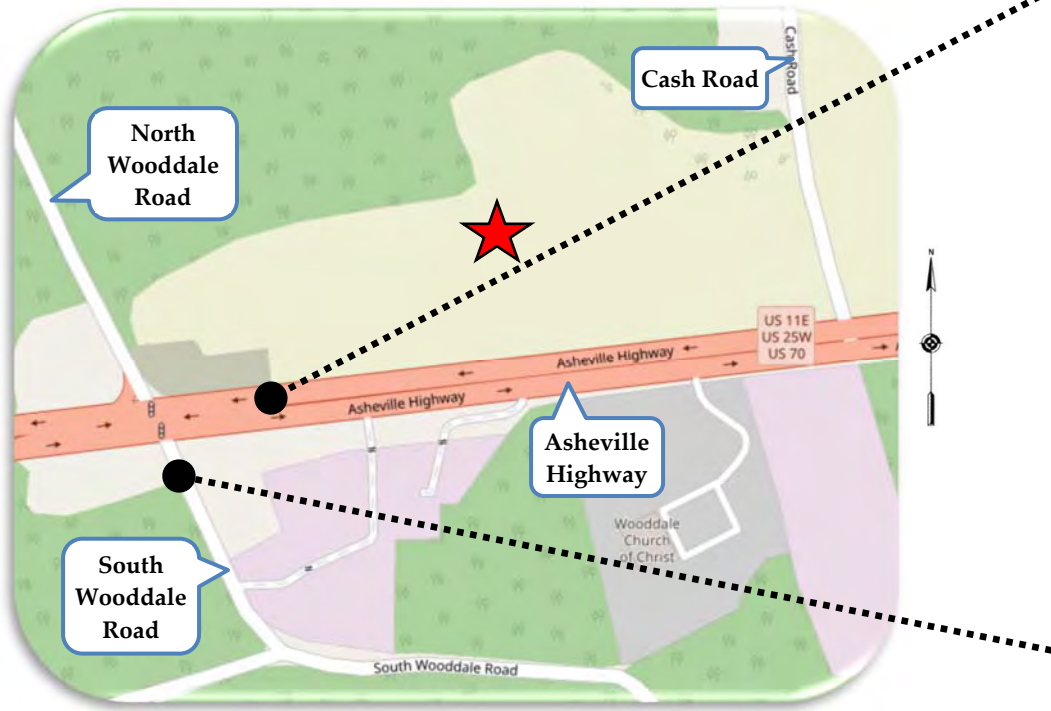


## PHOTO EXHIBITS



**Proposed Development Site**

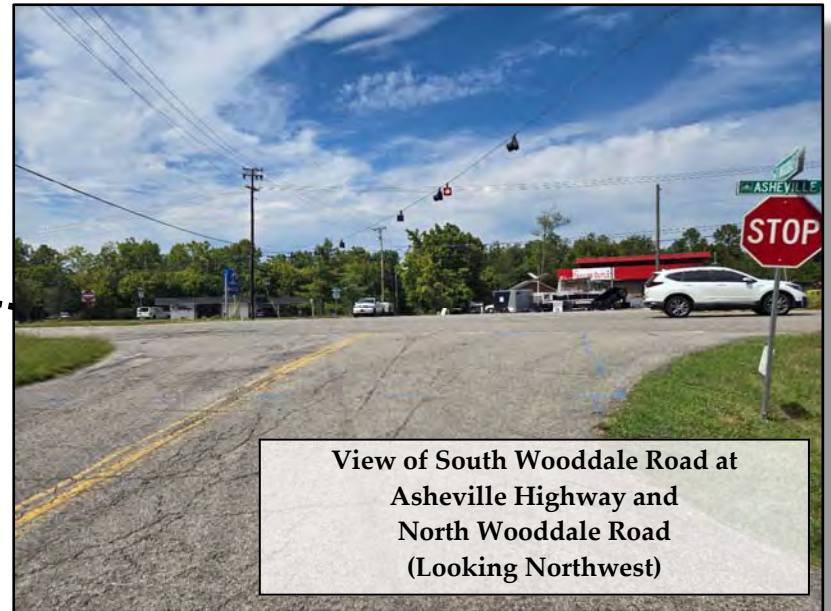




**Proposed Development Site**

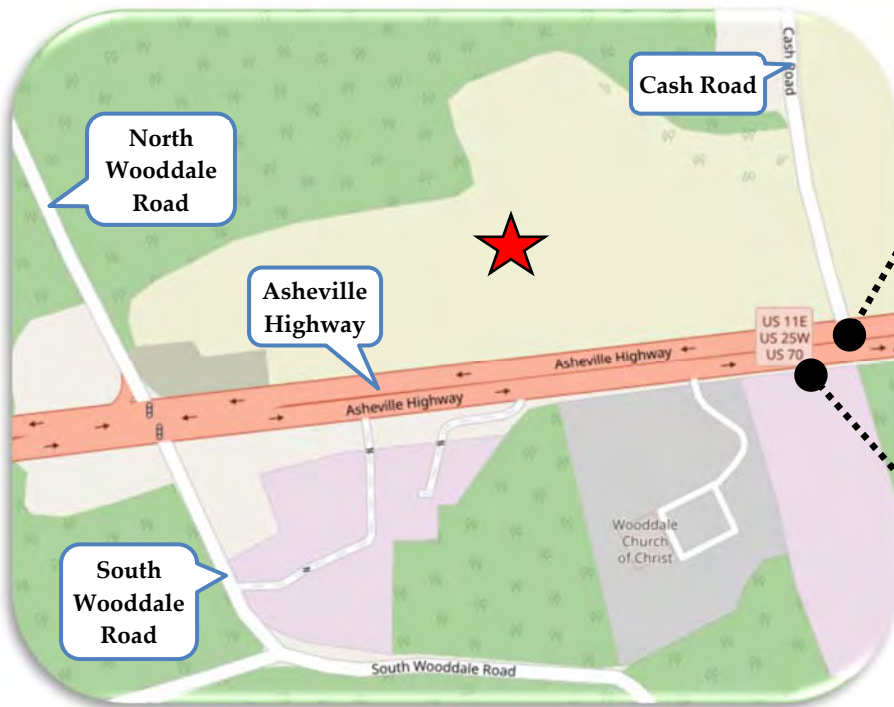


**View of Asheville Highway at  
South and North Wooddale Road  
(Looking West)**

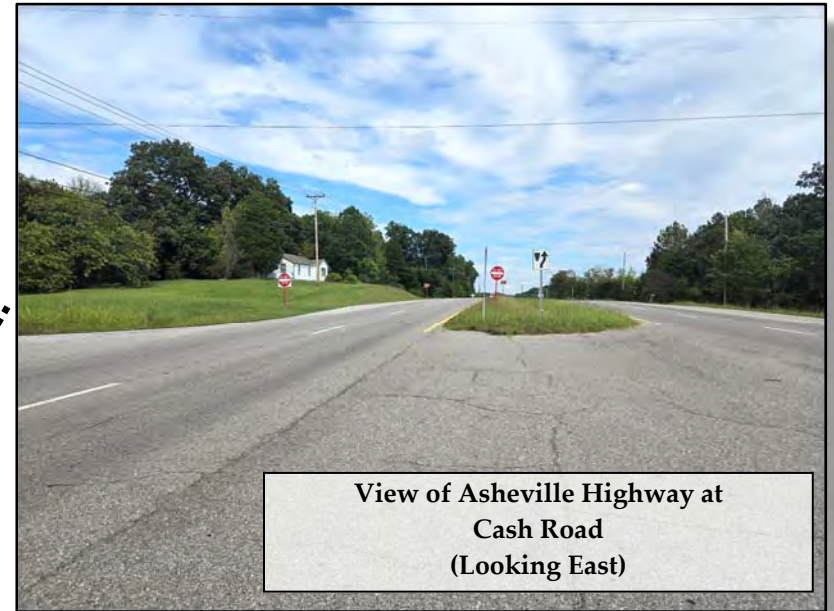


**View of South Wooddale Road at  
Asheville Highway and  
North Wooddale Road  
(Looking Northwest)**

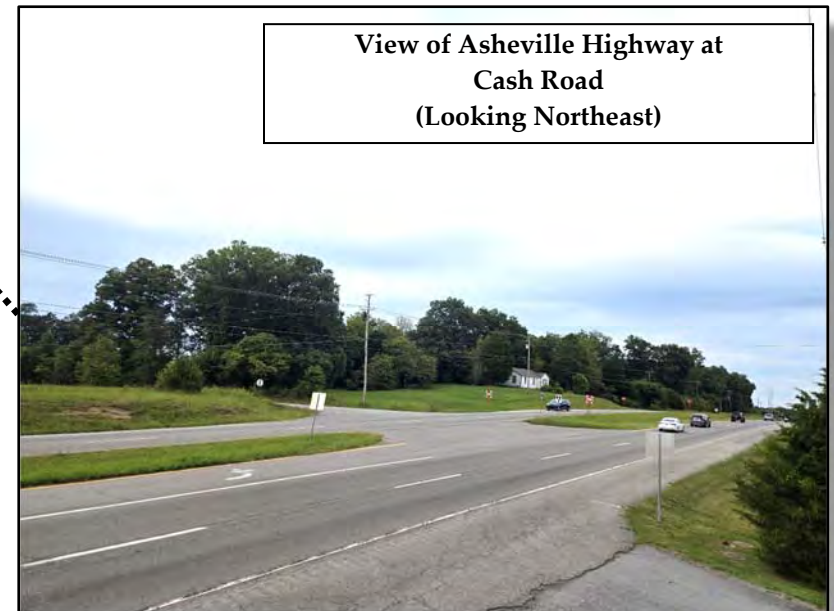




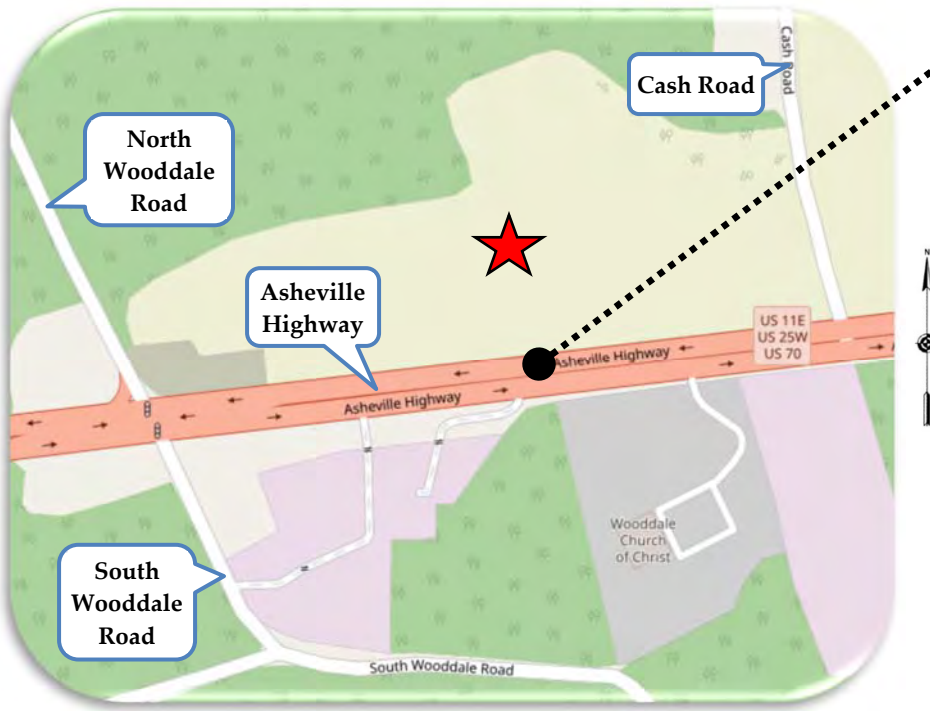
**Proposed Development Site**



**View of Asheville Highway at  
Cash Road  
(Looking East)**



**View of Asheville Highway at  
Cash Road  
(Looking Northeast)**



**Proposed Development Site**



**View of Asheville Highway at  
Proposed Entrance Location  
(Looking West)**

▪ **EXISTING TRANSPORTATION VOLUMES PER MODE:**

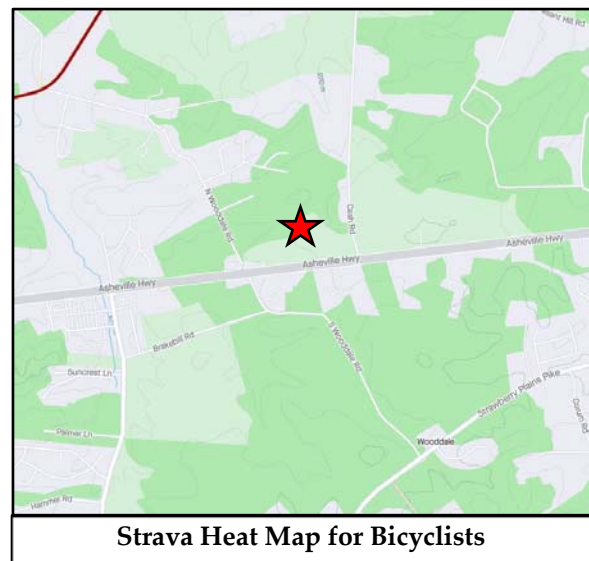
One annual vehicular traffic count location is located near the study area, and the Tennessee Department of Transportation (TDOT) conducts this count on Asheville Highway. The count location data is the following and can be viewed with further details in Appendix A:

- 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, South and North Wooddale Road, and Cash Road is unknown. However, with the lack of sidewalks and bike lanes, as well as high vehicular volumes, these roadways are assumed to have minimal pedestrian and bicyclist activity. During the traffic counts for this project, no bicyclists and a handful of "pedestrians" were observed at the intersections 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](https://www.strava.com), provides "heat" maps detailing routes taken by pedestrians, joggers, and bicyclists. The provided heat maps show the last two years of data, are updated monthly, and are gathered from individuals allowing their smart devices to track and compile

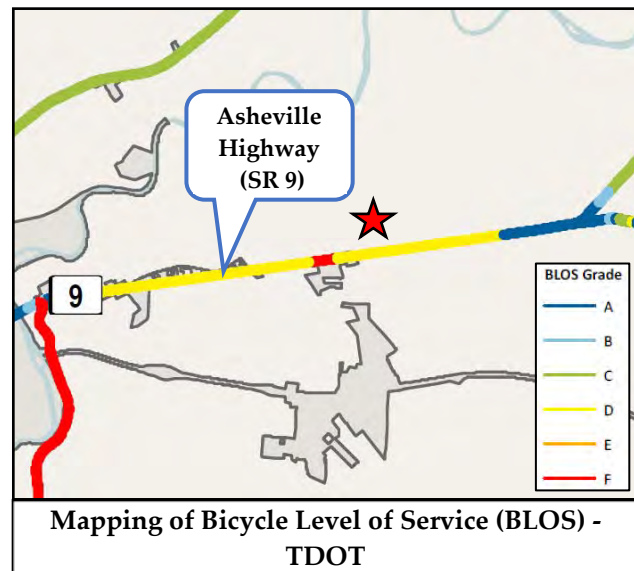




their routes (millions of users). The activities in the maps are shown on the roads with color intensities with darker colors signifying higher activity. The Strava heat maps show no pedestrian, jogger, or bicycle activity along Asheville Highway, South and North Wooddale Road, and Cash Road. The only activity shown in the surrounding area is bicyclists using North Ruggles Ferry Road to the northwest.

- **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.

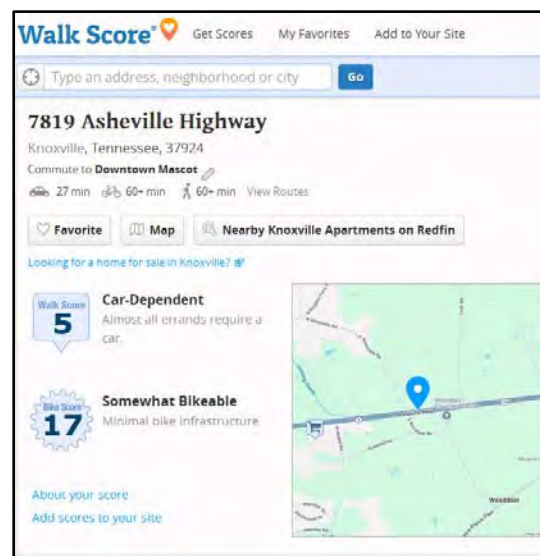


- **WALK SCORE:**

A private company offers a website at [walkscore.com](https://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 5 at the approximate development property address.

This Walk Score indicates that almost all errands currently require a vehicle for travel



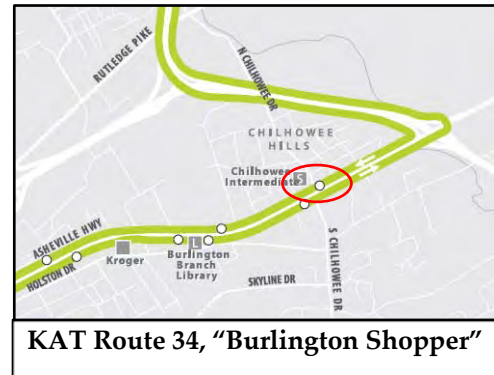


at the development property. The Walk Score is graded very low due to the lack of sidewalks, lack of nearby amenities, and the high vehicular volumes on the highway adjacent to the site. The site is given a Bike Score of 17, meaning there is minimal bike infrastructure. The site is not given a Transit 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.

The closest bus stop to the development site is 4.8 miles to the southwest by roadway and is on Route 34, "Burlington Shopper", at the intersection of North Chilhowee Drive and Asheville Highway. KAT made



several changes and improvements to their routes that began on August 26<sup>th</sup>, 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.

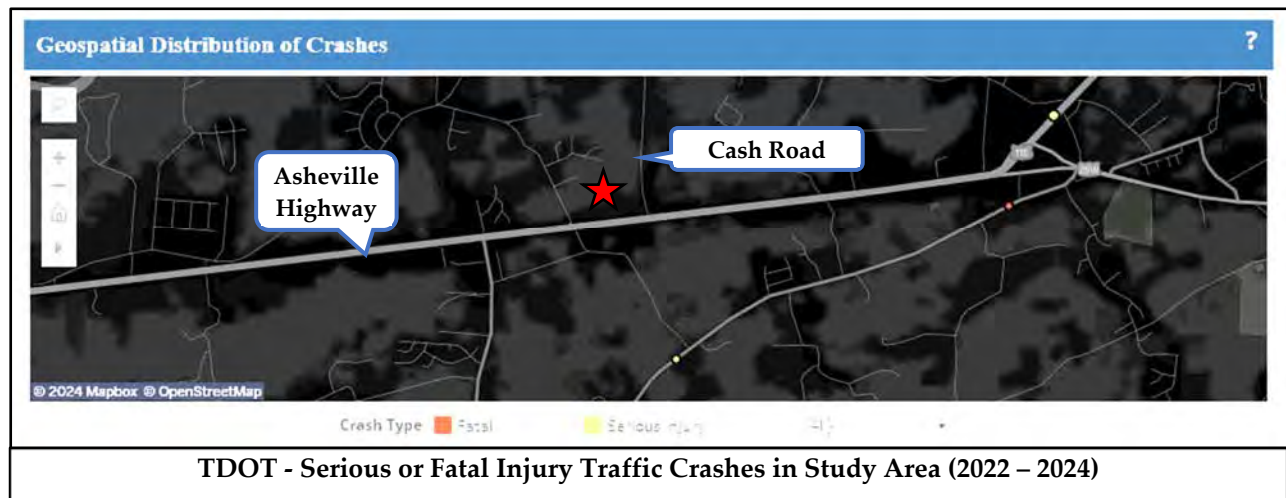
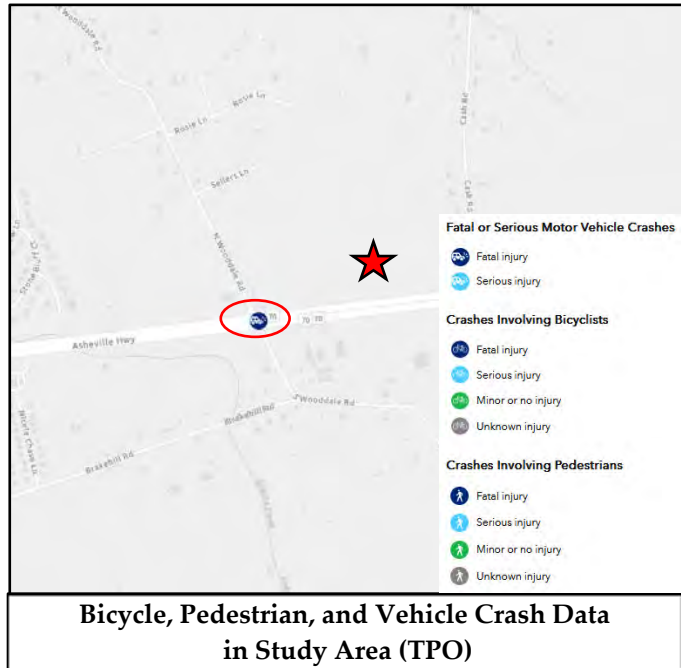
Since the distance to the nearest public bus service is several miles away, with no sidewalks or bike lanes available to access the bus stop without using a private vehicle, the proposed development is not expected to have any reduced vehicle trips due to public transit usage.

▪ **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, a fatal crash occurred at the intersection of Asheville Highway at South and North Wooddale Road during that time period. No crash factors were listed as the cause of this crash, but it did involve a senior driver. A further search on news websites was unsuccessful in determining further crash details.

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.

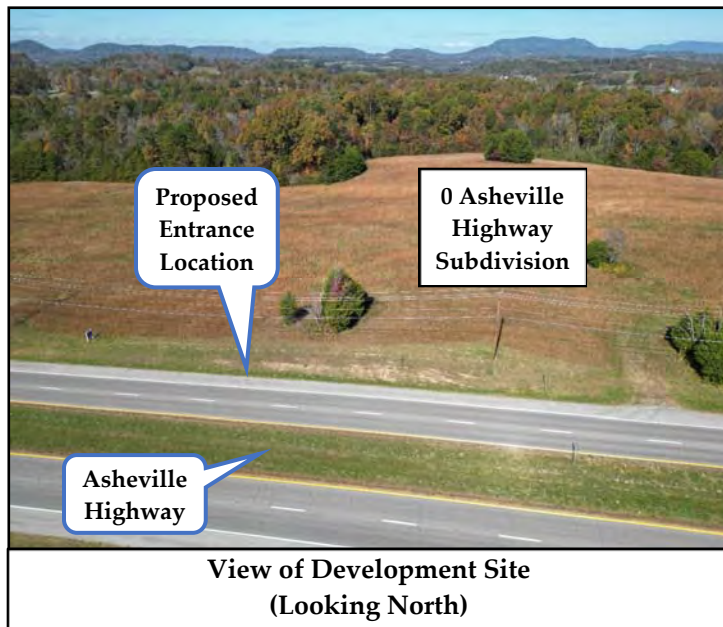
Ultimately, the crash data from the Knoxville TPO and TDOT is not specific enough to ascertain crash patterns or types to incorporate into the recommendations for this proposed development. However, TDOT continually monitors for high crash locations and conducts further investigations if a spot location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



## PROJECT DESCRIPTION

### ▪ LOCATION AND SITE PLAN:

The proposed plan layout with 111 multi-family attached townhouses on 10.24 +/- acres is designed by Urban Engineering and is shown in Figure 3. 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 north side of Asheville Road. Road "A" will be the entrance street for the Proposed Entrance off Asheville Highway, and a median opening is proposed at the entrance. The internal streets will form a looped pattern in the subdivision.

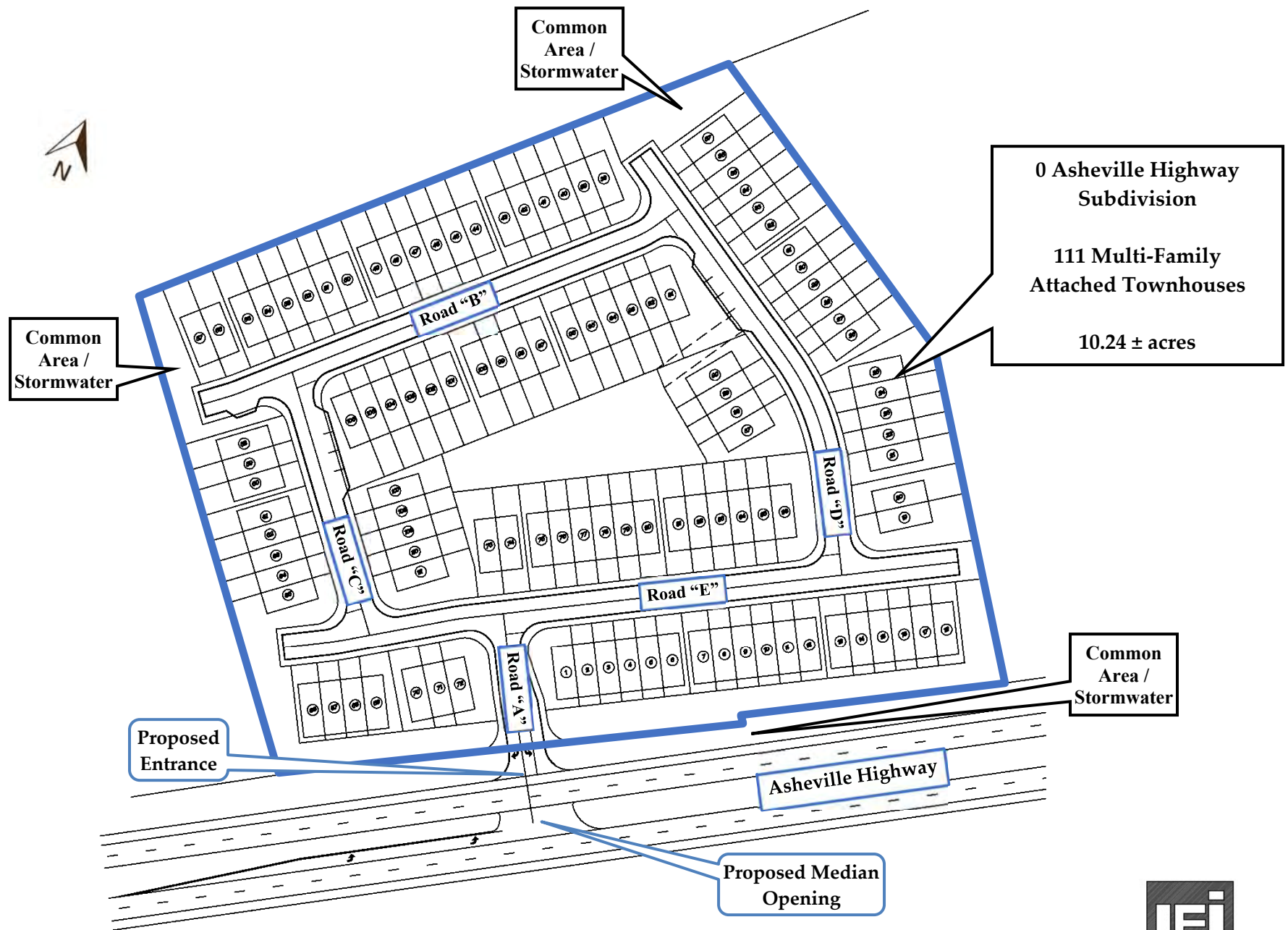


The 0 Asheville Highway Subdivision will have a few common areas that stormwater controls will occupy. These areas will be located on the corners and along the highway frontage of Asheville Highway.

The typical lot dimensions in the subdivision will be 110 feet deep and either 22 or 27 feet wide, providing a typical townhouse lot area of 2,420 or 2,970 square feet. Each townhouse will have a single-car 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. A total of nine on-street parking spaces will be provided for guests of the residents.

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**  
**0 Asheville Highway Subdivision**



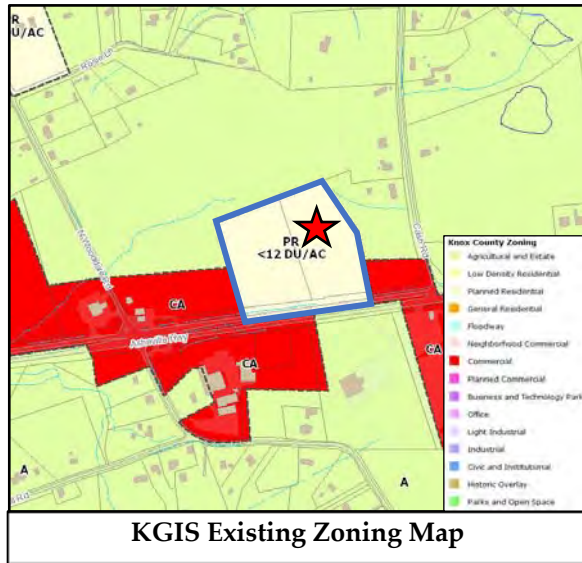
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▪ **PROPOSED USES AND ZONING REQUIREMENTS:**

The two parcels comprising the 0 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 15<sup>th</sup>, 2024. The property's previous zoning was Agricultural (A), and it was requested to be changed to Planned Residential (PR). The property rezoning was approved with a density of up to 12 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 south. Across Asheville Highway, the properties are zoned as Commercial (CA) and Agricultural (A). An electrical contractor occupies the commercial property with road access to the north provided by two entrances and an entrance on South Wooddale Road to the southeast. The Wooddale Church of Christ occupies the agricultural property on the other side of the highway. This church has singular road access to the north at Asheville Highway. None of the properties to the south have a median opening on Asheville Highway.
- To the east, one parcel is zoned Commercial (CA) on the southern portion adjacent to Asheville Highway and Agricultural (A) to the north. This parcel has a single-family detached house on its northern portion and is undeveloped along Cash Road and Asheville Highway to the south. Outside the house area, the property along the highway is an open-maintained field except for a recently installed roadside billboard.
- To the north, a single large parcel is primarily zoned as Agricultural (A). This parcel spans an area between Cash Road to the east and North Wooddale Road to the west—and the vast majority of the parcel is undeveloped and forested. To the southwest, the parcel is occupied by a pontoon and trailer sales business at the northeast corner of Asheville Highway at North Wooddale Road, and this portion of the parcel is zoned as Commercial (CA). This business on the intersection's northeast corner has two large entrance openings to the south on Asheville Highway and another to the west on North Wooddale Road.





▪ **ON-SITE CIRCULATION:**

The total length of the 0 Asheville Highway Subdivision internal roads will be 2,303 feet (0.44 miles), designed and constructed to Knox County specifications. The internal streets will be private and maintained by the owner after construction. The streets will have asphalt-paved surfaces with 8" extruded concrete curbs. The lane widths internally will be 13 feet each for a total 26-foot pavement width. The private right-of-way width within the development will be 40 feet. No sidewalks are proposed on the internal roads in this development.

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

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 private 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.

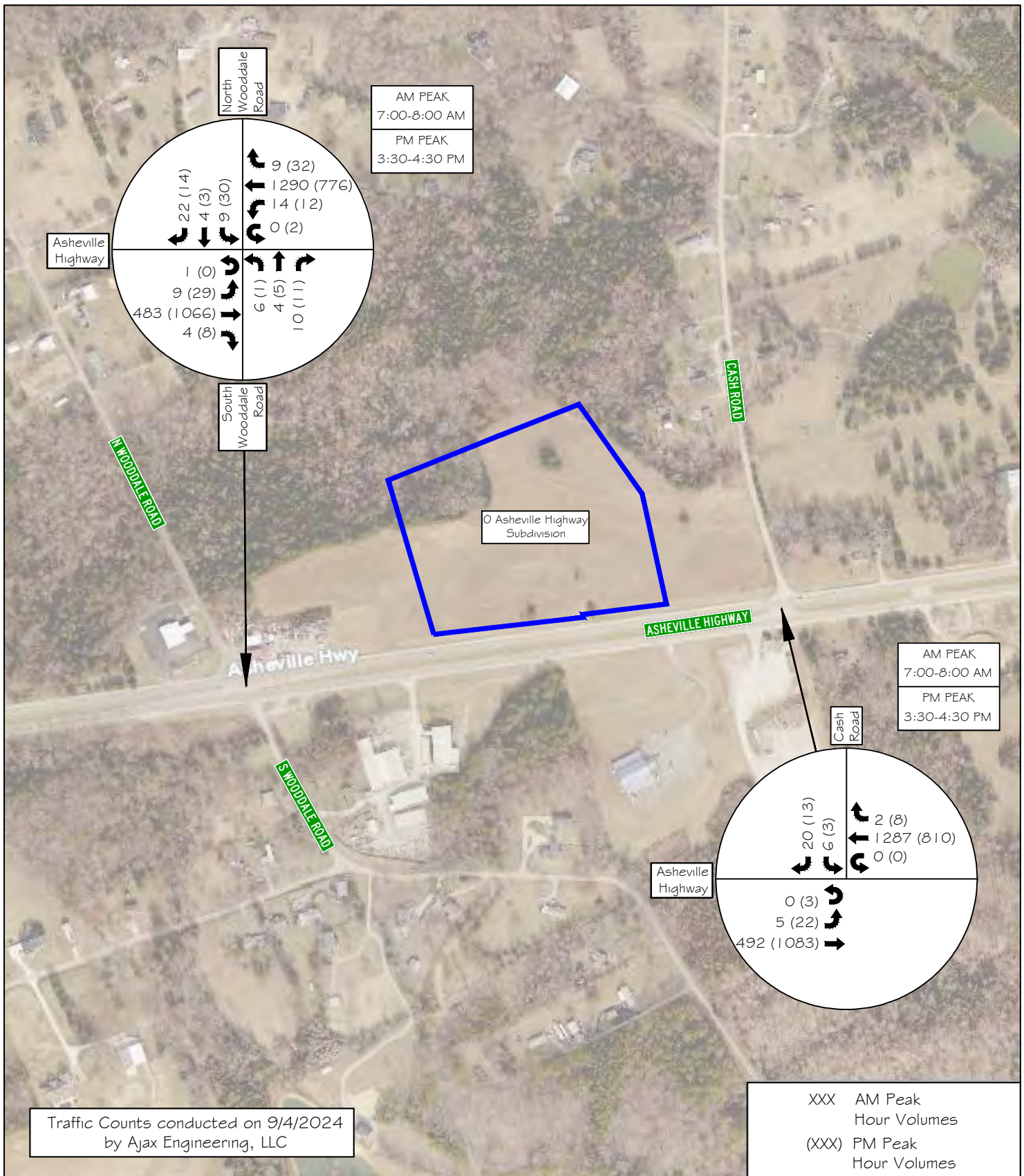
## ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

### ▪ EXISTING TRAFFIC CONDITIONS:

This study conducted a 6-hour traffic count at the unsignalized intersections of Asheville Highway at South and North Wooddale Road and at Cash Road on Wednesday, September 4<sup>th</sup>, 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. Both intersections 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 intersections 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 South and North Wooddale Road and at Cash Road.





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FIGURE 4

O 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.

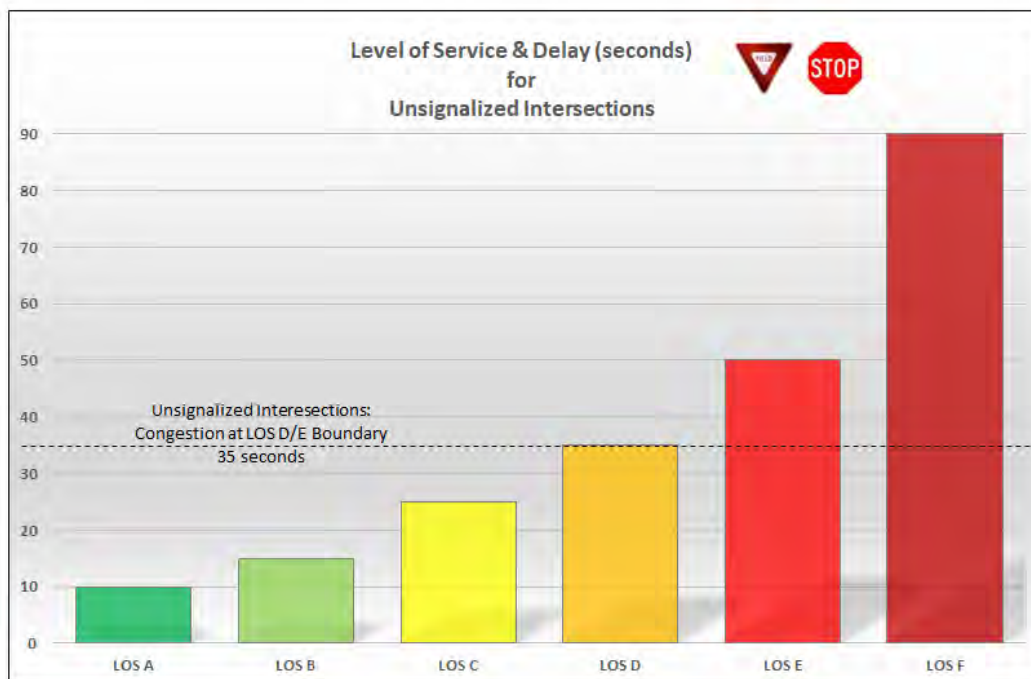
**TABLE 2**

**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 intersections in the table are shown with a LOS designation, delay (in seconds), and v/c ratio (volume/capacity) for the AM and PM peak hours. Appendix E includes the worksheets for the existing 2024 peak hour capacity analyses.

As shown in Table 3, the intersection of Asheville Highway at Cash Road is calculated to operate with good to average LOS and short to average vehicle delays in the existing peak hour 2024 conditions. However, at the intersection of Asheville Highway at South and North Wooddale Road, the shared southbound left/ thru lane is shown to be operating with high delays in the AM and PM peak hours at LOS E. The northbound movement is shown at LOS D.

**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 South Wooddale Road (NB) and North Wooddale Road (SB)	 Unsignalized	Northbound Left/Thru/Right	D	27.1	0.165	D	27.9	0.151
		Eastbound Left	C	17.0	0.063	B	10.7	0.065
		Westbound Left	A	8.9	0.026	B	14.3	0.067
		Southbound Left/Thru	E	43.4	0.177	E	44.1	0.347
		Southbound Right	C	16.1	0.090	B	12.8	0.057
Asheville Highway (WB & EB) at Cash Road (SB)	 Unsignalized	Eastbound Left	B	12.9	0.017	B	11.5	0.054
		Southbound Left/Right	C	22.9	0.192	C	16.0	0.079

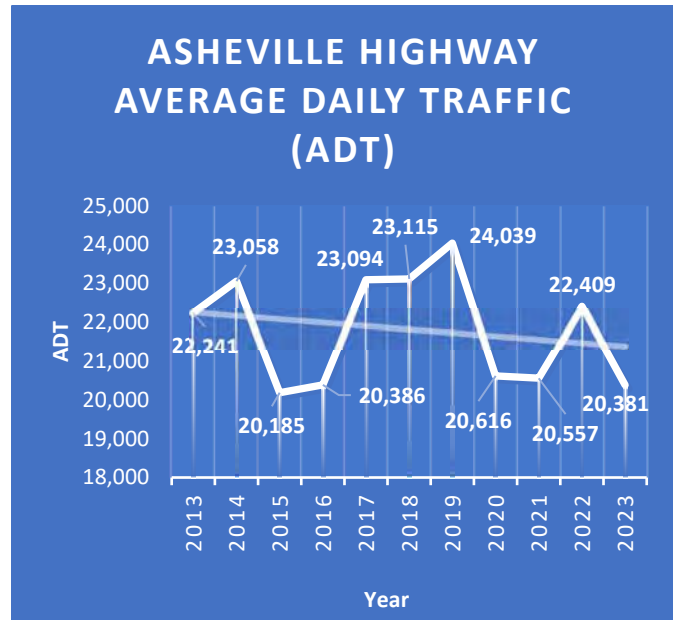
Note: All analyses were calculated in Synchro 12 software and reported using 7th Edition intersection methodology

<sup>a</sup> Level of Service , <sup>b</sup> Average Delay (sec/vehicle) , <sup>c</sup> Volume-to-Capacity Ratio

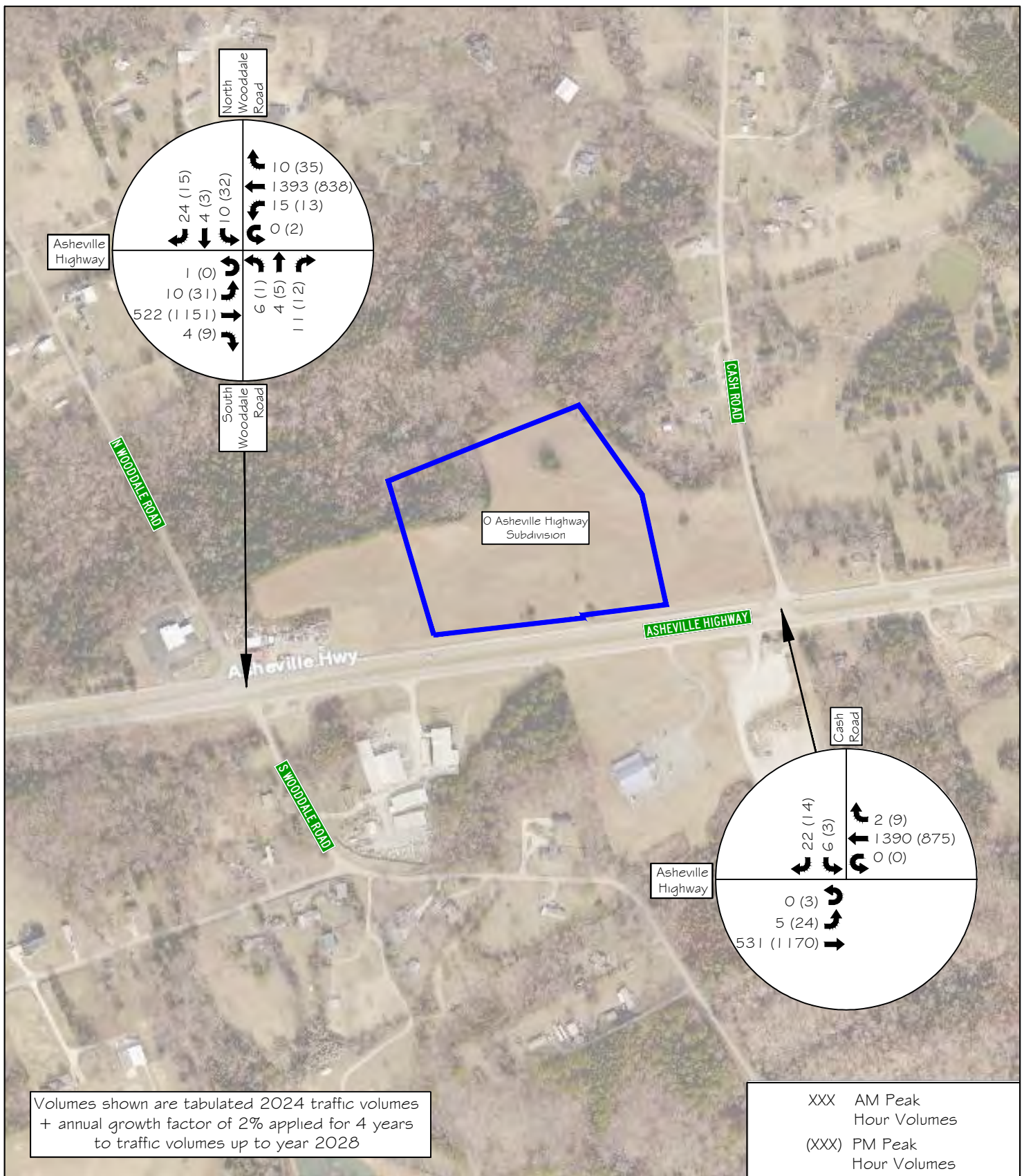
▪ **PROJECTED TRAFFIC CONDITIONS WITHOUT THE PROJECT:**

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 shown 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, to provide a conservative result, this study used an annual growth rate of +2% to calculate future growth on Asheville Highway, South and North Wooddale Road, and Cash Road up to 2028. The annual growth rate was applied to the existing 2024 volumes tabulated at the intersections 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 intersections without the project during the AM and PM peak hours.



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FIGURE 5



O 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 intersections. 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 moderately worse vehicle delays for all the intersection approaches and turning movements in the 2028 projected conditions versus the existing 2024 conditions. This result is due to the slight increase in traffic volumes due to the assumed general growth unrelated to the proposed development. In the projected conditions without the project, at the intersection of Asheville Highway at South and North Wooddale Road, the shared southbound left and thru lane is shown slipping to LOS F in the AM and PM peak hours.

**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 South Wooddale Road (NB) and North Wooddale Road (SB)	 Unsignalized	Northbound Left/Thru/Right	D	30.9	0.193	D	31.4	0.178
		Eastbound Left	C	18.7	0.077	B	11.2	0.075
		Westbound Left	A	9.1	0.029	C	15.4	0.079
		Southbound Left/Thru	F	53.3	0.228	F	55.3	0.424
		Southbound Right	C	17.4	0.107	B	13.4	0.066
Asheville Highway (WB & EB) at Cash Road (SB)	 Unsignalized	Eastbound Left	B	13.8	0.019	B	12.1	0.063
		Southbound Left/Right	D	25.6	0.225	C	17.0	0.089

Note: All analyses were calculated in Synchro 12 software and reported using 7th Edition intersection methodology

<sup>a</sup> Level of Service , <sup>b</sup> Average Delay (sec/vehicle) , <sup>c</sup> 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 0 Asheville Highway Subdivision will generate was based on the equations provided by Knoxville/Knox County Planning. These equations were developed from an extensive local study to estimate townhouse (and apartment) trip generation in the surrounding area. 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 often-referenced Institute of Transportation (ITE) Trip Generation Manual.

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

**TABLE 5**  
**TRIP GENERATION FOR 0 ASHEVILLE HIGHWAY SUBDIVISION**  
**111 Multi-Family Attached Townhouses**

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Local Trip Rate	Townhouses	111	1,049	22%	78%		55%	45%	
				13	46	59	47	38	85
Total New Volume Site Trips			1,049	13	46	59	47	38	85

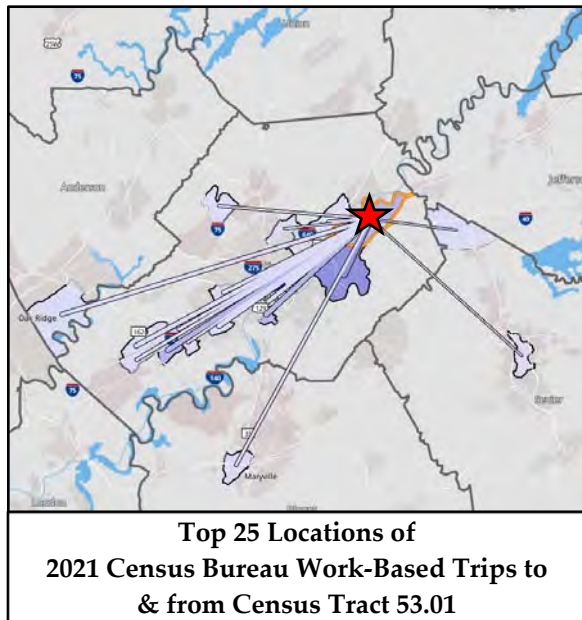
Data from Local Trip Rates and calculated by using Fitted Curve Equations

For the proposed residential development, it is estimated that 13 vehicles will enter and 46 will exit, for a total of 59 generated trips during the AM peak hour in the year 2028. Similarly, it is estimated that 47 vehicles will enter and 38 will exit, for a total of 85 generated trips during the PM peak hour in the year 2028. The calculated trips generated for an average weekday are estimated to be 1,049 vehicles for the proposed development. No vehicle trip reductions were included in the calculations or analysis.

▪ **TRIP DISTRIBUTION AND ASSIGNMENT:**

The projected trip distribution and assignment for the 0 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 upstream and downstream unsignalized intersections on Asheville Highway at South and North Wooddale Road and Cash Road near the proposed development site.

During the traffic counts, motorists on Asheville Highway showed a distinct preference for westbound travel towards Knoxville in the morning and the opposite in the afternoon peak period. This pattern was also observed from the side streets' turning movements to and from South and North Wooddale Road and Cash Road.



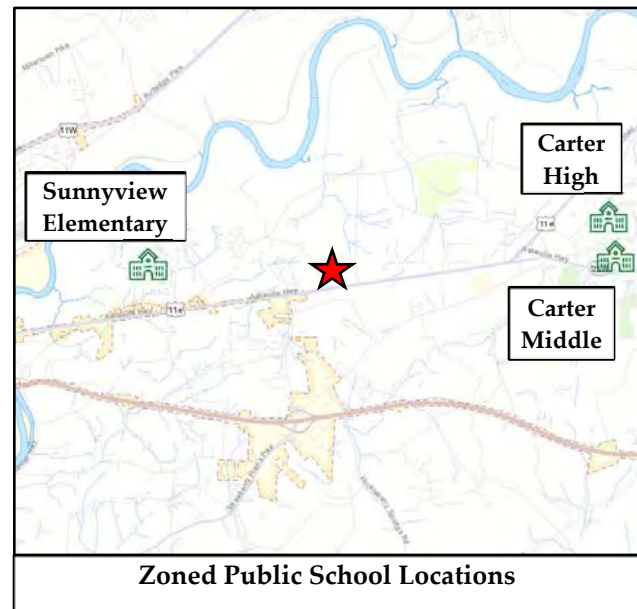
The second source for determining the projected trip distribution is based on work-related trips in the local area. Work-based trips will be a significant impetus for trips generated by the development, and these trips are more likely to travel to and from the west and southwest. This assertion is based 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 Sunnyview Elementary and Carter Middle and High School. The zoned public schools for this development property are located west and east of the development site. The zoned schools are between 2.4 and 3.3 miles from the proposed subdivision by roadway. The shortest and quickest routes from the subdivision to and from these schools will be made by

traveling initially east or west on Asheville Highway.

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.



Based on these factors, Figure 6 shows the projected distribution of traffic entering and exiting the proposed residential subdivision at the studied intersections and the Proposed Entrance. Overall, the majority of traffic (80%) 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 0 Asheville Highway Subdivision. This assignment is based on the assumed distribution of trips shown in Figure 6.

Furthermore, several other additional proposed non-related and nearby residential subdivisions are in the planning stages and are expected to also impact the studied intersections due to their generated trips. These other residential subdivisions include additional phases in the Neal's Landing and The Ridge at Neals Landing Subdivisions, the 8014 Asheville Highway Subdivision, and the Habitat for Humanity Subdivision. These known proposed residential subdivisions are just a bit further to the east and west of the 0 Asheville Highway Subdivision 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 0.6 miles away. The 8014 Asheville Highway Subdivision and the Habitat for Humanity Subdivision will be adjacent to each other and slightly east of Cash Road, approximately 1,500 feet away.

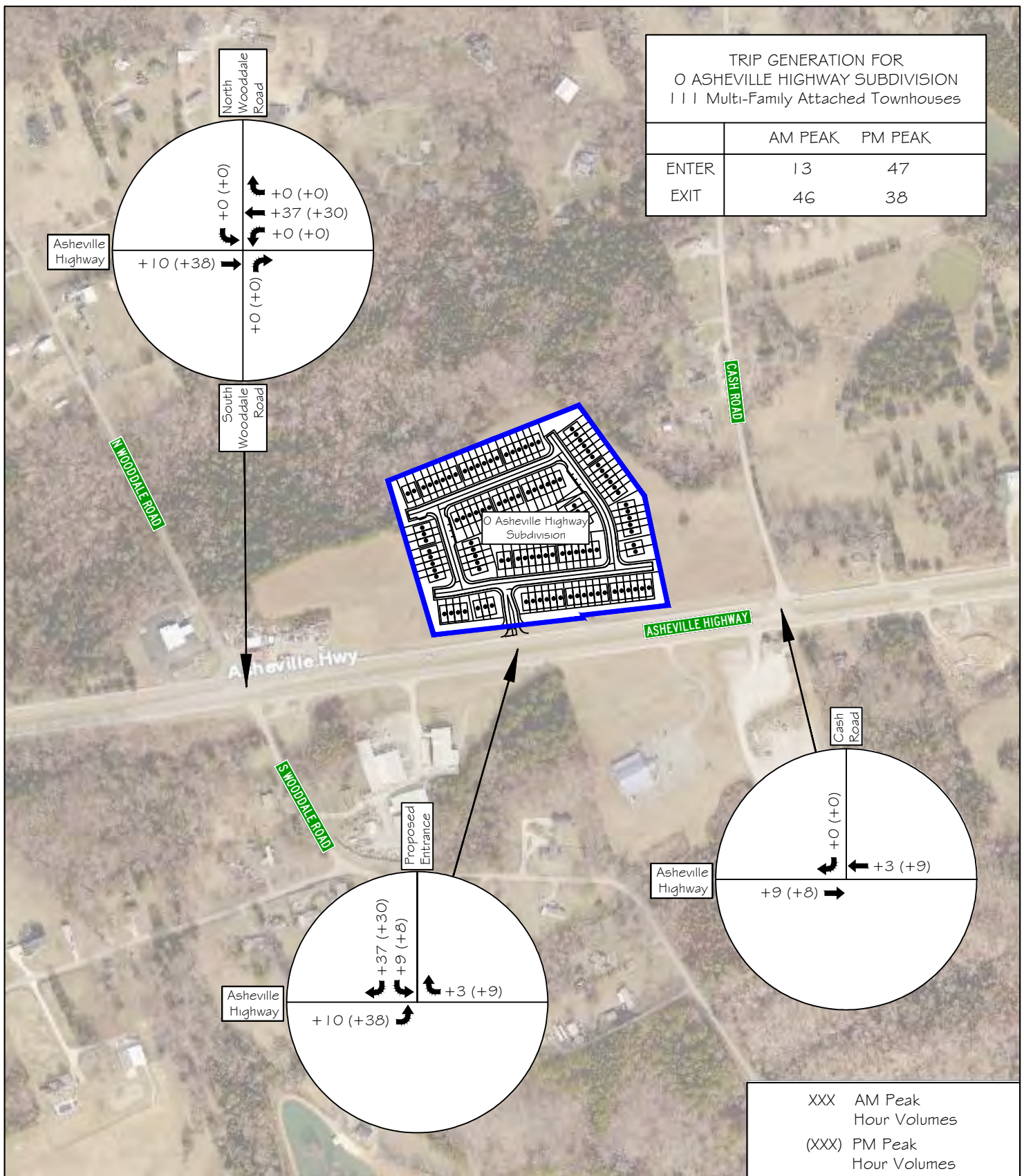
Figure 7b shows the traffic assignment of the computed trips generated by the additional phases in the Neal's Landing and The Ridge at Neals Landing Subdivisions. Figure 7c shows the proposed 8014 Asheville Highway Subdivision assignment. Figure 7d shows the proposed Habitat for Humanity Subdivision assignment. These additional future residential developments are also assumed to be fully occupied by 2028, and the trip assignments 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.







TRIP GENERATION FOR O ASHEVILLE HIGHWAY SUBDIVISION 111 Multi-Family Attached Townhouses		
	AM PEAK	PM PEAK
ENTER	13	47
EXIT	46	38



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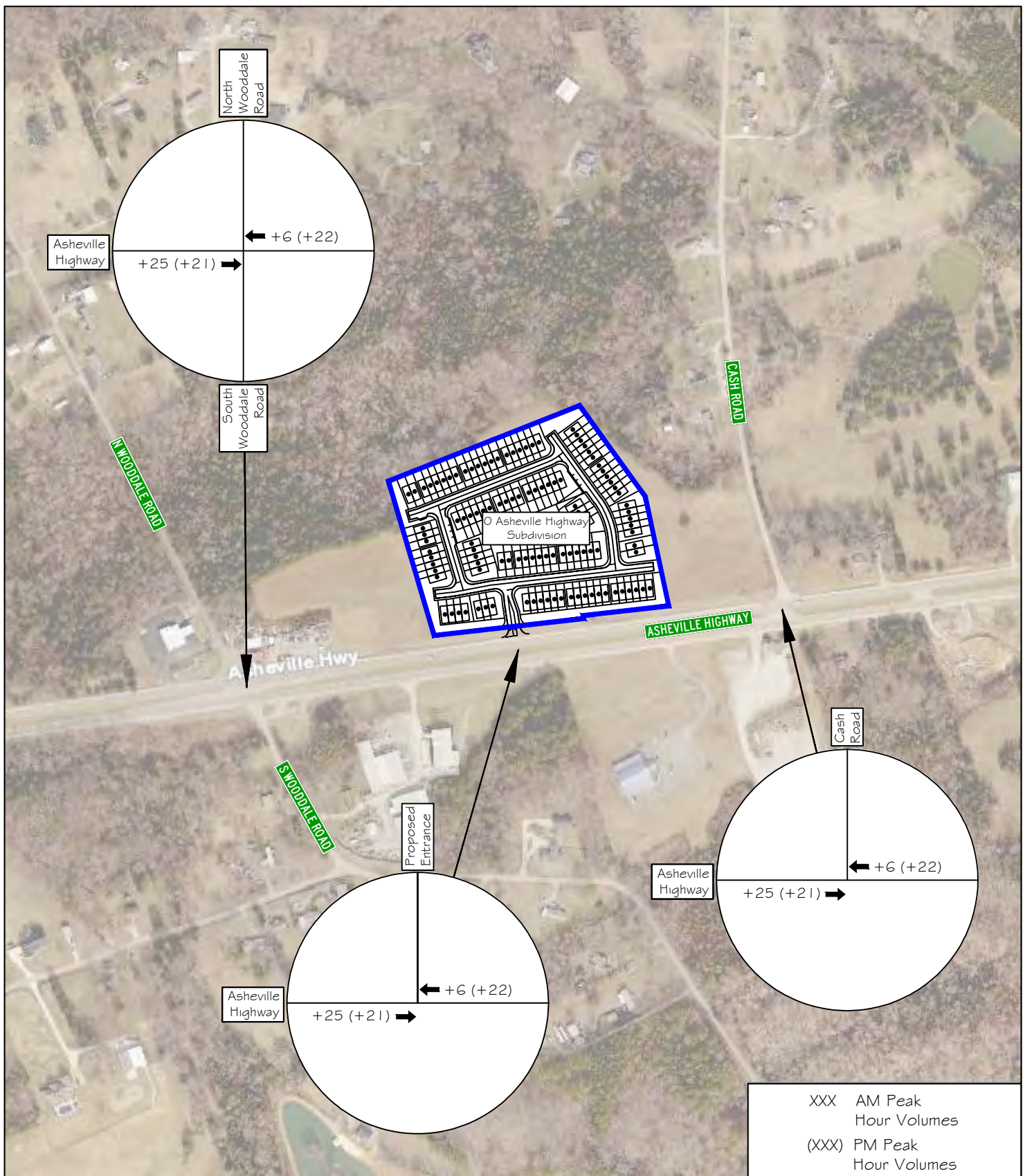


FIGURE 7a

O Asheville Highway Subdivision

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





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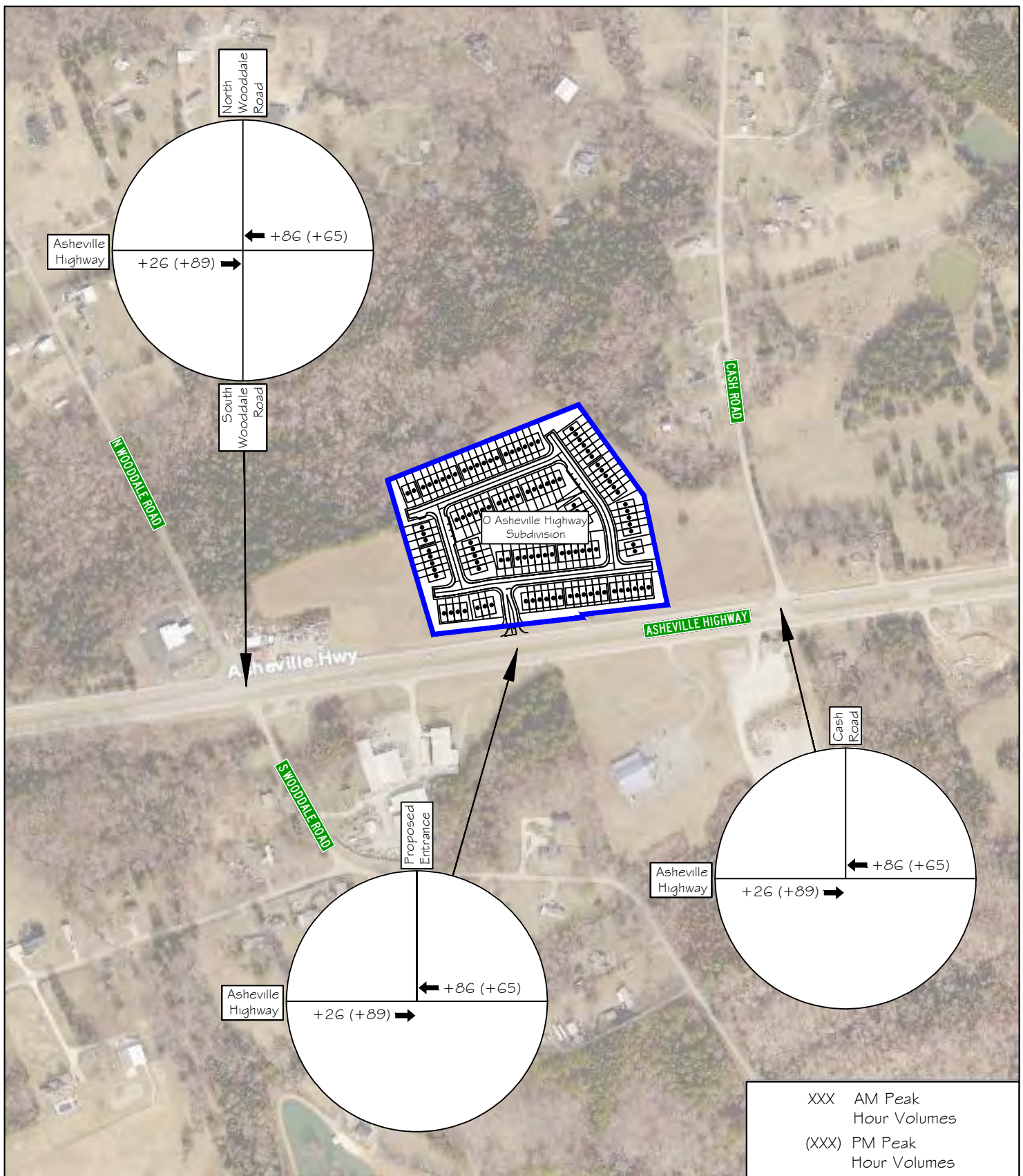


FIGURE 7b

O Asheville Highway Subdivision

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





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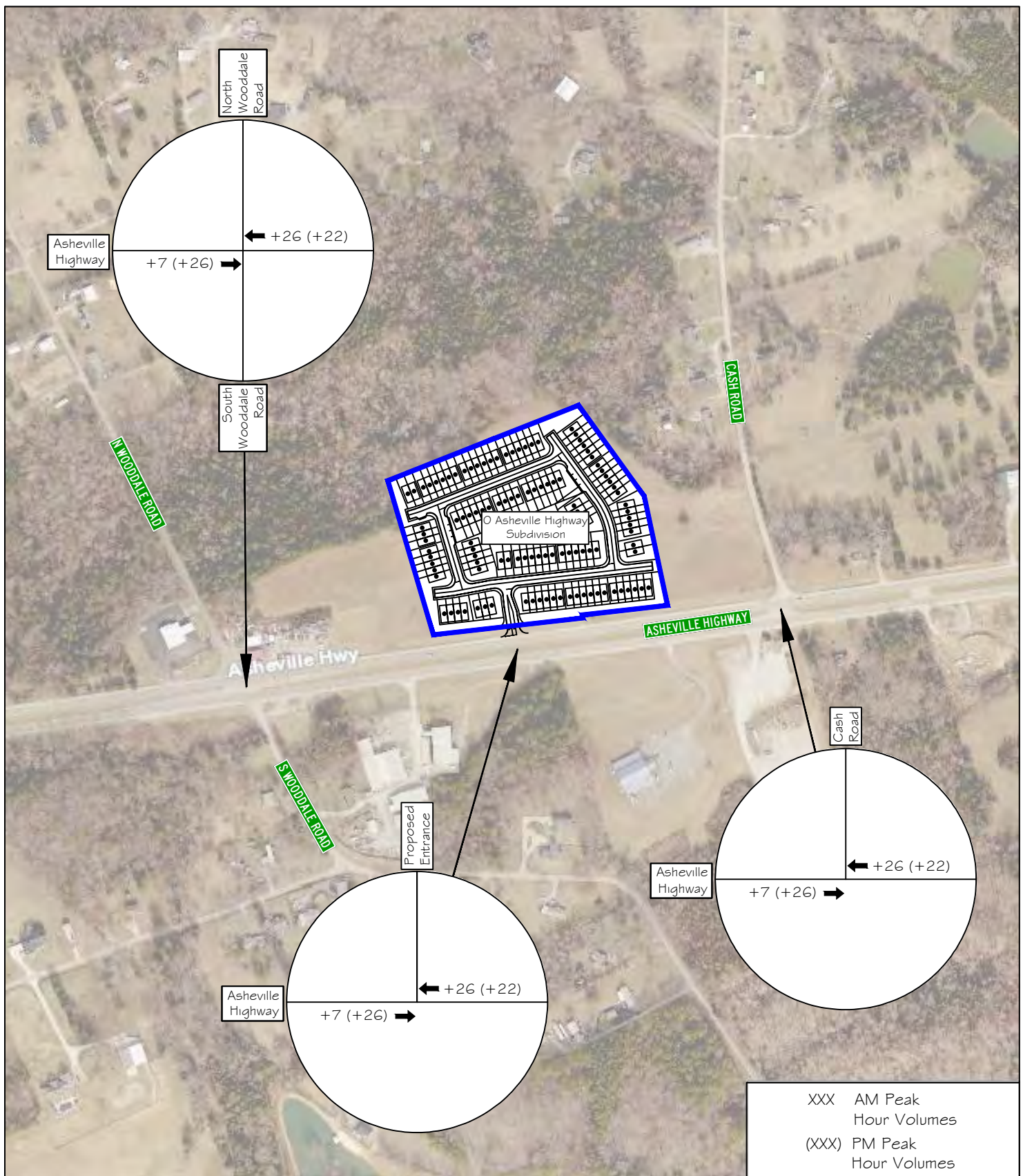


FIGURE 7c

O Asheville Highway Subdivision

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





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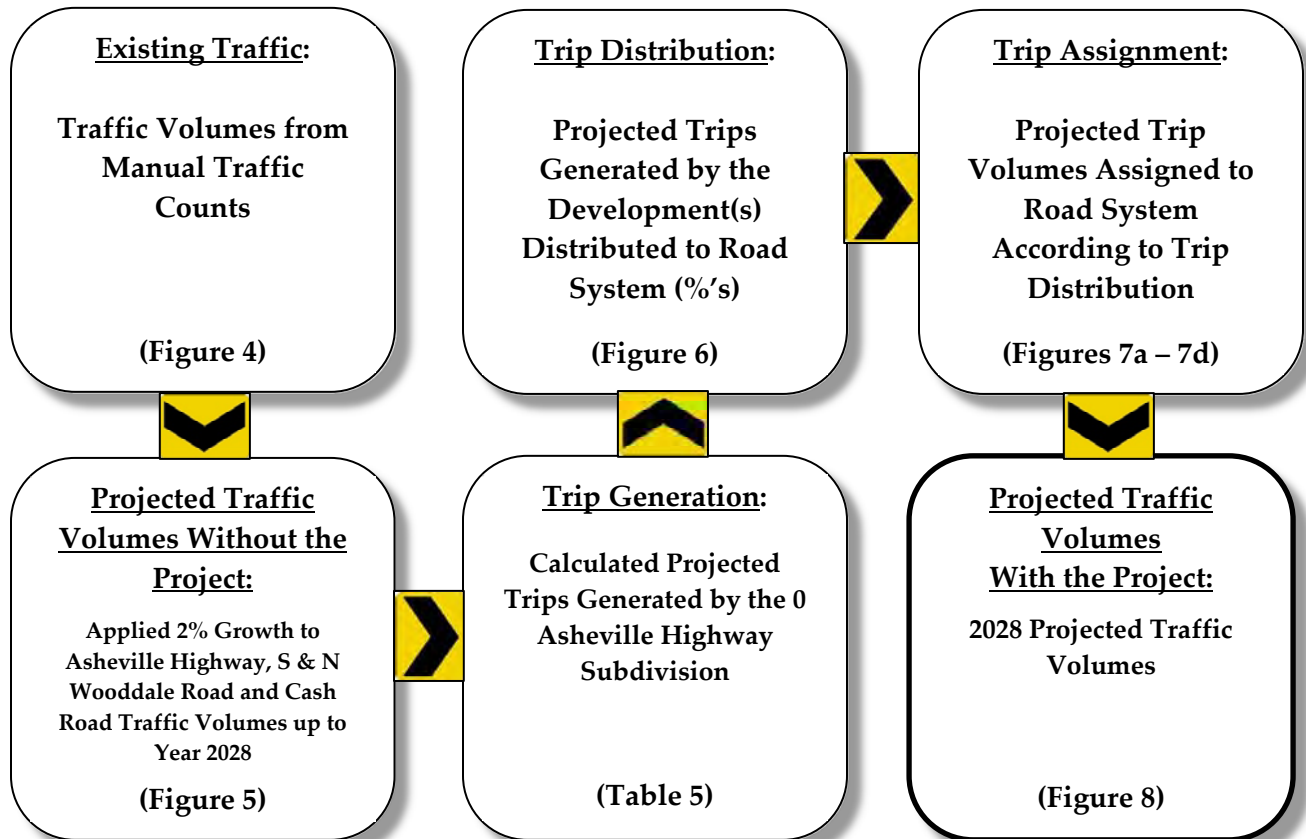
FIGURE 7d

O Asheville Highway Subdivision

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

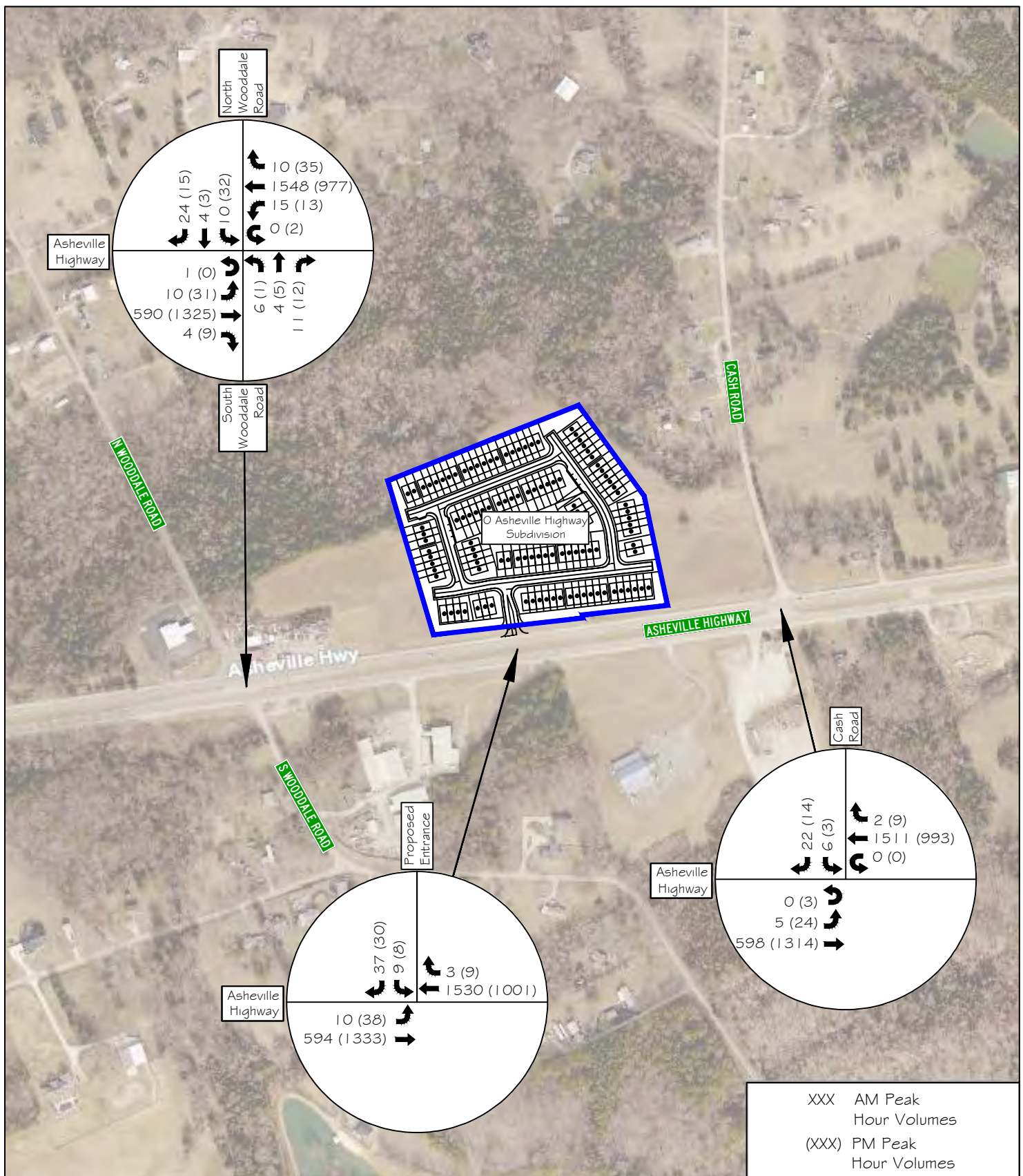
▪ **PROJECTED TRAFFIC CONDITIONS WITH THE PROJECT:**

Several additive steps were taken to estimate the total projected traffic volumes at the studied intersections when the proposed development 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 0 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 studied intersections when the 0 Asheville Highway Subdivision is fully built and occupied in 2028. In addition to the 0 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, 8014 Asheville Highway, and Habitat for Humanity Subdivisions. Figure 8 shows the projected 2028 AM and PM peak hour volumes for the 0 Asheville Highway Subdivision trips at the studied intersections and includes the trips from the other proposed non-related residential developments that are expected to be fully built and occupied by 2028.





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FIGURE 8




O 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 studied intersections 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 intersection of Asheville Highway at South and North Wooddale Road is shown with worse vehicle delays in the projected 2028 conditions, and specifically, the southbound and northbound approaches of North Wooddale Road and South Wooddale Road are calculated to operate at LOS F and E, respectively in the AM and PM peak hours. The proposed intersection of Asheville Highway at the Proposed Entrance is shown with acceptable vehicle delays except for the southbound exiting left turn lane shown operating at LOS F. Note: The Proposed Entrance was modeled in the software with two southbound lanes: one for exiting right turns towards the west and one for exiting left turns towards the east. The entrance was also modeled with an exclusive left lane in the median of 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 South Wooddale Road (NB) and North Wooddale Road (SB)	 Unsignalized	Northbound Left/Thru/Right	E	38.6	0.238	E	42.1	0.233
		Eastbound Left	C	22.1	0.094	B	12.3	0.087
		Westbound Left	A	9.4	0.031	C	18.3	0.099
		Southbound Left/Thru	F	70.8	0.289	F	85.4	0.558
		Southbound Right	C	19.4	0.122	B	14.8	0.075
Asheville Highway (WB & EB) at Cash Road (SB)	 Unsignalized	Eastbound Left	B	14.9	0.021	B	13.3	0.074
		Southbound Left/Right	D	29.8	0.260	C	19.1	0.104
Asheville Highway (WB & EB) at Proposed Entrance (SB)	 Unsignalized	Eastbound Left	C	15.2	0.031	B	12.1	0.077
		Southbound Left	F	107.9	0.225	F	108.0	0.205
		Southbound Right	C	19.0	0.138	B	14.2	0.079

Note: All analyses were calculated in Synchro 12 software and reported using 7th Edition intersection methodology

<sup>a</sup> Level of Service, <sup>b</sup> Average Delay (sec/vehicle), <sup>c</sup> Volume-to-Capacity Ratio

A summary of the capacity analyses for the existing upstream and downstream intersections on Asheville Highway is presented in Tables 7a and 7b. These tables provide a side-by-side summary and comparison of the intersections for the existing 2024 conditions, projected conditions in 2028 without the project, and the projected conditions in 2028 with the project, which includes the impact of the other nearby known proposed residential subdivisions.

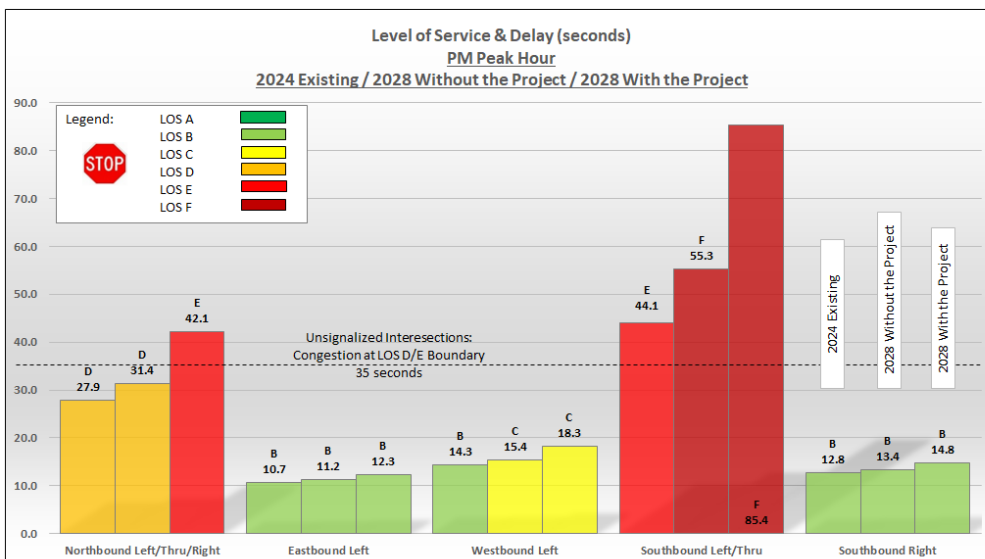
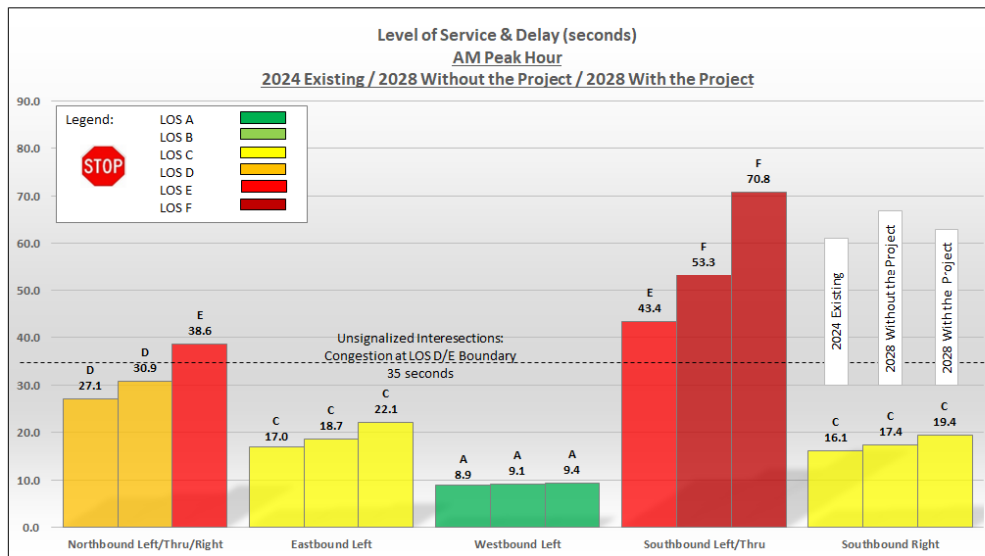
TABLE 7a  
INTERSECTION CAPACITY ANALYSIS SUMMARY  
ASHEVILLE HIGHWAY AT SOUTH & NORTH WOODDALE ROAD



LOCATION / PEAK HOUR MOVEMENT	2024 EXISTING			2028 WITHOUT THE PROJECT			2028 WITH THE PROJECT		
	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>
<b>AM Peak</b>									
Northbound Left/Thru/Right	D	27.1	0.165	D	30.9	0.193	E	38.6	0.238
Eastbound Left	C	17.0	0.063	C	18.7	0.077	C	22.1	0.094
Westbound Left	A	8.9	0.026	A	9.1	0.029	A	9.4	0.031
Southbound Left/Thru	E	43.4	0.177	F	53.3	0.228	F	70.8	0.289
Southbound Right	C	16.1	0.090	C	17.4	0.107	C	19.4	0.122
<b>PM Peak</b>									
Northbound Left/Thru/Right	D	27.9	0.151	D	31.4	0.178	E	42.1	0.233
Eastbound Left	B	10.7	0.065	B	11.2	0.075	B	12.3	0.087
Westbound Left	B	14.3	0.067	C	15.4	0.079	C	18.3	0.099
Southbound Left/Thru	E	44.1	0.347	F	55.3	0.424	F	85.4	0.558
Southbound Right	B	12.8	0.057	B	13.4	0.066	B	14.8	0.075

Note: All analyses were calculated in Synchro 12 software and reported using 7th Edition intersection methodology

<sup>a</sup> Level of Service, <sup>b</sup> Average Delay (sec/vehicle), <sup>c</sup> Volume-to-Capacity Ratio



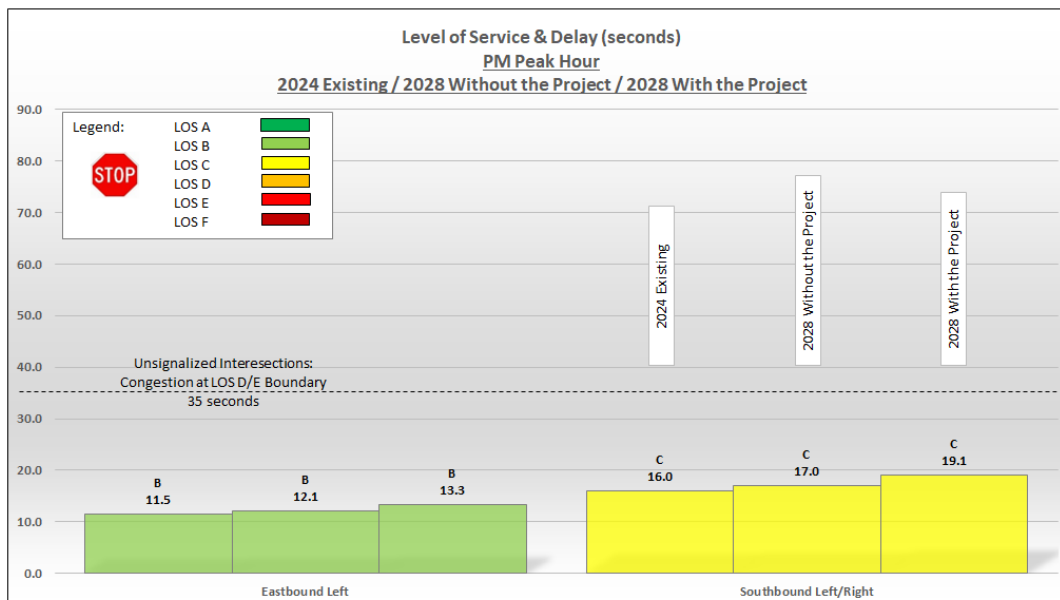
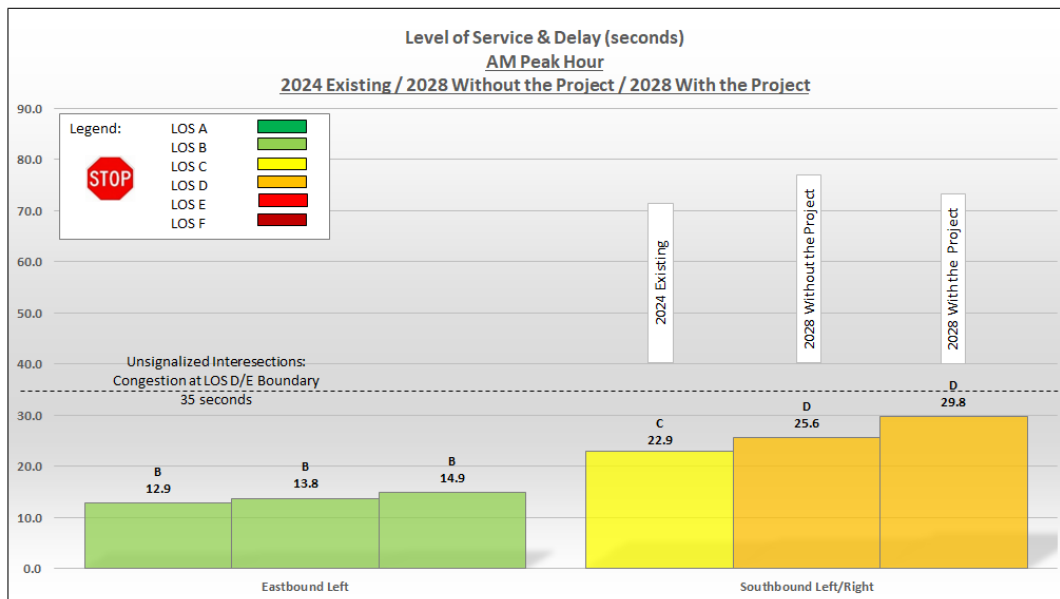
**TABLE 7b**  
**INTERSECTION CAPACITY ANALYSIS SUMMARY**  
**ASHEVILLE HIGHWAY AT CASH ROAD**



LOCATION / PEAK HOUR MOVEMENT	2024 EXISTING			2028 WITHOUT THE PROJECT			2028 WITH THE PROJECT		
	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>
<b>AM Peak</b>									
Eastbound Left	B	12.9	0.017	B	13.8	0.019	B	14.9	0.021
Southbound Left/Right	C	22.9	0.192	D	25.6	0.225	D	29.8	0.260
<b>PM Peak</b>									
Eastbound Left	B	11.5	0.054	B	12.1	0.063	B	13.3	0.074
Southbound Left/Right	C	16.0	0.079	C	17.0	0.089	C	19.1	0.104

Note: All analyses were calculated in Synchro 12 software and reported using 7th Edition intersection methodology

<sup>a</sup> Level of Service, <sup>b</sup> Average Delay (sec/vehicle), <sup>c</sup> Volume-to-Capacity Ratio





▪ **POTENTIAL TRANSPORTATION SAFETY ISSUES:**

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

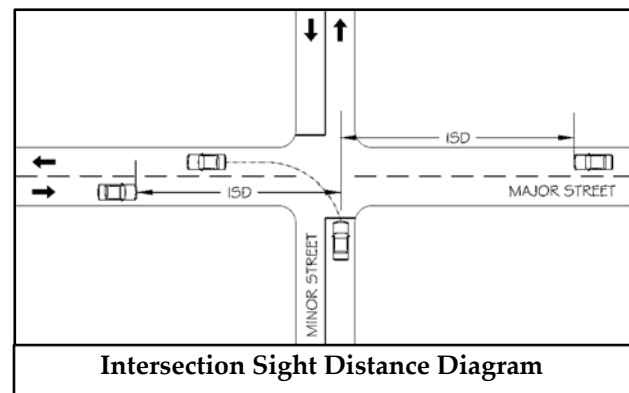
○ **EVALUATION OF SIGHT DISTANCE**

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



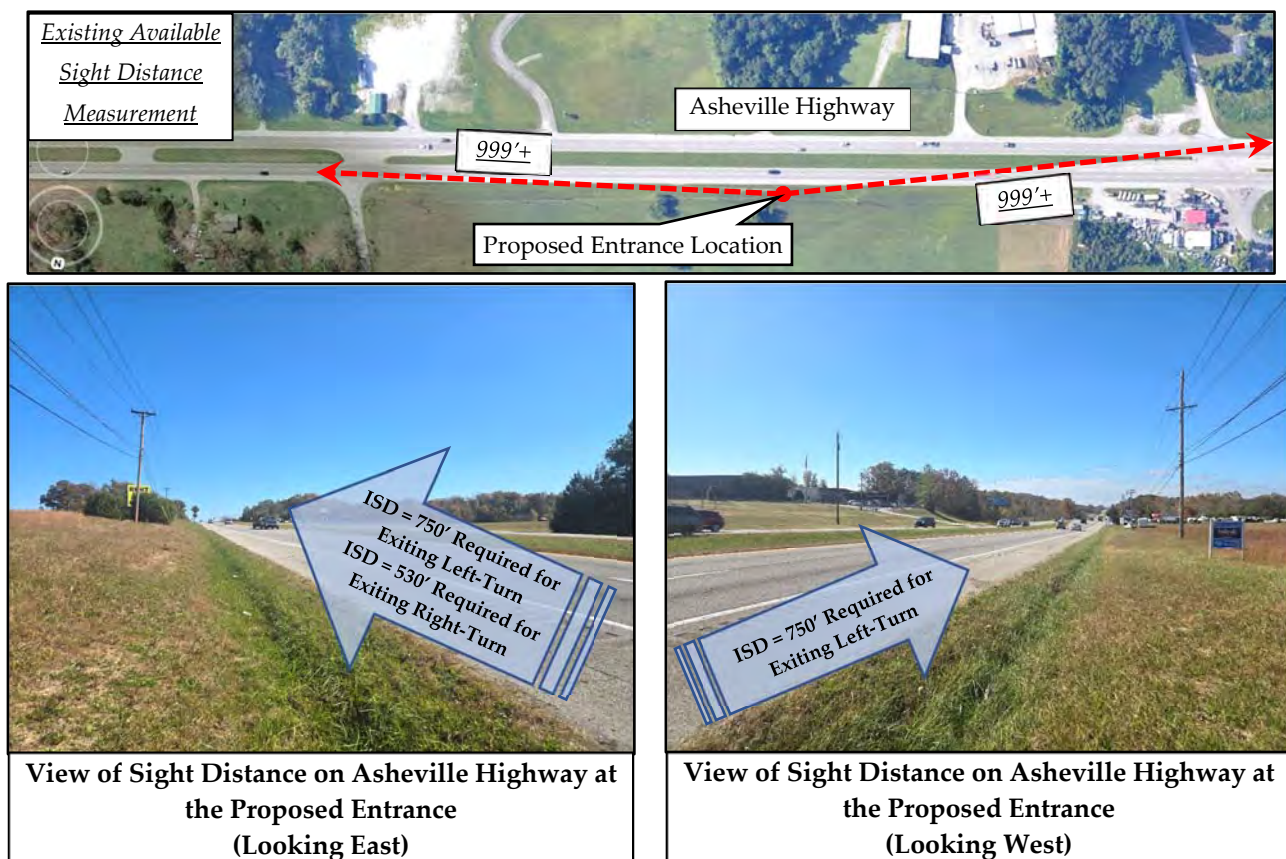
at a 4-way intersection: (1) left-turn, (2) right-turn, (3) or a crossing maneuver across the major street. For turns from the minor street, ISD is needed to allow a stopped motorist to turn onto a major street without being overtaken by an approaching vehicle. The most critical ISD is for left turns 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.

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 (eastbound) 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'+ feet (limit of the rangefinder) to the east and the 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.



○ **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 westbound right-turn lane on Asheville Highway at the Proposed Entrance was not met in the AM or PM peak hour. However, the threshold for a separate eastbound left-turn lane was 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 95<sup>th</sup> percentile vehicle queues. The 95<sup>th</sup> 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 95<sup>th</sup> percentile vehicle queue length means 95% certainty that the vehicle queue will not extend beyond that point. The results of this assessment are shown in Table 8 and are provided within the Synchro capacity result worksheets shown 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 95<sup>th</sup> 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 95<sup>th</sup> percentile queues since adequate storage space for a single vehicle will

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

As noted in the table, the vehicle queue result obtained during the PM peak hour for the northbound left/thru/right lane from South Wooddale Road and the southbound left/thru lane from North Wooddale Road at Asheville Highway should be taken under advisement. This warning is due to these movements 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. Otherwise, these vehicle queues are calculated to be and are expected to be short in the projected 2028 conditions, primarily due to the minimal volumes on these approaches at Asheville Highway. The Proposed Entrance is calculated to have minimal vehicle queues even though the southbound left is projected to operate at LOS F during peak hours. This short vehicle queue result is due to the low projected volumes turning left from the Proposed Entrance towards the east.

**TABLE 8**  
**TURN LANE STORAGE & VEHICLE QUEUE SUMMARY -**  
**2028 PROJECTED PEAK HOUR TRAFFIC WITH THE PROJECT**

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	PROVIDED STORAGE LENGTH (ft)	SYNCHRO 95 <sup>th</sup> PERCENTILE QUEUE LENGTH (ft) <sup>1</sup>		ADEQUATE LENGTH?
				AM PEAK HOUR	PM PEAK HOUR	
Asheville Highway (WB & EB) at South Wooddale Road (NB) and North Wooddale Road (SB)	 Unsignalized	Eastbound U-Turn/Left	225	23	23	✓
		Westbound U-Turn/Left	250	8	8	✓
		Northbound Left/Thru/Right	n/a	3	8 *	n/a
		Southbound Left/Thru	n/a	28	63 *	n/a
		Southbound Right	50	10	5	✓
Asheville Highway (WB & EB) at Cash Road (SB)	 Unsignalized	Eastbound U-Turn/Left	95	3	5	✓
		Westbound U-Turn/Left	n/a	0	0	n/a
		Southbound Left/Right	n/a	25	8	n/a
Asheville Highway (WB & EB) at Proposed Entrance (SB)	 Unsignalized	Eastbound Left	TBD	3	5	-
		Southbound Left	TBD	18	18	-
		Southbound Right	n/a	13	8	n/a

<sup>1</sup> 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 0 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 South and North Wooddale Road:** This intersection currently operates with high vehicle delays in the existing AM and PM peak hours, particularly for the southbound approach of North Wooddale Road. These delays are expected to worsen if overall general growth on Asheville Highway increases in the future, even without adding generated trips from the proposed 0 Asheville Highway Subdivision and other non-related planned residential subdivisions included in the analyses. However, the vehicle queues were calculated to be short due to the minimal volumes on the side streets. It should be noted that when considerable vehicle delays are calculated for minor side streets, this does not always necessitate mitigation. If only one vehicle experiences a significant delay in attempting to enter a high-volume major street, mitigation is neither realistic nor cost-effective.

Subsequently, it is recommended that TDOT monitor this intersection for further evaluation. A fatal crash occurred at this intersection in 2021. While it appears that there have not been any recorded fatalities since then, the combination of the general future traffic growth, the large expanse of the intersection, the existing established need for flashing beacons, and the high side street vehicle delays, this intersection needs to be monitored for potential improvements. The side street volumes on South and North Wooddale Road are not expected to be substantial enough to meet volume-related warrant thresholds for a traffic signal. However, vehicle crashes may necessitate the need. Additionally, any future development on South or North Wooddale Road could significantly increase side street volumes to meet threshold warrants for a potential traffic signal.



**Asheville Highway at Cash Road:** This intersection is projected to operate with average vehicle delays and minimal vehicle queues. No specific recommendations are offered for this intersection.

The 0 Asheville Highway Subdivision was originally proposed without a median opening on Asheville Highway at the Proposed Entrance location. This arrangement would have required the future subdivision residents to perform U-turn movements at the upstream and downstream median openings at South and North Wooddale Road and Cash Road. However, one of the main factors in abandoning this and proposing a median opening at the Proposed Entrance was the reduced sight distance from the eastbound left-turn lane on Asheville Highway at Cash Road.

U-turn maneuvers require substantial sight distance. A U-turn's sight distance must be long enough to allow a motorist to perceive a gap in the oncoming traffic, complete the U-turn, and accelerate to the road's operating speed without causing the approaching vehicles to reduce their speed substantially.



**View of Sight Distance at the Eastbound Left-Turn Lane on Asheville Highway at Cash Road (Looking East)**

NCHRP Report 524, Safety of U-Turns at Unsignalized Median Openings, by the Transportation Research Board, provides guidance for these traffic maneuvers. The report lists the Florida Median Handbook as a resource for recommended sight distance requirements for U-turns at unsignalized median openings. Based on Table 8 in this handbook, for a speed of 55 mph (the posted speed limit), the table recommends a sight distance of 1,250 feet. This distance is provided for passenger cars based on a two-second reaction time, a U-turn maneuver beginning at 0 mph, and a 50-foot clearance factor.

A sight distance length of 1,250 feet is not currently available from the eastbound left-turn lane on Asheville Highway at Cash Road, looking towards the east. This reduction in sight distance is primarily due to the slight vertical curve just east of the intersection, which restricts further distance viewing of oncoming vehicles. The vegetation in the median is currently unmowed, which also contributes to limiting the view of oncoming

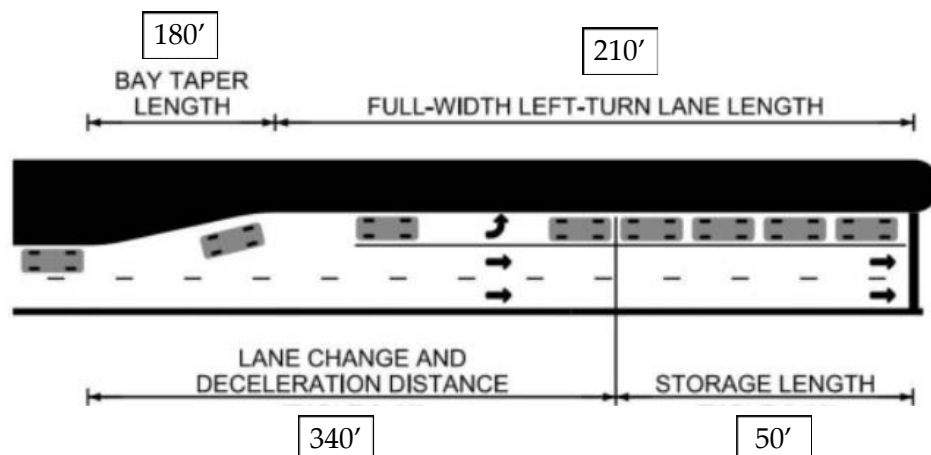
traffic. With these restrictions, at most, the available sight distance to the east is approximately 550 feet. For those reasons, the initial decision that would require motorists to perform U-turns to enter and exit the subdivision was abandoned, and a median opening on Asheville Highway at the Proposed Entrance was proposed as part of the development.



**Asheville Highway at Proposed Entrance:** This intersection is projected to operate with average vehicle delays and minimal vehicle queues. However, the southbound exiting lane is projected to operate at LOS F during the AM and PM peak hours.

- 3a) It is recommended that a median opening be permitted on Asheville Highway for the Proposed Entrance due to sight distance restrictions at Cash Road and the considerable side street delays on South and North Wooddale Road. Because of these limitations, a median opening should be provided that would eliminate the need for U-turns occurring on Asheville Highway at these existing upstream and downstream intersections, which would otherwise be necessary for entering and exiting subdivision vehicles. While beneficial for the proposed subdivision, it should be noted that this median opening may become attractive for motorists who want to perform a U-turn that would otherwise use the upstream and downstream openings at Cash Road and South and North Wooddale Road. This median opening should be midway between North Wooddale Road and Cash Road, nearly 890 feet from each existing intersecting street.
- 3b) The construction of a westbound right-turn lane on Asheville Highway for traffic entering at the proposed Road "A" Entrance is not warranted based on the projected 2028 traffic volumes. However, the need for an eastbound left-turn lane on Asheville Highway at the proposed median opening for traffic entering is projected to be warranted.

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:



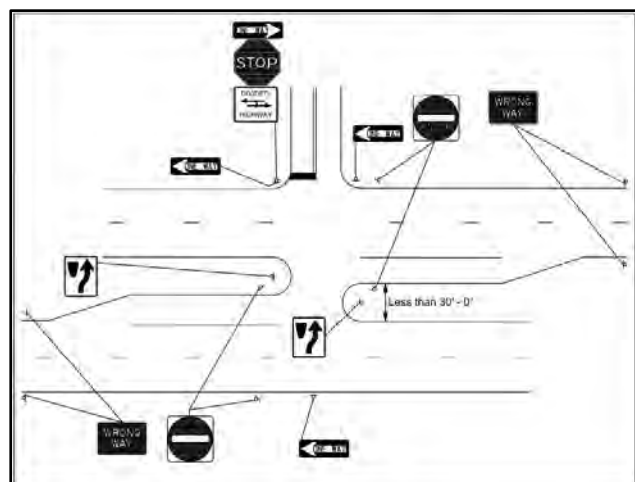


The lane change and deceleration distance are a function of vehicle speeds, and the designer can assume some deceleration before the lane change. For this proposed left-turn lane on Asheville Highway, a vehicle speed of 45 mph was assumed, with vehicle speeds slightly reduced due to some deceleration occurring before the lane change. Thus, the recommended lengths for this proposed left-turn lane include a lane change and deceleration distance of 340 feet and a storage length of 50 feet, for a total of 390 feet. The longest 95<sup>th</sup> percentile vehicle queue length for the eastbound left-turn lane on Asheville Highway was calculated to be 3 and 5 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.

- 3c) Due to the projected high vehicle delays for exiting southbound left turns from the proposed subdivision towards the east, separate left and right turn lanes are recommended for the Proposed Entrance approach at Asheville Highway. The left-turn lane should have a minimum vehicle storage of 75 feet, and the right-turn lane should be a continuation of the Road "A" southbound lane traveling towards the highway. 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.

- 3d) 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 the recommended median opening design.

- 3e) Many regulatory signs should be installed to avoid and help prevent wrong-way vehicles on Asheville Highway at the Proposed Entrance. Figure 2.10 in TDOT's Traffic Design Manual illustrates the signage



TDOT Traffic Design Manual – Figure 2.10

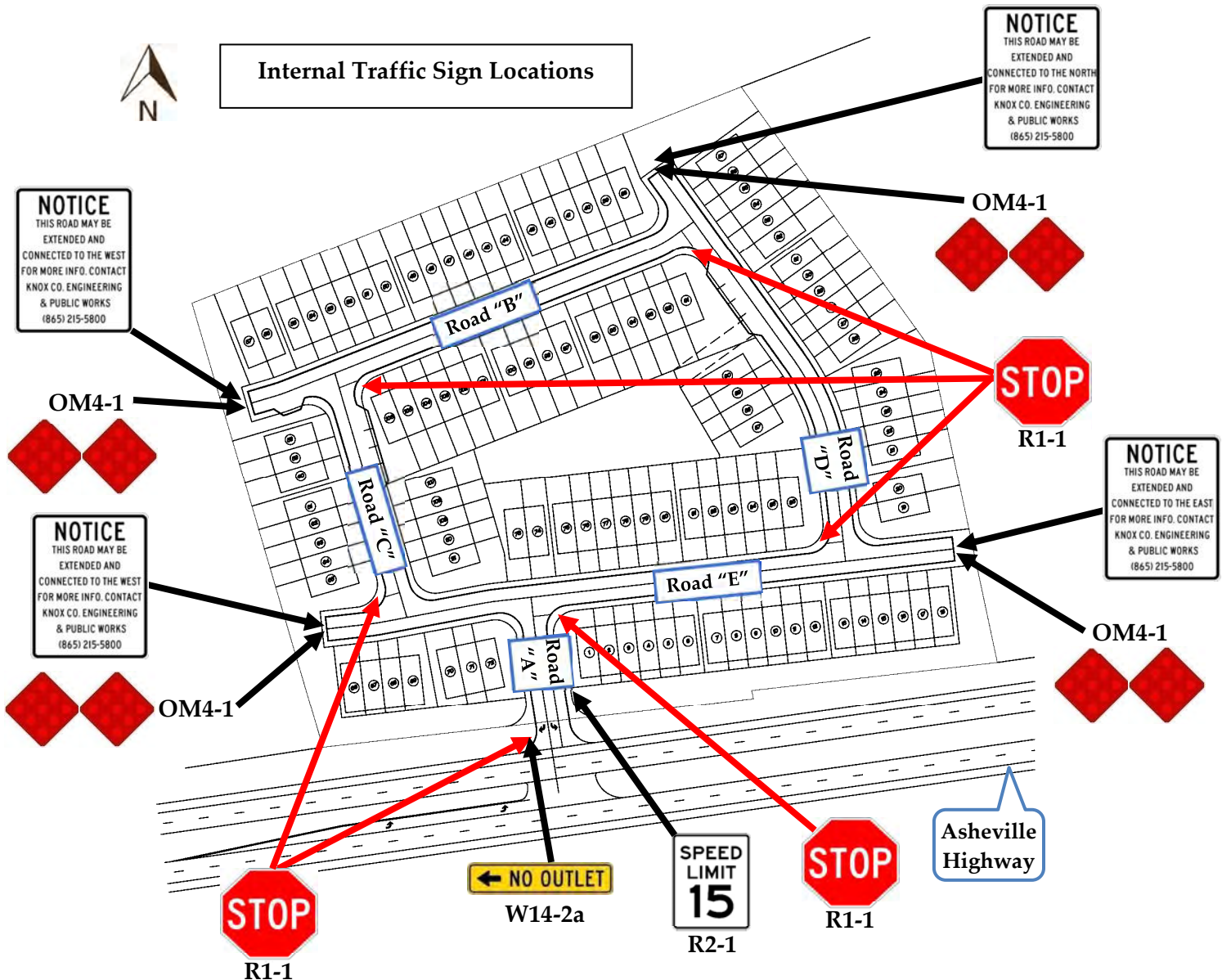
required for the Proposed Entrance at Asheville Highway.

- 3f) Intersection sight distance at the Proposed Entrance at Asheville Highway must not be impacted by future landscaping, signage, or existing or future vegetation. Based on a posted speed limit of 55 mph on Asheville Highway, the required intersection sight distance is 750 feet for exiting left and 530 feet for right-turning vehicles. The existing sight distances at the Proposed Entrance location were estimated visually to be adequate in both directions. The site designer must ensure that the intersection sight distances are accounted for and provided in the design plans.



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

- 4a) A 15-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the Proposed Entrance, Road "A", off Asheville Highway. Since the subdivision streets will not be public roads, a posted speed limit of less than 25-mph is acceptable. 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.
- 4b) 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.



- 4c) The Stop Sign (R1-1) on the Road "A" 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.
- 4d) Dual end-of-roadway object markers (OM4-1) should be installed at the end of the subdivision's internal roads, as shown in the image. 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 Road "B", the northern end of Road "D", and the western and eastern ends of Road "E" 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 / north / east – for more info. contact Knox Co. Engineering & Public Works (865) 215-5800".
- 4e) The proposed lots within the development adjacent to Asheville Highway should not be allowed direct access to the south.
- 4f) 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 15-mph in the development, the required internal intersection sight distance is 170 feet. The site designer should ensure that internal sight distance lengths are met.
- 4g) 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.
- 4h) All drainage grates and covers for the residential development must be pedestrian and bicycle-safe.
- 4i) 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.
- 4j) 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**

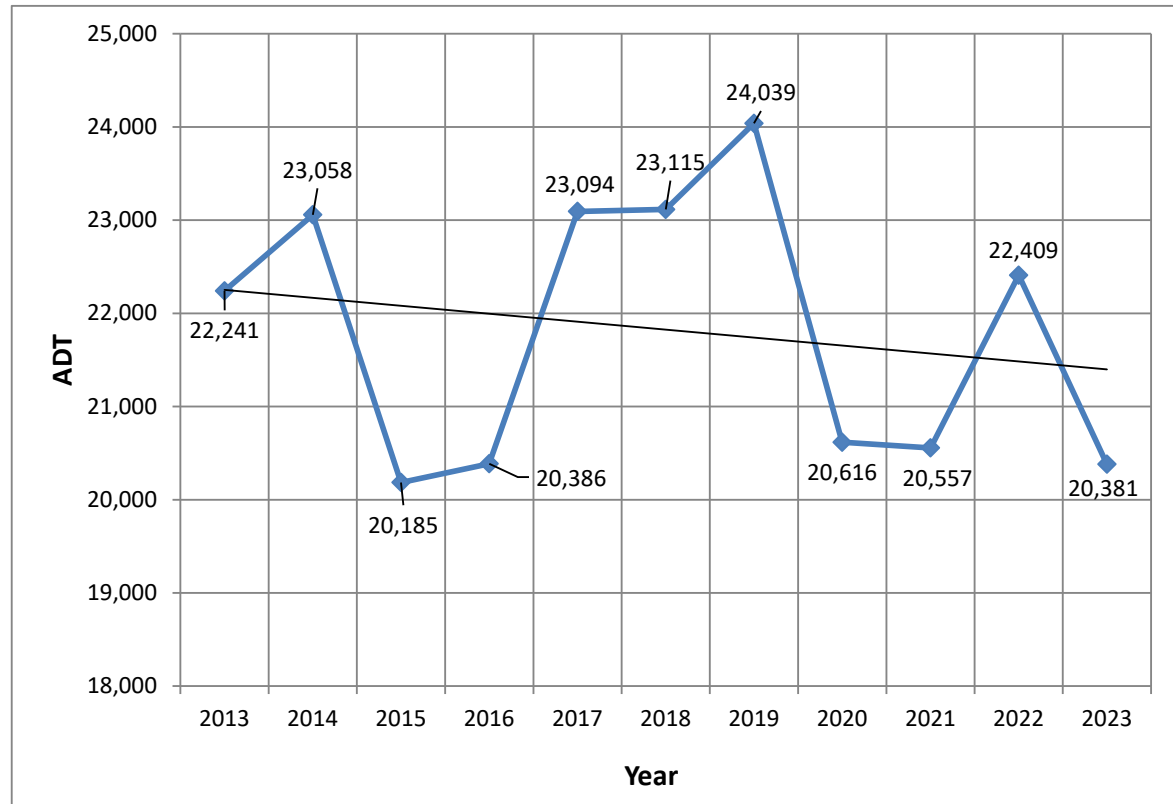
## Historical Traffic Counts

Organization: TDOT

Station ID #: 47000058

Location: Asheville Highway, east of Molly Bright Road

YEAR	AADT	
2013	22,241	Trendline ↓
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	



2013 - 2023 Growth Rate = -8.4%

Average Annual Growth Rate = -0.9%



## **APPENDIX B**

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



# Route 34: Burlington Shopper

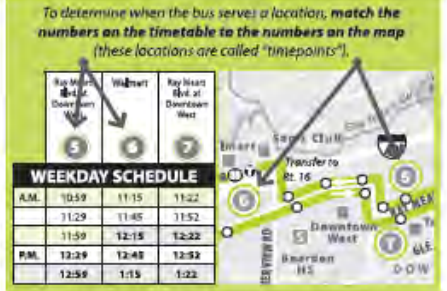
# How to Read this Schedule



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
			8:55 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						
8:15 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 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!

**TSS** 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!

**TSS** 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](http://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](http://katbus.com) • Customer Service: 865-637-3000



## Rider Tools and Tips

## Herramientas y consejos para los pasajeros

### Fare Information

Fare Type	Regular Fare	Discounted Fare
1-Ride pass	\$1.00	\$0.50
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](http://katbus.com).

### Riding Tips

- Plan your trip using this map, the free Transit app, or our homepage trip planner on [katbus.com](http://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](http://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:



Scan QR code to download Transit



### Información sobre tarifas

Tipo de tarifa	Tarifa regular	Tarifa con descuento
Pase de 1 viaje	\$1.00	\$0.50
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](http://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](http://katbus.com).
- Siempre llegue a la parada del autobús 5 minutos antes.
- Cuando vea que llega el autobús, haga una señal 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](http://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 Caldos (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 paratransito para quienes cualifiquen. Para más información, visite [katbus.com](http://katbus.com) o llame a KAT al 865-637-3000.



\*Información en español en el interior\*

**Burlington  
Shopper**  
(Weekdays & Weekends)

### 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







## 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**



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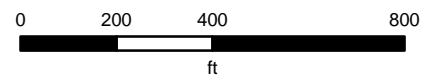
## Zoning Map

9.10.24

**Knoxville - Knox County - KUB Geographic Information System**



Printed: 9/10/2024 at 1:49:42 PM



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## **APPENDIX D**

### **MANUAL TRAFFIC COUNT DATA**

TRAFFIC COUNT DATA

Major Street: Asheville Highway (WB and EB)  
Minor Street: N Wooddale Road (SB) and S Wooddale Road (NB)  
Traffic Control: Stop Control on Minor Street

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

TIME BEGIN	N Wooddale Road				Asheville Highway				S Wooddale Road				Asheville Highway				VEHICLE TOTAL	PEAK HOUR
	SOUTHBOUND				WESTBOUND				NORTHBOUND				EASTBOUND					
	U-TURN	LT	THRU	RT	U-TURN	LT	THRU	RT	U-TURN	LT	THRU	RT	U-TURN	LT	THRU	RT		
7:00 AM	0	1	1	7	0	1	299	1	0	2	0	2	0	3	100	2	419	7:00 AM - 8:00 AM
7:15 AM	0	2	1	4	0	3	330	1	0	0	1	3	0	1	133	0	479	
7:30 AM	0	2	1	3	0	6	355	2	0	3	2	2	0	1	115	0	492	
7:45 AM	0	4	1	8	0	4	306	5	0	1	1	3	1	4	135	2	475	
8:00 AM	0	4	2	4	1	3	245	3	0	0	1	0	0	1	123	0	387	
8:15 AM	0	4	1	4	0	3	240	4	0	0	1	1	0	2	135	0	395	
8:30 AM	0	5	1	7	0	1	230	2	0	1	1	1	0	2	131	0	382	
8:45 AM	0	5	0	0	0	2	208	6	0	0	1	1	0	7	118	0	348	
TOTAL	0	27	8	37	1	23	2213	24	0	7	8	13	1	21	990	4	3377	
2:00 PM	0	5	1	3	0	5	160	4	0	0	3	0	0	9	144	1	335	
2:15 PM	0	3	2	3	0	4	153	4	0	2	1	2	0	14	176	5	369	
2:30 PM	0	5	0	3	0	1	144	1	0	2	2	3	0	6	159	3	329	
2:45 PM	0	6	1	4	0	4	157	6	0	0	3	5	0	9	190	3	388	
3:00 PM	0	7	5	7	1	9	133	5	0	1	1	3	0	5	191	3	371	
3:15 PM	0	5	0	3	1	3	146	3	0	0	2	2	0	7	247	5	424	
3:30 PM	0	4	1	2	2	3	197	12	0	0	2	4	0	4	257	2	490	3:30 PM - 4:30 PM
3:45 PM	0	11	1	2	0	2	250	11	0	1	1	4	0	11	283	0	577	
4:00 PM	0	10	1	7	0	5	171	5	0	0	2	2	0	7	236	3	449	
4:15 PM	0	5	0	3	0	2	158	4	0	0	0	1	0	7	290	3	473	
4:30 PM	0	4	0	3	1	2	166	6	0	2	2	2	0	5	288	4	485	
4:45 PM	0	2	3	3	0	1	164	1	0	3	2	3	0	11	299	2	494	
5:00 PM	0	5	0	1	0	6	165	2	0	2	1	6	0	4	304	1	497	
5:15 PM	0	5	1	3	1	0	145	2	0	1	2	3	0	6	294	4	467	
5:30 PM	0	1	1	4	0	1	179	1	0	1	1	0	1	8	310	3	511	
5:45 PM	0	3	1	2	1	1	144	3	0	0	2	5	0	3	298	1	464	
TOTAL	0	81	18	53	7	49	2632	70	0	15	27	45	1	116	3966	43	7123	

2024 AM Peak Hour7:00 AM - 8:00 AM

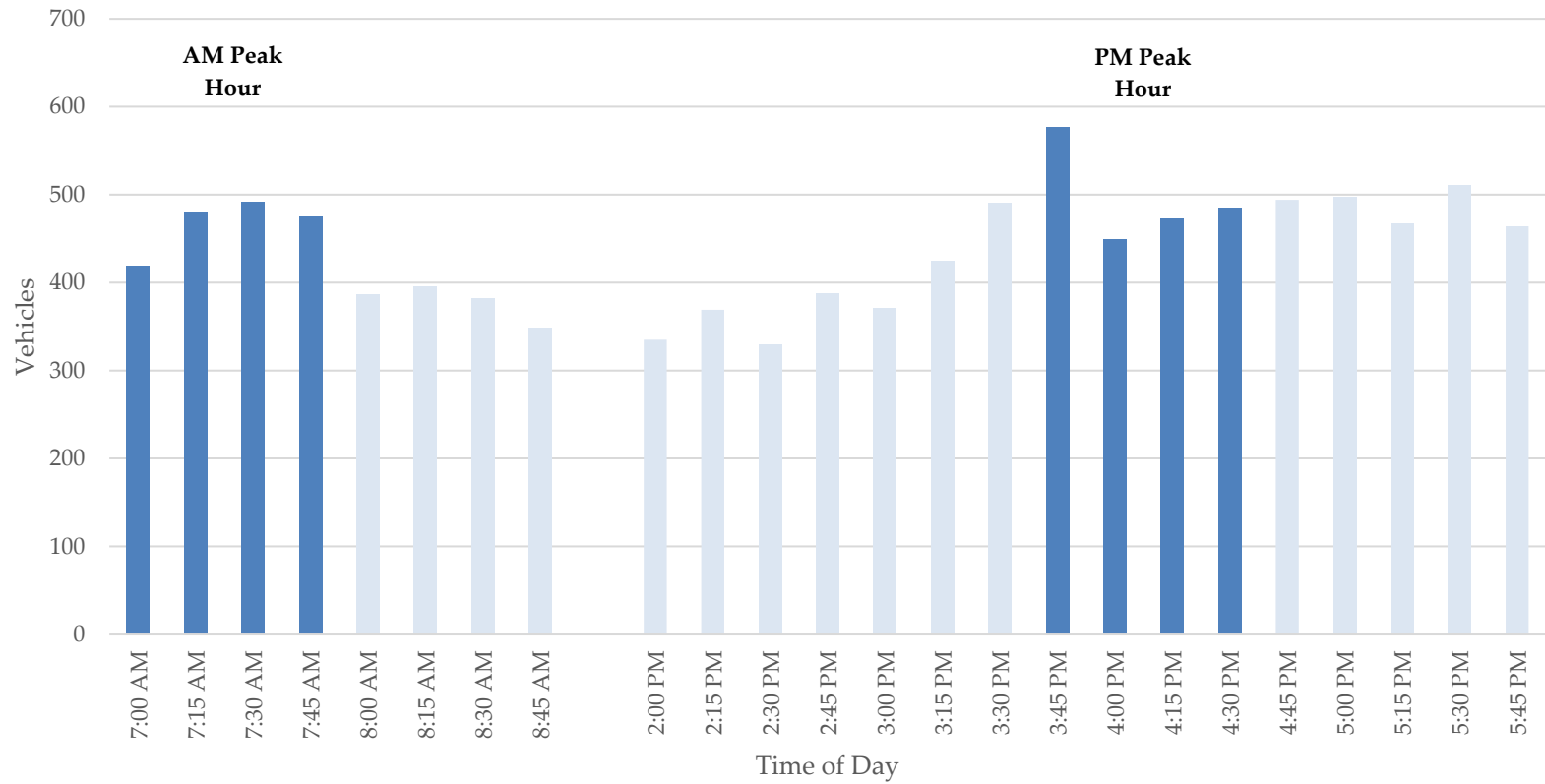
	N Wooddale Road				Asheville Highway				S Wooddale Road				Asheville Highway			
TIME BEGIN	SOUTHBOUND				WESTBOUND				NORTHBOUND				EASTBOUND			
	U-TURN	LT	THRU	RT	U-TURN	LT	THRU	RT	U-TURN	LT	THRU	RT	U-TURN	LT	THRU	RT
7:00 AM	0	1	1	7	0	1	299	1	0	2	0	2	0	3	100	2
7:15 AM	0	2	1	4	0	3	330	1	0	0	1	3	0	1	133	0
7:30 AM	0	2	1	3	0	6	355	2	0	3	2	2	0	1	115	0
7:45 AM	0	4	1	8	0	4	306	5	0	1	1	3	1	4	135	2
TOTAL	0	9	4	22	0	14	1290	9	0	6	4	10	1	9	483	4
TRUCK %	0.0%	0.0%	0.0%	9.1%	0.0%	14.3%	3.3%	0.0%	0.0%	16.7%	0.0%	10.0%	0.0%	11.1%	5.8%	0.0%
PHF <sub>mvmt</sub>	-	0.56	1.00	0.69	-	0.58	0.91	0.45	-	0.50	0.50	0.83	0.25	0.56	0.89	0.50
PHF <sub>app</sub>	0.67				0.90				0.71				0.88			
PHF <sub>int</sub>	0.95															

2024 PM Peak Hour3:30 PM - 4:30 PM

	N Wooddale Road				Asheville Highway				S Wooddale Road				Asheville Highway			
TIME BEGIN	SOUTHBOUND				WESTBOUND				NORTHBOUND				EASTBOUND			
	U-TURN	LT	THRU	RT	U-TURN	LT	THRU	RT	U-TURN	LT	THRU	RT	U-TURN	LT	THRU	RT
3:30 PM	0	4	1	2	2	3	197	12	0	0	2	4	0	4	257	2
3:45 PM	0	11	1	2	0	2	250	11	0	1	1	4	0	11	283	0
4:00 PM	0	10	1	7	0	5	171	5	0	0	2	2	0	7	236	3
4:15 PM	0	5	0	3	0	2	158	4	0	0	0	1	0	7	290	3
TOTAL	0	30	3	14	2	12	776	32	0	1	5	11	0	29	1066	8
TRUCK %	0.0%	0.0%	0.0%	7.1%	0.0%	8.3%	3.1%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.0%
PHF <sub>mvmt</sub>	-	0.68	0.75	0.50	0.25	0.60	0.78	0.67	-	0.25	0.63	0.69	-	0.66	0.92	0.67
PHF <sub>app</sub>	0.65				0.78				0.71				0.92			
PHF <sub>int</sub>	0.86															



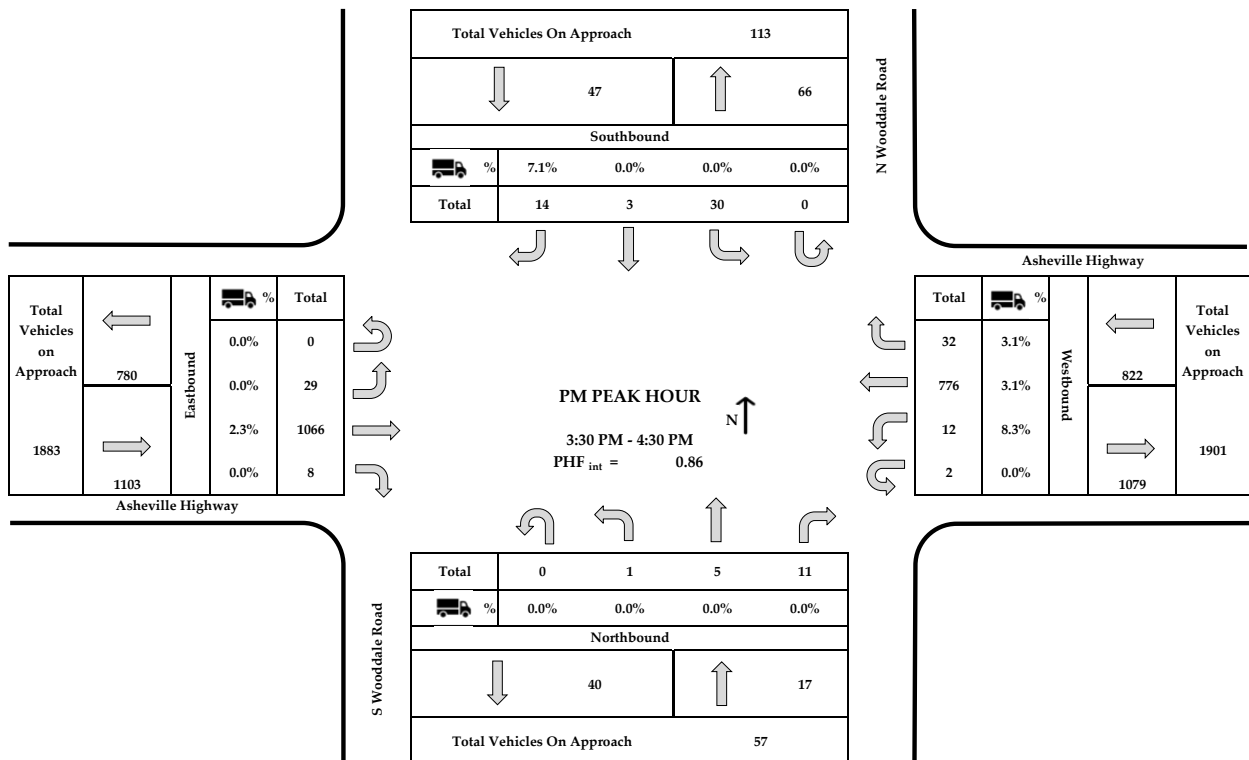
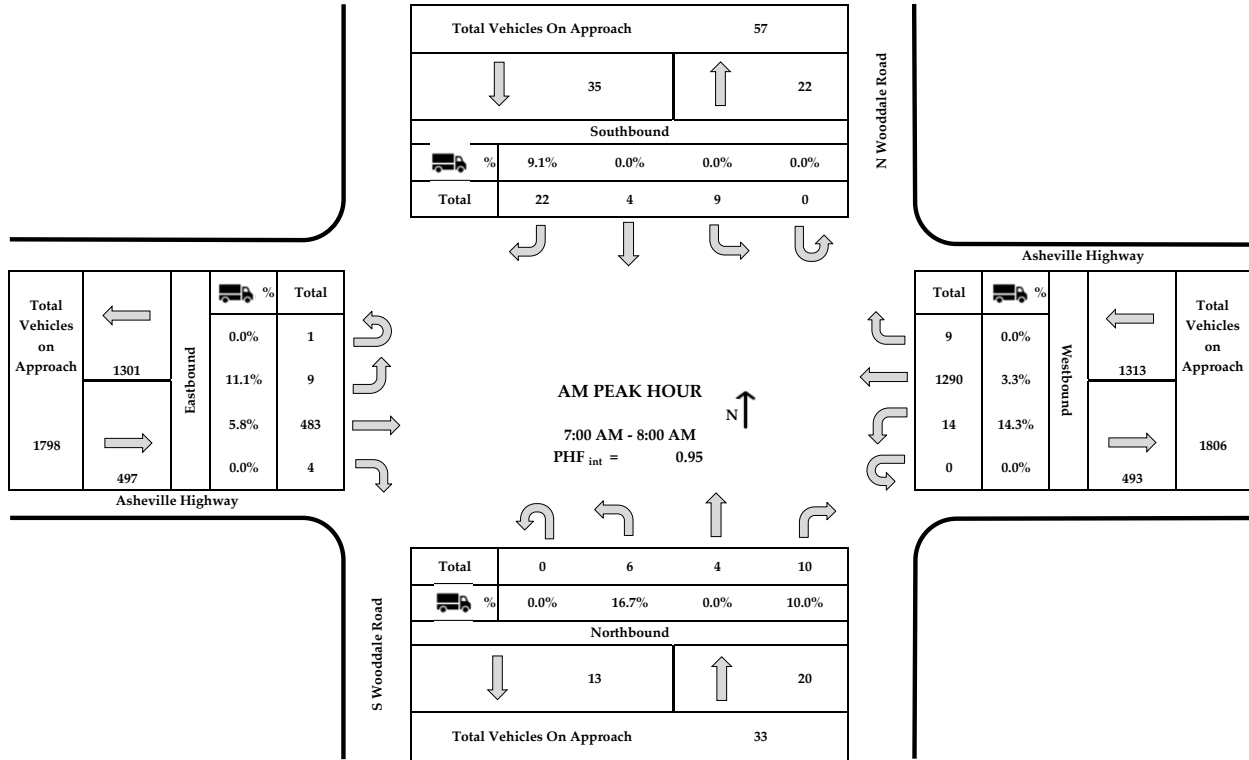
**Asheville Highway at N/S Wooddale Road**  
**Intersection Traffic Count Totals**  
**9/4/2024**



# PEAK HOUR DATA

Major Street: Asheville Highway (WB and EB)  
 Minor Street: N Wooddale Road (SB) and S Wooddale Road (NB)  
 Traffic Control: Stop Control on Minor Street

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



# **TRAFFIC COUNT DATA**

Major Street: Asheville Highway (WB and EB)  
 Minor Street: Cash Road (SB)  
 Traffic Control: Stop Conditions on Minor Street

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

	Cash Road		Asheville Highway			Asheville Highway				
TIME BEGIN	SOUTHBOUND		WESTBOUND			EASTBOUND			VEHICLE TOTAL	PEAK HOUR
	LT	RT	U-TURN	THRU	RT	U-TURN	LT	THRU		
7:00 AM	0	4	0	298	0	0	1	98	401	7:00 AM - 8:00 AM
7:15 AM	4	8	0	326	0	0	0	138	476	
7:30 AM	2	2	0	366	2	0	2	128	502	
7:45 AM	0	6	0	297	0	0	2	128	433	
8:00 AM	2	2	0	250	1	0	1	134	390	
8:15 AM	3	2	0	243	0	0	2	138	388	
8:30 AM	3	2	0	232	1	0	0	140	378	
8:45 AM	0	1	0	213	3	0	1	128	346	
TOTAL	14	27	0	2225	7	0	9	1032	3314	
2:00 PM	2	4	0	163	0	1	7	144	321	
2:15 PM	2	1	0	160	1	0	2	176	342	
2:30 PM	2	4	0	143	0	0	4	171	324	
2:45 PM	2	1	0	164	1	0	4	203	375	
3:00 PM	0	8	0	144	0	0	1	199	352	
3:15 PM	1	0	0	155	0	0	4	245	405	
3:30 PM	1	1	0	216	4	1	4	256	483	3:30 PM - 4:30 PM
3:45 PM	2	3	0	255	3	0	5	289	557	
4:00 PM	0	5	0	182	1	1	6	252	447	
4:15 PM	0	4	0	157	0	1	7	286	455	
4:30 PM	1	2	0	166	3	0	7	299	478	
4:45 PM	1	4	0	161	1	1	4	293	465	
5:00 PM	0	3	0	172	0	0	3	314	492	
5:15 PM	1	3	0	146	2	0	2	307	461	
5:30 PM	1	2	0	178	2	0	5	306	494	
5:45 PM	2	2	0	145	0	0	6	294	449	
TOTAL	18	47	0	2707	18	5	71	4034	6900	

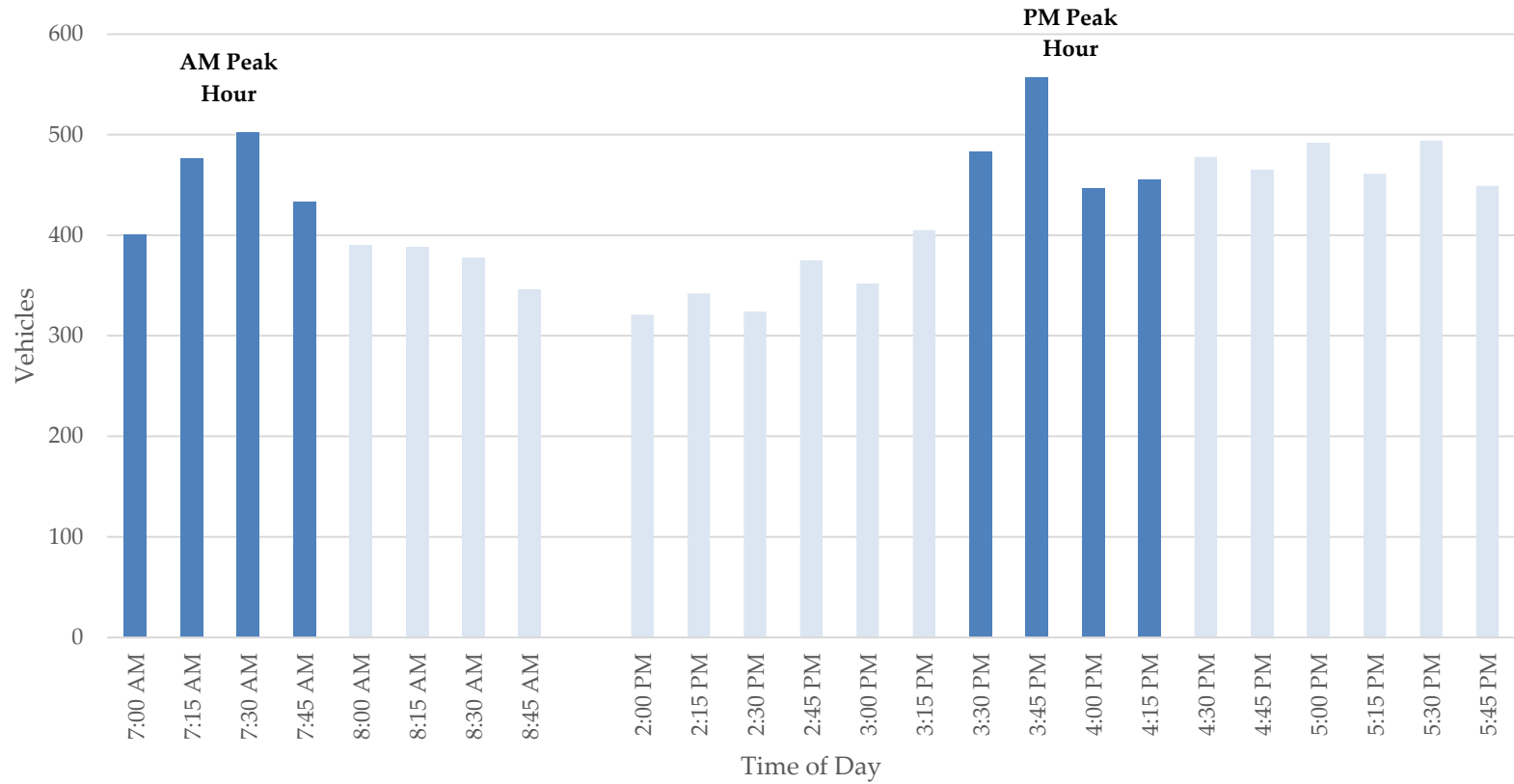
## 2024 AM Peak Hour 7:00 AM - 8:00 AM

TIME BEGIN	Cash Road		Asheville Highway			Asheville Highway		
	SOUTHBOUND		WESTBOUND			EASTBOUND		
	LT	RT	U-TURN	THRU	RT	U-TURN	LT	THRU
7:00 AM	0	4	0	298	0	0	1	98
7:15 AM	4	8	0	326	0	0	0	138
7:30 AM	2	2	0	366	2	0	2	128
7:45 AM	0	6	0	297	0	0	2	128
TOTAL	6	20	0	1287	2	0	5	492
PHF	0.38	0.63	-	0.88	0.25	-	0.63	0.89
TRUCK %	0.0%	0.0%	0.0%	3.8%	50.0%	0.0%	0.0%	6.1%

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

TIME BEGIN	Cash Road		Asheville Highway			Asheville Highway		
	SOUTHBOUND		WESTBOUND			EASTBOUND		
	LT	RT	U-TURN	THRU	RT	U-TURN	LT	THRU
3:30 PM	1	1	0	216	4	1	4	256
3:45 PM	2	3	0	255	3	0	5	289
4:00 PM	0	5	0	182	1	1	6	252
4:15 PM	0	4	0	157	0	1	7	286
TOTAL	3	13	0	810	8	3	22	1083
PHF	0.38	0.65	-	0.79	0.50	0.75	0.79	0.94
TRUCK %	0.0%	0.0%	0.0%	3.3%	12.5%	0.0%	0.0%	2.3%

**Asheville Highway at Cash Road  
Intersection Traffic Count Totals  
9/4/2024**

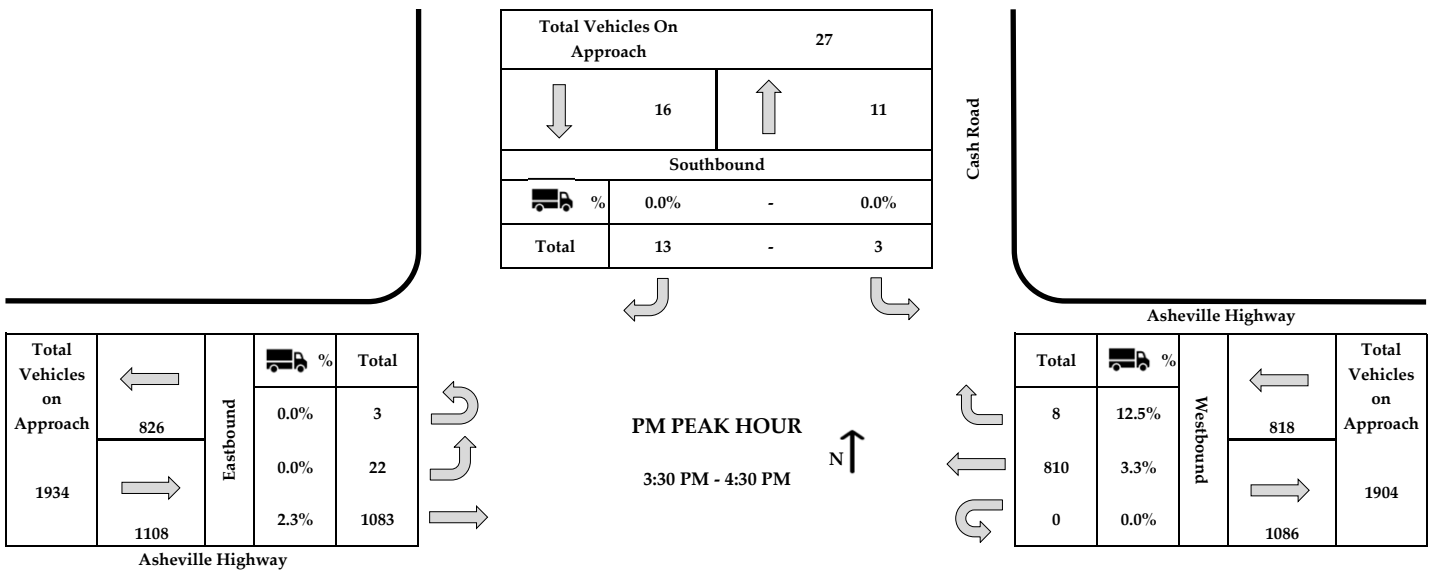
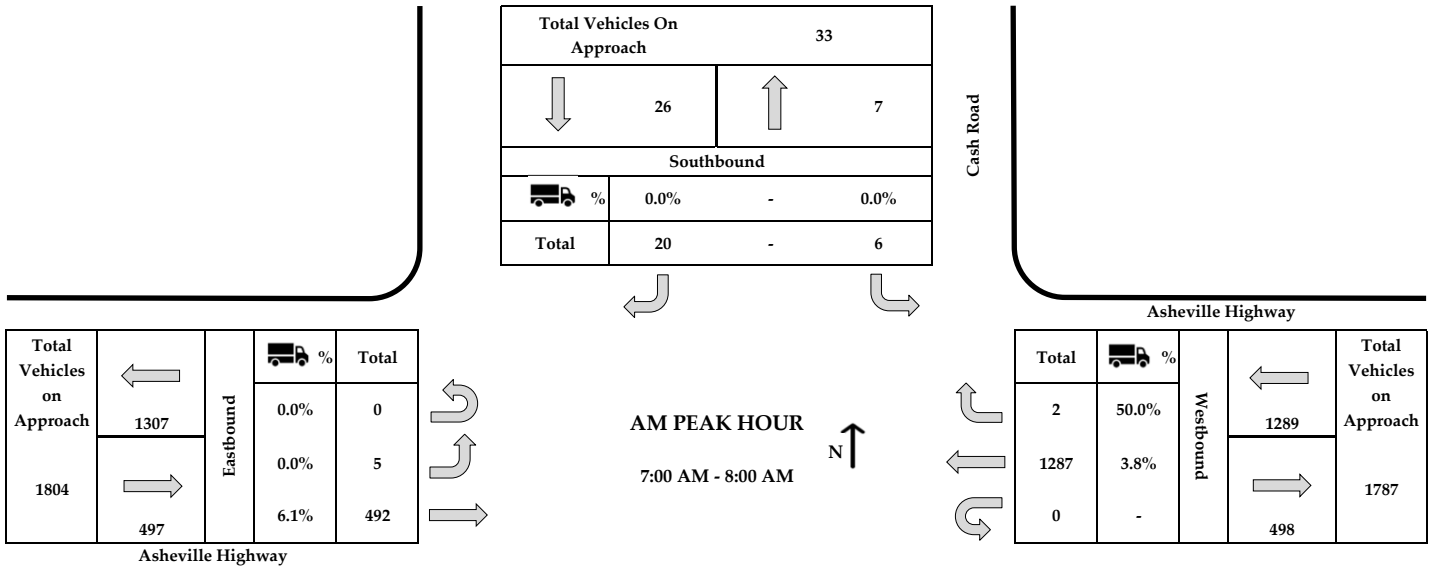




## PEAK HOUR DATA

Major Street: Asheville Highway (WB and EB)  
 Minor Street: Cash Road (SB)  
 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

# HCM 7th TWSC

## 3: S Wooddale Road/N Wooddale Road & Asheville Highway

Intersection													
Int Delay, s/veh	1.3												
Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱			↕			↰	↱
Traffic Vol, veh/h	1	9	483	4	14	1290	9	6	4	10	9	4	22
Future Vol, veh/h	1	9	483	4	14	1290	9	6	4	10	9	4	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	None	-	-	None	-	-	Stop
Storage Length	-	225	-	-	250	-	-	-	-	-	-	-	50
Veh in Median Storage, #	-	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	-	2	-	-	-2	-	-	2	-	-	0	-
Peak Hour Factor	25	56	89	50	58	91	45	50	50	83	56	100	69
Heavy Vehicles, %	0	11	6	0	14	3	0	17	0	10	0	0	9
Mvmt Flow	4	16	543	8	24	1418	20	12	8	12	16	4	32
Major/Minor	Major1			Major2			Minor1			Minor2			
Conflicting Flow All	1438	1438	0	0	551	0	0	1346	2073	275	1791	2067	719
Stage 1	-	-	-	-	-	-	-	587	587	-	1476	1476	-
Stage 2	-	-	-	-	-	-	-	759	1486	-	315	591	-
Critical Hdwy	6.4	4.32	-	-	4.38	-	-	8.24	6.9	7.3	7.5	6.5	7.08
Critical Hdwy Stg 1	-	-	-	-	-	-	-	7.24	5.9	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	7.24	5.9	-	6.5	5.5	-
Follow-up Hdwy	2.5	2.31	-	-	2.34	-	-	3.67	4	3.4	3.5	4	3.39
Pot Cap-1 Maneuver	177	425	-	-	937	-	-	83	43	688	52	55	356
Stage 1	-	-	-	-	-	-	-	400	468	-	135	192	-
Stage 2	-	-	-	-	-	-	-	306	161	-	676	498	-
Platoon blocked, %			-	-		-	-						
Mov Cap-1 Maneuver	320	320	-	-	937	-	-	67	40	688	43	50	356
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	164	108	-	109	138	-
Stage 1	-	-	-	-	-	-	-	375	439	-	131	187	-
Stage 2	-	-	-	-	-	-	-	266	157	-	611	467	-
Approach	EB			WB			NB			SB			
HCM Control Delay, s/v	0.6			0.15			27.15			26.65			
HCM LOS							D			D			
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2				
Capacity (veh/h)	194	320	-	-	937	-	-	114	356				
HCM Lane V/C Ratio	0.165	0.063	-	-	0.026	-	-	0.177	0.09				
HCM Control Delay (s/veh)	27.1	17	-	-	8.9	-	-	43.4	16.1				
HCM Lane LOS	D	C	-	-	A	-	-	E	C				
HCM 95th %tile Q(veh)	0.6	0.2	-	-	0.1	-	-	0.6	0.3				







# HCM 7th TWSC

## 7: Asheville Highway & Cash Road

### Intersection

Int Delay, s/veh 0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	492	1287	2	6	20
Future Vol, veh/h	5	492	1287	2	6	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	95	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	1	-
Grade, %	-	2	-2	-	0	-
Peak Hour Factor	63	89	88	25	38	63
Heavy Vehicles, %	0	6	4	50	0	0
Mvmt Flow	8	553	1463	8	16	32








Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1471	0	0 1759 735
Stage 1	-	-	- 1467 -
Stage 2	-	-	- 292 -
Critical Hdwy	4.1	-	- 6.8 6.9
Critical Hdwy Stg 1	-	-	- 5.8 -
Critical Hdwy Stg 2	-	-	- 5.8 -
Follow-up Hdwy	2.2	-	- 3.5 3.3
Pot Cap-1 Maneuver	465	-	- 77 366
Stage 1	-	-	- 182 -
Stage 2	-	-	- 738 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	465	-	- 76 366
Mov Cap-2 Maneuver	-	-	- 151 -
Stage 1	-	-	- 179 -
Stage 2	-	-	- 738 -

Approach	EB	WB	SB
HCM Control Delay, s/v 0.18		0	22.91
HCM LOS			C





Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	465	-	-	-	248
HCM Lane V/C Ratio	0.017	-	-	-	0.192
HCM Control Delay (s/veh)	12.9	-	-	-	22.9
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.7

# HCM 7th TWSC

## 3: S Wooddale Road/N Wooddale Road & Asheville Highway

Intersection													
Int Delay, s/veh	1.7												
Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Traffic Vol, veh/h	29	1066	8	2	12	776	32	1	5	11	30	3	14
Future Vol, veh/h	29	1066	8	2	12	776	32	1	5	11	30	3	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	-	None	-	-	None	-	-	Stop
Storage Length	225	-	-	-	250	-	-	-	-	-	-	-	50
Veh in Median Storage, #	-	0	-	-	-	0	-	-	1	-	-	1	-
Grade, %	-	2	-	-	-	-2	-	-	2	-	-	0	-
Peak Hour Factor	66	92	67	25	60	78	67	25	63	69	68	75	50
Heavy Vehicles, %	0	2	0	0	8	3	3	0	0	0	0	0	7
Mvmt Flow	44	1159	12	8	20	995	48	4	8	16	44	4	28
Major/Minor	Major1			Major2			Minor1			Minor2			
Conflicting Flow All	1043	0	0	1171	1171	0	0	1808	2351	585	1746	2333	521
Stage 1	-	-	-	-	-	-	-	1253	1253	-	1075	1075	-
Stage 2	-	-	-	-	-	-	-	555	1099	-	671	1259	-
Critical Hdwy	4.1	-	-	6.4	4.26	-	-	7.9	6.9	7.1	7.5	6.5	7.04
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.9	5.9	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	6.9	5.9	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.5	2.28	-	-	3.5	4	3.3	3.5	4	3.37
Pot Cap-1 Maneuver	675	-	-	263	560	-	-	41	28	444	56	37	487
Stage 1	-	-	-	-	-	-	-	161	214	-	238	298	-
Stage 2	-	-	-	-	-	-	-	459	257	-	417	244	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	675	-	-	416	416	-	-	33	24	444	~ 44	33	487
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	109	102	-	141	121	-
Stage 1	-	-	-	-	-	-	-	151	200	-	222	278	-
Stage 2	-	-	-	-	-	-	-	398	240	-	361	228	-
Approach	EB			WB			NB			SB			
HCM Control Delay, s/v	0.39			0.37			27.9			32.6			
HCM LOS							D			D			
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2				
Capacity (veh/h)	185	675	-	-	416	-	-	139	487				
HCM Lane V/C Ratio	0.151	0.065	-	-	0.067	-	-	0.347	0.057				
HCM Control Delay (s/veh)	27.9	10.7	-	-	14.3	-	-	44.1	12.8				
HCM Lane LOS	D	B	-	-	B	-	-	E	B				
HCM 95th %tile Q(veh)	0.5	0.2	-	-	0.2	-	-	1.4	0.2				
Notes													
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined		*: All major volume in platoon							

# HCM 7th TWSC 7: Asheville Highway & Cash Road








Intersection							
Int Delay, s/veh	0.4						
Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	3	22	1083	810	8	3	13
Future Vol, veh/h	3	22	1083	810	8	3	13
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	-	95	-	-	-	0	-
Veh in Median Storage, #	-	-	0	0	-	1	-
Grade, %	-	-	2	-2	-	0	-
Peak Hour Factor	75	79	94	79	50	38	65
Heavy Vehicles, %	0	0	2	3	13	0	0
Mvmt Flow	4	28	1152	1025	16	8	20
Major/Minor	Major1		Major2		Minor2		
Conflicting Flow All	1041	1041	0	-	0	1673	521
Stage 1	-	-	-	-	-	1033	-
Stage 2	-	-	-	-	-	640	-
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	318	676	-	-	-	88	506
Stage 1	-	-	-	-	-	309	-
Stage 2	-	-	-	-	-	493	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	586	586	-	-	-	84	506
Mov Cap-2 Maneuver	-	-	-	-	-	202	-
Stage 1	-	-	-	-	-	292	-
Stage 2	-	-	-	-	-	493	-
Approach	EB		WB		SB		
HCM Control Delay, s/v	0.31		0		16.01		
HCM LOS					C		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1		
Capacity (veh/h)	586	-	-	-	355		
HCM Lane V/C Ratio	0.054	-	-	-	0.079		
HCM Control Delay (s/veh)	11.5	-	-	-	16		
HCM Lane LOS	B	-	-	-	C		
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3		

## **PROJECTED CONDITIONS WITHOUT THE PROJECT**



# HCM 7th TWSC





## 3: S Wooddale Road/N Wooddale Road & Asheville Highway

Intersection													
Int Delay, s/veh	1.5												
Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Traffic Vol, veh/h	1	10	522	4	15	1393	10	6	4	11	10	4	24
Future Vol, veh/h	1	10	522	4	15	1393	10	6	4	11	10	4	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	None	-	-	None	-	-	Stop
Storage Length	-	225	-	-	250	-	-	-	-	-	-	-	50
Veh in Median Storage, #	-	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	-	2	-	-	-2	-	-	2	-	-	0	-
Peak Hour Factor	25	56	89	50	58	91	45	50	50	83	56	100	69
Heavy Vehicles, %	0	11	6	0	14	3	0	17	0	10	0	0	9
Mvmt Flow	4	18	587	8	26	1531	22	12	8	13	18	4	35
Major/Minor	Major1			Major2			Minor1			Minor2			
Conflicting Flow All	1553	1553	0	0	595	0	0	1453	2239	297	1935	2232	776
Stage 1	-	-	-	-	-	-	-	634	634	-	1594	1594	-
Stage 2	-	-	-	-	-	-	-	819	1605	-	341	638	-
Critical Hdwy	6.4	4.32	-	-	4.38	-	-	8.24	6.9	7.3	7.5	6.5	7.08
Critical Hdwy Stg 1	-	-	-	-	-	-	-	7.24	5.9	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	7.24	5.9	-	6.5	5.5	-
Follow-up Hdwy	2.5	2.31	-	-	2.34	-	-	3.67	4	3.4	3.5	4	3.39
Pot Cap-1 Maneuver	149	382	-	-	900	-	-	68	33	665	41	43	325
Stage 1	-	-	-	-	-	-	-	372	444	-	114	168	-
Stage 2	-	-	-	-	-	-	-	279	139	-	653	474	-
Platoon blocked, %			-	-		-	-						
Mov Cap-1 Maneuver	284	284	-	-	900	-	-	52	30	665	33	39	325
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	143	90	-	92	121	-
Stage 1	-	-	-	-	-	-	-	343	409	-	111	163	-
Stage 2	-	-	-	-	-	-	-	236	135	-	579	437	-
Approach	EB			WB			NB			SB			
HCM Control Delay, s/v 0.66				0.15			30.87			31.24			
HCM LOS							D			D			
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2				
Capacity (veh/h)	172	284	-	-	900	-	-	96	325				
HCM Lane V/C Ratio	0.193	0.077	-	-	0.029	-	-	0.228	0.107				
HCM Control Delay (s/veh)	30.9	18.7	-	-	9.1	-	-	53.3	17.4				
HCM Lane LOS	D	C	-	-	A	-	-	F	C				
HCM 95th %tile Q(veh)	0.7	0.2	-	-	0.1	-	-	0.8	0.4				

# HCM 7th TWSC 7: Asheville Highway & Cash Road

## Intersection

Int Delay, s/veh 0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	531	1390	2	6	22
Future Vol, veh/h	5	531	1390	2	6	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	95	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	1	-
Grade, %	-	2	-2	-	0	-
Peak Hour Factor	63	89	88	25	38	63
Heavy Vehicles, %	0	6	4	50	0	0
Mvmt Flow	8	597	1580	8	16	35








Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1588	0	0 1898 794
Stage 1	-	-	- - 1584 -
Stage 2	-	-	- - 314 -
Critical Hdwy	4.1	-	- - 6.8 6.9
Critical Hdwy Stg 1	-	-	- - 5.8 -
Critical Hdwy Stg 2	-	-	- - 5.8 -
Follow-up Hdwy	2.2	-	- - 3.5 3.3
Pot Cap-1 Maneuver	419	-	- - 63 335
Stage 1	-	-	- - 157 -
Stage 2	-	-	- - 720 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	419	-	- - 61 335
Mov Cap-2 Maneuver	-	-	- - 130 -
Stage 1	-	-	- - 154 -
Stage 2	-	-	- - 720 -

Approach	EB	WB	SB
HCM Control Delay, s/v 0.18		0	25.59
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	419	-	-	-	225
HCM Lane V/C Ratio	0.019	-	-	-	0.225
HCM Control Delay (s/veh)	13.8	-	-	-	25.6
HCM Lane LOS	B	-	-	-	D
HCM 95th %tile Q(veh)	0.1	-	-	-	0.8





# HCM 7th TWSC

## 3: S Wooddale Road/N Wooddale Road & Asheville Highway

Intersection													
Int Delay, s/veh	2												
Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Traffic Vol, veh/h	31	1151	9	2	13	838	35	1	5	12	32	3	15
Future Vol, veh/h	31	1151	9	2	13	838	35	1	5	12	32	3	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	-	None	-	-	None	-	-	Stop
Storage Length	225	-	-	-	250	-	-	-	-	-	-	-	50
Veh in Median Storage, #	-	0	-	-	-	0	-	-	1	-	-	1	-
Grade, %	-	2	-	-	-	-2	-	-	2	-	-	0	-
Peak Hour Factor	66	92	67	25	60	78	67	25	63	69	68	75	50
Heavy Vehicles, %	0	2	0	0	8	3	3	0	0	0	0	0	7
Mvmt Flow	47	1251	13	8	22	1074	52	4	8	17	47	4	30
Major/Minor	Major1			Major2			Minor1			Minor2			
Conflicting Flow All	1127	0	0	1265	1265	0	0	1950	2538	632	1883	2518	563
Stage 1	-	-	-	-	-	-	-	1352	1352	-	1160	1160	-
Stage 2	-	-	-	-	-	-	-	599	1186	-	723	1358	-
Critical Hdwy	4.1	-	-	6.4	4.26	-	-	7.9	6.9	7.1	7.5	6.5	7.04
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.9	5.9	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	6.9	5.9	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.5	2.28	-	-	3.5	4	3.3	3.5	4	3.37
Pot Cap-1 Maneuver	627	-	-	228	514	-	-	32	21	413	~ 44	28	457
Stage 1	-	-	-	-	-	-	-	139	190	-	211	272	-
Stage 2	-	-	-	-	-	-	-	431	232	-	388	219	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	627	-	-	377	377	-	-	24	18	413	~ 33	24	457
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	92	86	-	122	104	-
Stage 1	-	-	-	-	-	-	-	128	176	-	195	251	-
Stage 2	-	-	-	-	-	-	-	365	214	-	328	202	-
Approach	EB			WB			NB			SB			
HCM Control Delay, s/v	0.4			0.39			31.45			39.83			
HCM LOS							D			E			
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2				
Capacity (veh/h)	165	627	-	-	377	-	-	120	457				
HCM Lane V/C Ratio	0.178	0.075	-	-	0.079	-	-	0.424	0.066				
HCM Control Delay (s/veh)	31.4	11.2	-	-	15.4	-	-	55.3	13.4				
HCM Lane LOS	D	B	-	-	C	-	-	F	B				
HCM 95th %tile Q(veh)	0.6	0.2	-	-	0.3	-	-	1.8	0.2				
Notes													
~: Volume exceeds capacity		\$: Delay exceeds 300s			+: Computation Not Defined				*: All major volume in platoon				

# HCM 7th TWSC

## 7: Asheville Highway & Cash Road








Intersection							
Int Delay, s/veh	0.4						
Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	3	24	1170	875	9	3	14
Future Vol, veh/h	3	24	1170	875	9	3	14
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	-	95	-	-	-	0	-
Veh in Median Storage, #	-	-	0	0	-	1	-
Grade, %	-	-	2	-2	-	0	-
Peak Hour Factor	75	79	94	79	50	38	65
Heavy Vehicles, %	0	0	2	3	13	0	0
Mvmt Flow	4	30	1245	1108	18	8	22
Major/Minor	Major1		Major2		Minor2		
Conflicting Flow All	1126	1126	0	-	0	1808	563
Stage 1	-	-	-	-	-	1117	-
Stage 2	-	-	-	-	-	691	-
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	281	628	-	-	-	72	475
Stage 1	-	-	-	-	-	279	-
Stage 2	-	-	-	-	-	464	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	543	543	-	-	-	67	475
Mov Cap-2 Maneuver	-	-	-	-	-	180	-
Stage 1	-	-	-	-	-	261	-
Stage 2	-	-	-	-	-	464	-
Approach	EB		WB		SB		
HCM Control Delay, s/v	0.32		0		16.97		
HCM LOS					C		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1		
Capacity (veh/h)	543	-	-	-	330		
HCM Lane V/C Ratio	0.063	-	-	-	0.089		
HCM Control Delay (s/veh)	12.1	-	-	-	17		
HCM Lane LOS	B	-	-	-	C		
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3		



## **PROJECTED CONDITIONS WITH THE PROJECT**





# HCM 7th TWSC

## 3: S Wooddale Road/N Wooddale Road & Asheville Highway

Intersection													
Int Delay, s/veh	1.7												
Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Traffic Vol, veh/h	1	10	590	4	15	1548	10	6	4	11	10	4	24
Future Vol, veh/h	1	10	590	4	15	1548	10	6	4	11	10	4	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	None	-	-	None	-	-	Stop
Storage Length	-	225	-	-	250	-	-	-	-	-	-	-	75
Veh in Median Storage, #	-	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	-	2	-	-	-2	-	-	2	-	-	0	-
Peak Hour Factor	25	56	89	50	58	91	45	50	50	83	56	100	69
Heavy Vehicles, %	0	11	6	0	14	3	0	17	0	10	0	0	9
Mvmt Flow	4	18	663	8	26	1701	22	12	8	13	18	4	35
Major/Minor	Major1			Major2			Minor1			Minor2			
Conflicting Flow All	1723	1723	0	0	671	0	0	1615	2486	335	2143	2479	862
Stage 1	-	-	-	-	-	-	-	711	711	-	1764	1764	-
Stage 2	-	-	-	-	-	-	-	904	1775	-	379	715	-
Critical Hdwy	6.4	4.32	-	-	4.38	-	-	8.24	6.9	7.3	7.5	6.5	7.08
Critical Hdwy Stg 1	-	-	-	-	-	-	-	7.24	5.9	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	7.24	5.9	-	6.5	5.5	-
Follow-up Hdwy	2.5	2.31	-	-	2.34	-	-	3.67	4	3.4	3.5	4	3.39
Pot Cap-1 Maneuver	115	326	-	-	839	-	-	50	23	626	28	30	285
Stage 1	-	-	-	-	-	-	-	330	406	-	89	139	-
Stage 2	-	-	-	-	-	-	-	244	112	-	620	438	-
Platoon blocked, %			-	-		-	-						
Mov Cap-1 Maneuver	232	232	-	-	839	-	-	37	20	626	22	26	285
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	118	70	-	72	99	-
Stage 1	-	-	-	-	-	-	-	299	368	-	86	134	-
Stage 2	-	-	-	-	-	-	-	201	109	-	538	396	-
Approach	EB			WB			NB			SB			
HCM Control Delay, s/v	0.7			0.14			38.63			39.24			
HCM LOS							E			E			
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2				
Capacity (veh/h)	140	232	-	-	839	-	-	76	285				
HCM Lane V/C Ratio	0.238	0.094	-	-	0.031	-	-	0.289	0.122				
HCM Control Delay (s/veh)	38.6	22.1	-	-	9.4	-	-	70.8	19.4				
HCM Lane LOS	E	C	-	-	A	-	-	F	C				
HCM 95th %tile Q(veh)	0.9	0.3	-	-	0.1	-	-	1.1	0.4				






# HCM 7th TWSC

## 7: Asheville Highway & Cash Road

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	598	1511	2	6	22
Future Vol, veh/h	5	598	1511	2	6	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	95	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	1	-
Grade, %	-	2	-2	-	0	-
Peak Hour Factor	63	89	88	25	38	63
Heavy Vehicles, %	0	6	4	50	0	0
Mvmt Flow	8	672	1717	8	16	35
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	1725	0	-	0	2073	863
Stage 1	-	-	-	-	1721	-
Stage 2	-	-	-	-	352	-
Critical Hdwy	4.1	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	371	-	-	-	48	302
Stage 1	-	-	-	-	132	-
Stage 2	-	-	-	-	689	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	371	-	-	-	47	302
Mov Cap-2 Maneuver	-	-	-	-	110	-
Stage 1	-	-	-	-	130	-
Stage 2	-	-	-	-	689	-
Approach	EB	WB		SB		
HCM Control Delay, s/v	0.17	0		29.77		
HCM LOS	D					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	371	-	-	-	195	
HCM Lane V/C Ratio	0.021	-	-	-	0.26	
HCM Control Delay (s/veh)	14.9	-	-	-	29.8	
HCM Lane LOS	B	-	-	-	D	
HCM 95th %tile Q(veh)	0.1	-	-	-	1	

# HCM 7th TWSC

## 9: Asheville Highway & Proposed Entrance

Intersection						
Int Delay, s/veh	0.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	10	594	1530	3	9	37
Future Vol, veh/h	10	594	1530	3	9	37
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	210	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	0	-
Peak Hour Factor	89	89	88	88	90	90
Heavy Vehicles, %	0	6	4	0	0	0
Mvmt Flow	11	667	1739	3	10	41
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	1742	0	-	0	2097	871
Stage 1	-	-	-	-	1740	-
Stage 2	-	-	-	-	356	-
Critical Hdwy	4.1	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	366	-	-	-	46	298
Stage 1	-	-	-	-	129	-
Stage 2	-	-	-	-	686	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	366	-	-	-	45	298
Mov Cap-2 Maneuver	-	-	-	-	45	-
Stage 1	-	-	-	-	125	-
Stage 2	-	-	-	-	686	-
Approach	EB	WB		SB		
HCM Control Delay, s/v	0.25	0		36.37		
HCM LOS	E					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	366	-	-	-	45	298
HCM Lane V/C Ratio	0.031	-	-	-	0.225	0.138
HCM Control Delay (s/veh)	15.2	-	-	-	107.9	19
HCM Lane LOS	C	-	-	-	F	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.7	0.5










# HCM 7th TWSC

## 3: S Wooddale Road/N Wooddale Road & Asheville Highway

### Intersection

Int Delay, s/veh 2.4

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Traffic Vol, veh/h	31	1325	9	2	13	977	35	1	5	12	32	3	15
Future Vol, veh/h	31	1325	9	2	13	977	35	1	5	12	32	3	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	-	None	-	-	None	-	-	Stop
Storage Length	225	-	-	-	250	-	-	-	-	-	-	-	75
Veh in Median Storage, #	-	0	-	-	-	0	-	-	1	-	-	1	-
Grade, %	-	2	-	-	-	-2	-	-	2	-	-	0	-
Peak Hour Factor	66	92	67	25	60	78	67	25	63	69	68	75	50
Heavy Vehicles, %	0	2	0	0	8	3	3	0	0	0	0	0	7
Mvmt Flow	47	1440	13	8	22	1253	52	4	8	17	47	4	30

Major/Minor	Major1			Major2			Minor1			Minor2			
Conflicting Flow All	1305	0	0	1454	1454	0	0	2228	2905	727	2156	2886	652
Stage 1	-	-	-	-	-	-	-	1541	1541	-	1338	1338	-
Stage 2	-	-	-	-	-	-	-	688	1364	-	818	1548	-
Critical Hdwy	4.1	-	-	6.4	4.26	-	-	7.9	6.9	7.1	7.5	6.5	7.04
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.9	5.9	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	6.9	5.9	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.5	2.28	-	-	3.5	4	3.3	3.5	4	3.37
Pot Cap-1 Maneuver	537	-	-	173	433	-	-	19	12	356	~28	16	399
Stage 1	-	-	-	-	-	-	-	104	150	-	164	224	-
Stage 2	-	-	-	-	-	-	-	378	187	-	340	177	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	537	-	-	300	300	-	-	14	9	356	~19	14	399
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	68	63	-	93	79	-
Stage 1	-	-	-	-	-	-	-	94	137	-	148	202	-
Stage 2	-	-	-	-	-	-	-	308	168	-	278	162	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v 0.39		0.41	42.12	59.26
HCM LOS			E	F





Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	126	537	-	-	300	-	-	92	399
HCM Lane V/C Ratio	0.233	0.087	-	-	0.099	-	-	0.558	0.075
HCM Control Delay (s/veh)	42.1	12.3	-	-	18.3	-	-	85.4	14.8
HCM Lane LOS	E	B	-	-	C	-	-	F	B
HCM 95th %tile Q(veh)	0.9	0.3	-	-	0.3	-	-	2.5	0.2

### Notes

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






# HCM 7th TWSC

## 7: Asheville Highway & Cash Road

Intersection							
Int Delay, s/veh	0.4						
Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	3	24	1314	993	9	3	14
Future Vol, veh/h	3	24	1314	993	9	3	14
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	-	95	-	-	-	0	-
Veh in Median Storage, #	-	-	0	0	-	1	-
Grade, %	-	-	2	-2	-	0	-
Peak Hour Factor	75	79	94	79	50	38	65
Heavy Vehicles, %	0	0	2	3	13	0	0
Mvmt Flow	4	30	1398	1257	18	8	22
Major/Minor	Major1		Major2		Minor2		
Conflicting Flow All	1275	1275	0	-	0	2034	637
Stage 1	-	-	-	-	-	1266	-
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	225	551	-	-	-	51	425
Stage 1	-	-	-	-	-	233	-
Stage 2	-	-	-	-	-	424	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	466	466	-	-	-	47	425
Mov Cap-2 Maneuver	-	-	-	-	-	149	-
Stage 1	-	-	-	-	-	215	-
Stage 2	-	-	-	-	-	424	-
Approach	EB		WB		SB		
HCM Control Delay, s/v	0.32		0		19.14		
HCM LOS					C		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1		
Capacity (veh/h)	466	-	-	-	284		
HCM Lane V/C Ratio	0.074	-	-	-	0.104		
HCM Control Delay (s/veh)	13.3	-	-	-	19.1		
HCM Lane LOS	B	-	-	-	C		
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3		

# HCM 7th TWSC

## 9: Asheville Highway & Proposed Entrance

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	38	1333	1001	9	8	30
Future Vol, veh/h	38	1333	1001	9	8	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	210	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	0	-
Peak Hour Factor	90	92	79	90	90	90
Heavy Vehicles, %	0	2	3	0	0	0
Mvmt Flow	42	1449	1267	10	9	33
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	1277	0	-	0	2081	639
Stage 1	-	-	-	-	1272	-
Stage 2	-	-	-	-	809	-
Critical Hdwy	4.1	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	550	-	-	-	47	424
Stage 1	-	-	-	-	231	-
Stage 2	-	-	-	-	404	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	550	-	-	-	43	424
Mov Cap-2 Maneuver	-	-	-	-	43	-
Stage 1	-	-	-	-	213	-
Stage 2	-	-	-	-	404	-
Approach	EB	WB		SB		
HCM Control Delay, s/v	0.34	0		33.96		
HCM LOS	D					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	550	-	-	-	43	424
HCM Lane V/C Ratio	0.077	-	-	-	0.205	0.079
HCM Control Delay (s/veh)	12.1	-	-	-	108	14.2
HCM Lane LOS	B	-	-	-	F	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.7	0.3

## **APPENDIX F**

### **TRIP GENERATION DATA**

# Local Apartment Trip Generation Study

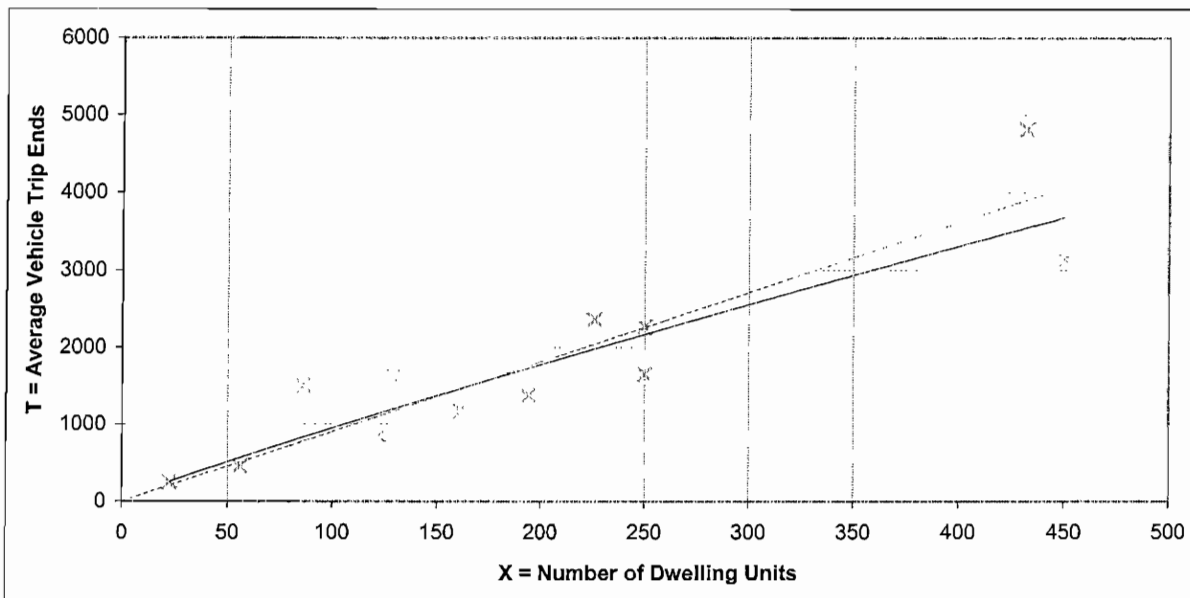
Average Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday

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

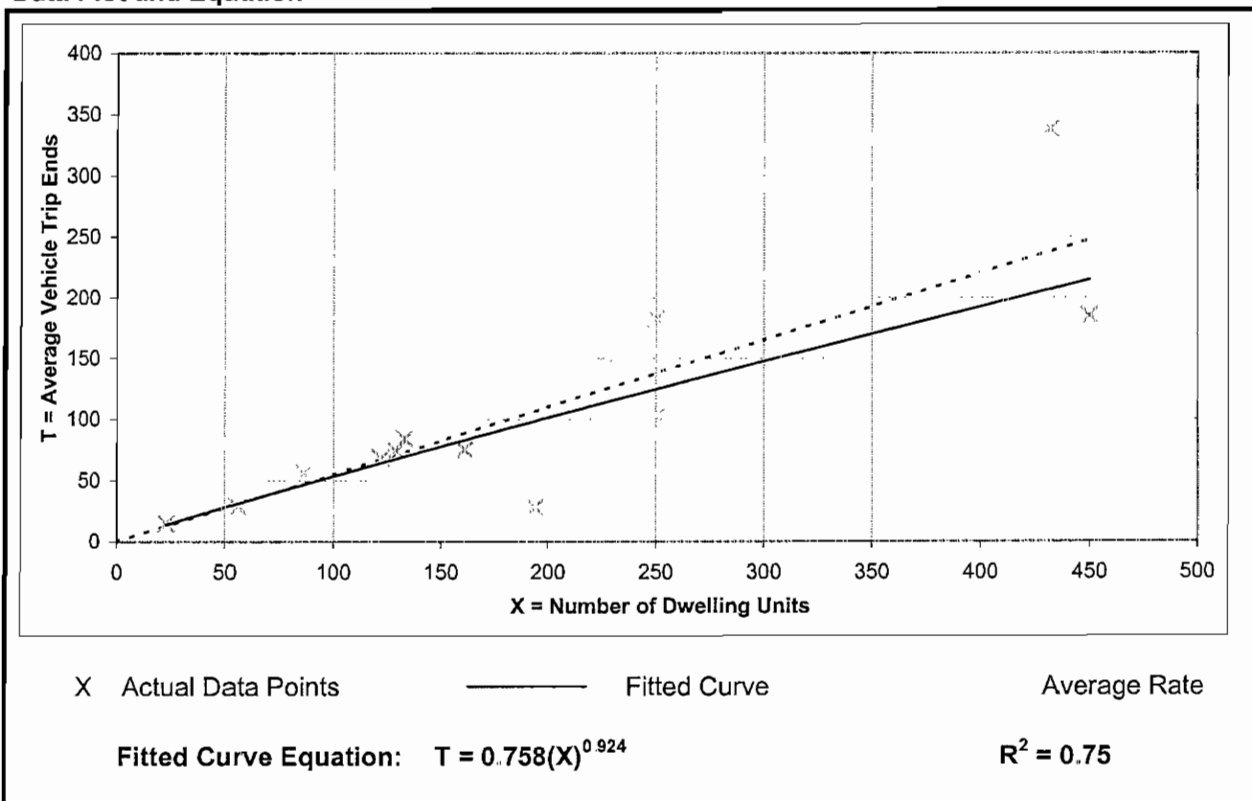
Average Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 7 and 9 a.m.

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



# Local Apartment Trip Generation Study

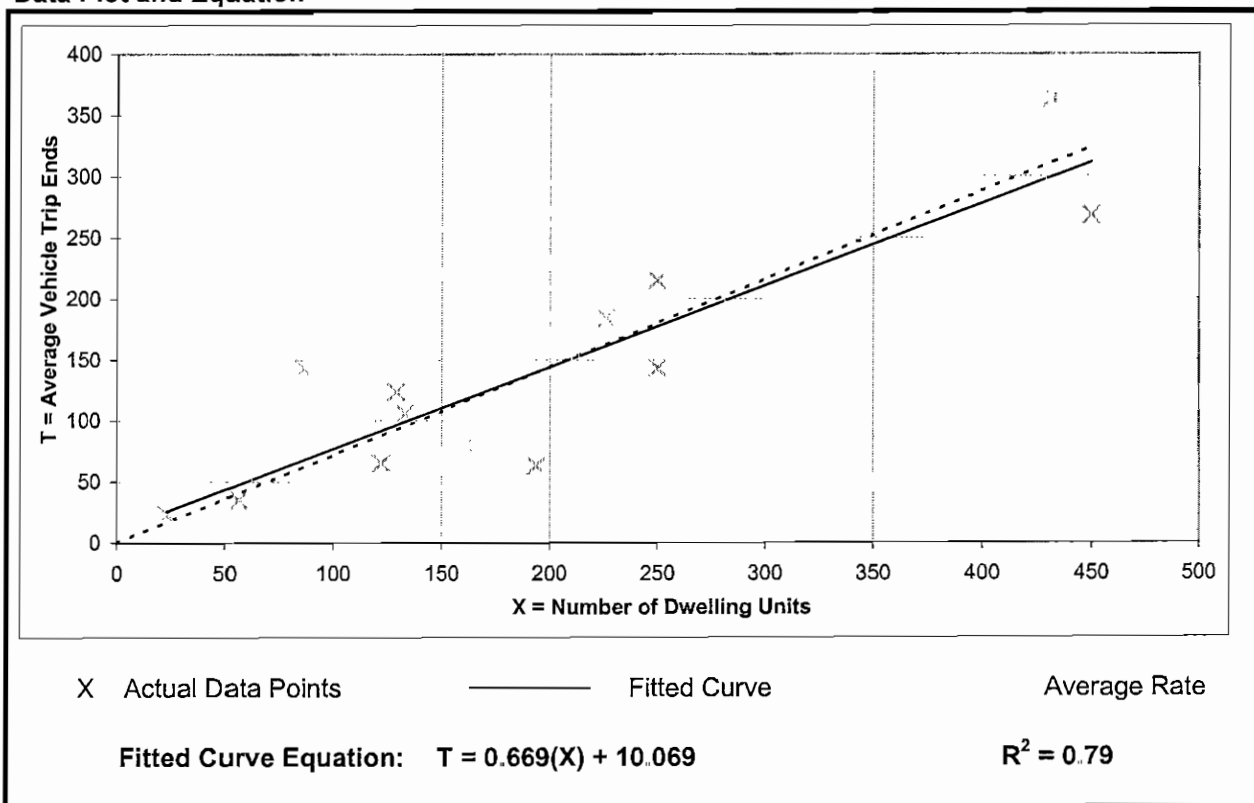
Average Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 4 and 6 p.m.

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



TRIP GENERATION FOR 0 ASHEVILLE HIGHWAY SUBDIVISION

111 Multi-Family Attached Townhouses

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Local Trip Rate	Townhouses	111	1,049	22%	78%		55%	45%	
				13	46	59	47	38	85
Total New Volume Site Trips			1,049	13	46	59	47	38	85

Data from Local Trip Rates and calculated by using Fitted Curve Equations

## TRIP GENERATION FOR 0 ASHEVILLE HIGHWAY SUBDIVISION

### 111 Multi-Family Attached Townhouses

111 Units = X

---

#### Weekday:

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

$$T = 15.193 * 68.98$$
$$T = \underline{\underline{1,049 \text{ trips}}}$$

---

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

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

$$T = 0.758 * 78$$
$$T = \underline{\underline{59 \text{ trips}}}$$

---

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

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

$$T = 0.669 * 111 + 10.07$$
$$T = \underline{\underline{85 \text{ trips}}}$$

## **APPENDIX G**

### **2021 CENSUS BUREAU DATA**



## Destination Analysis

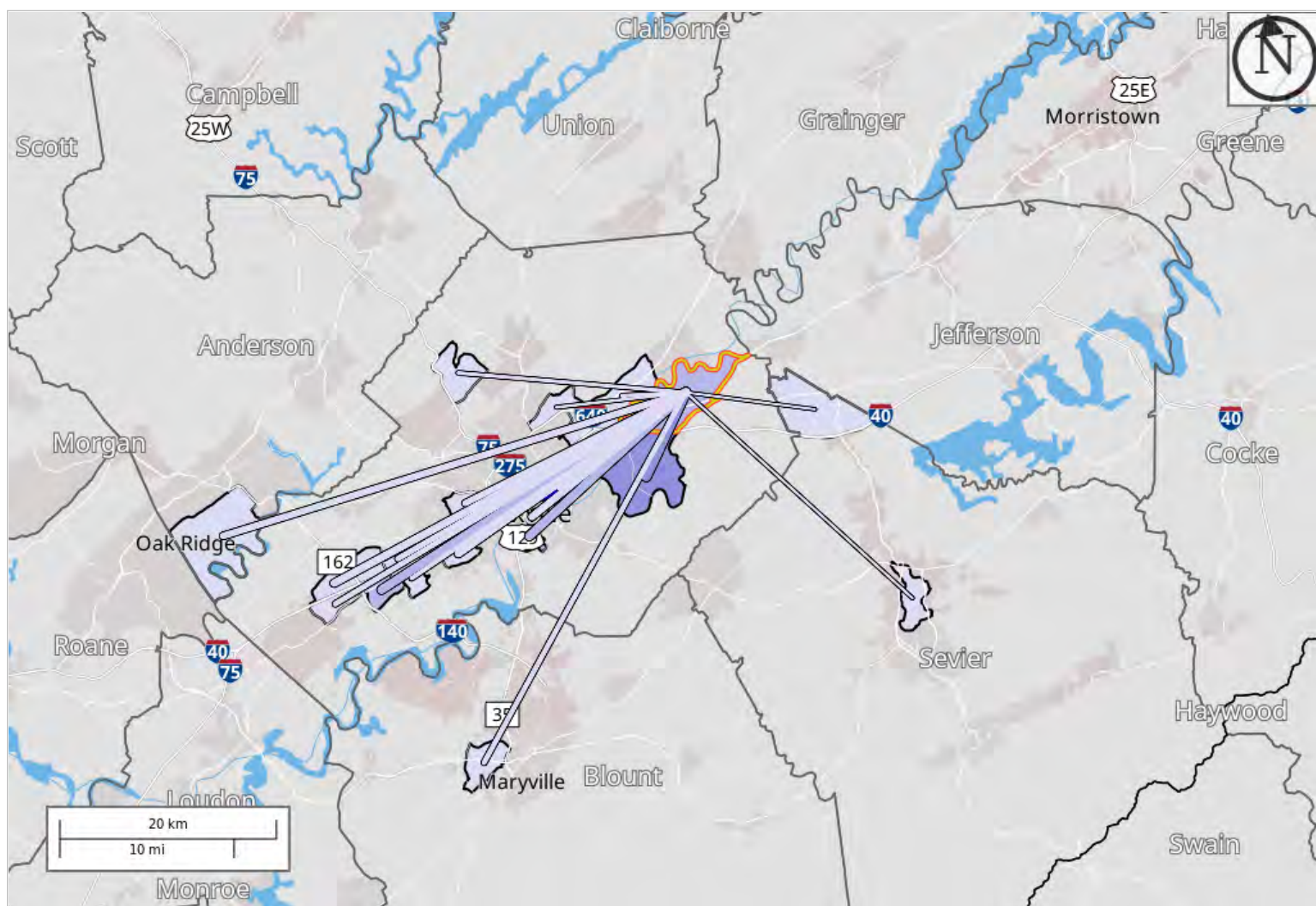
**Workers:** Living in 53.01 (Knox, TN)

**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

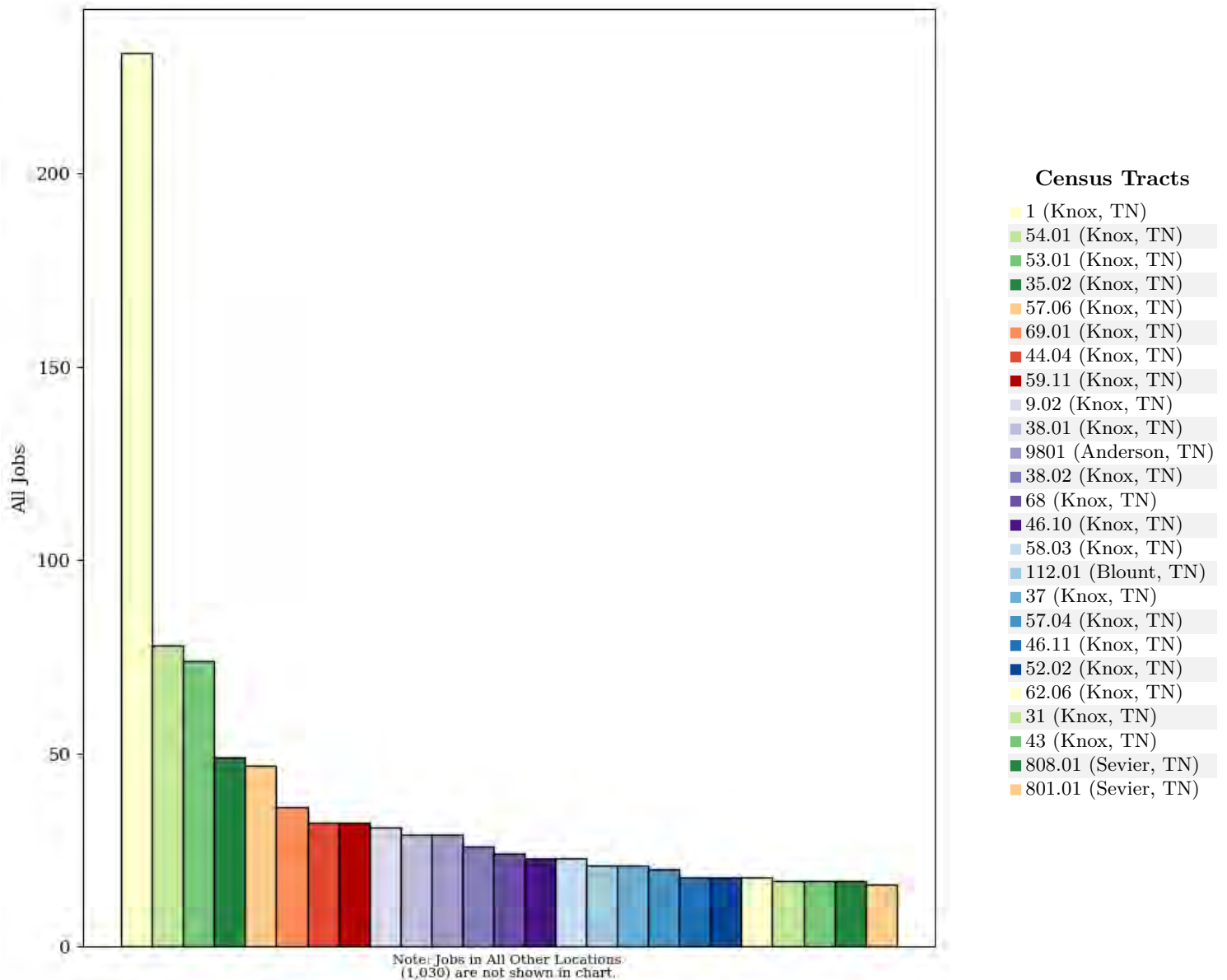
##### Job Count

- ▮ 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	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	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**



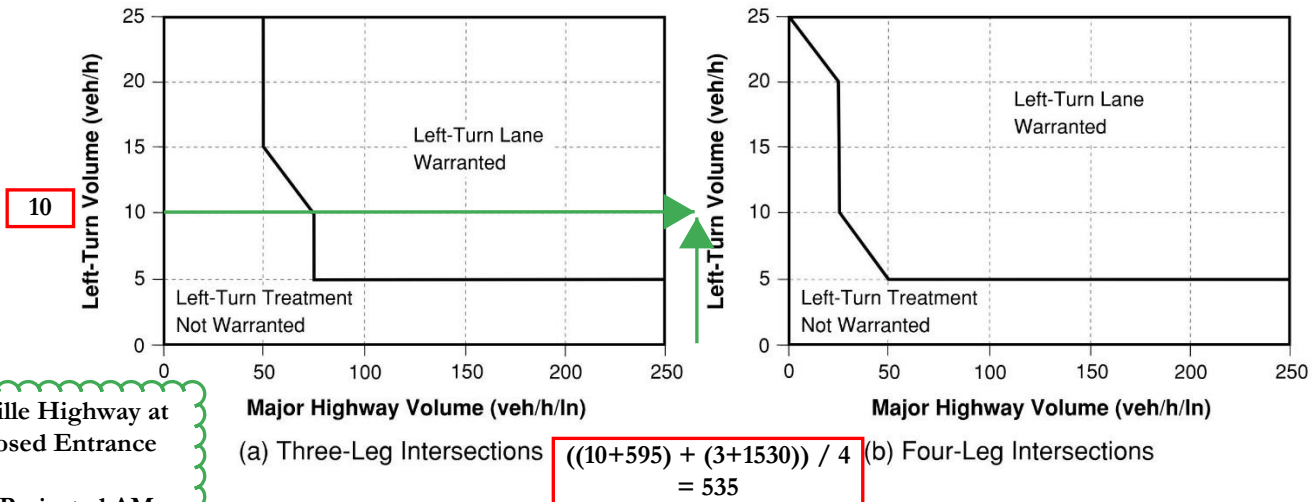


Figure 3-17: Left-Turn Lane Warrant for Four-Lane Rural Roadways (Unsignalized) <sup>22, 23</sup>

Asheville Highway at  
Proposed Entrance

2028 Projected AM  
EB Left Turns = 10

EB Left Turn Lane  
Warranted

#### 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.

<sup>22</sup> TRB, NCHRP Report 745, Left-Turn Accommodations at Unsignalized Intersections (2013)

<sup>23</sup> AASHTO, A Policy on Geometric Design of Highways and Streets 7<sup>th</sup> Edition (2018)

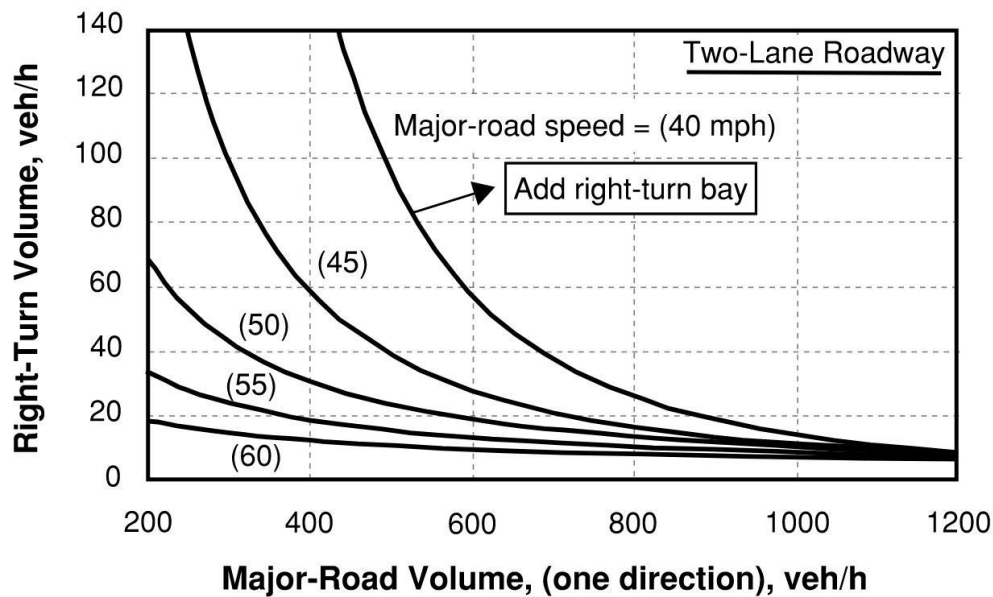
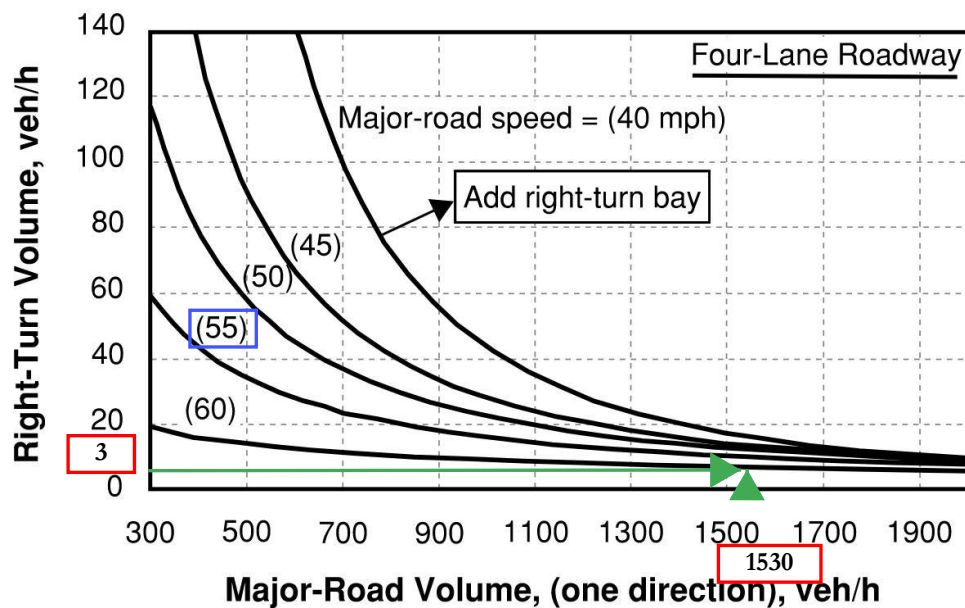


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>24</sup>



Asheville Highway at  
Proposed Entrance

2028 Projected AM  
WB Right Turns = 3

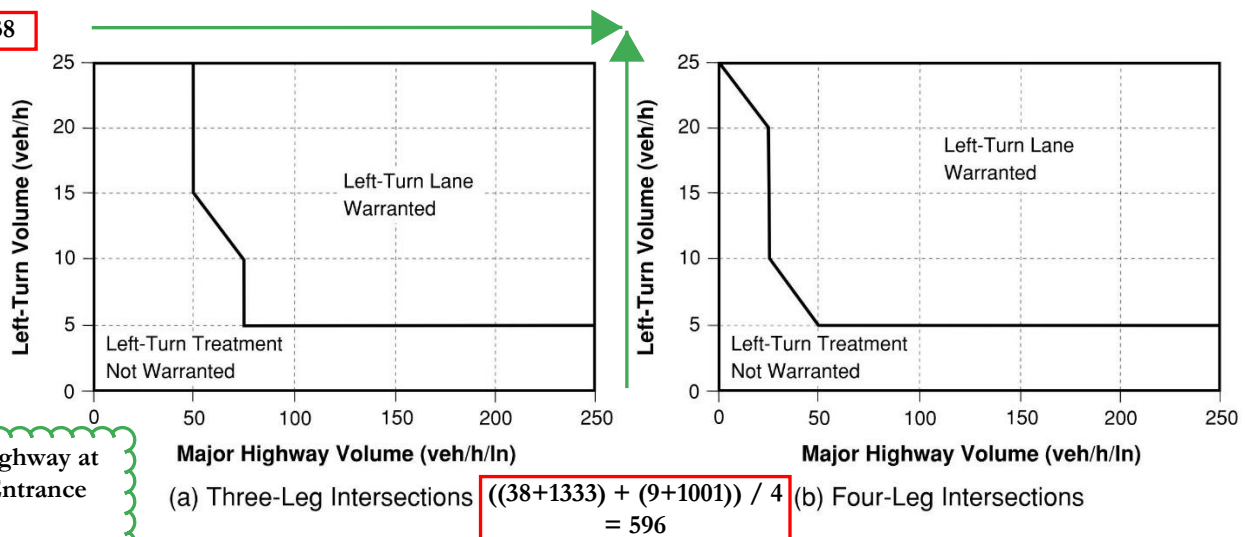
WB Right Turn Lane  
NOT  
Warranted

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

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

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

38

Figure 3-17: Left-Turn Lane Warrant for Four-Lane Rural Roadways (Unsignalized)<sup>22, 23</sup>

Asheville Highway at  
Proposed Entrance

2028 Projected PM  
EB Left Turns = 38

EB Left Turn Lane  
Warranted

#### 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.

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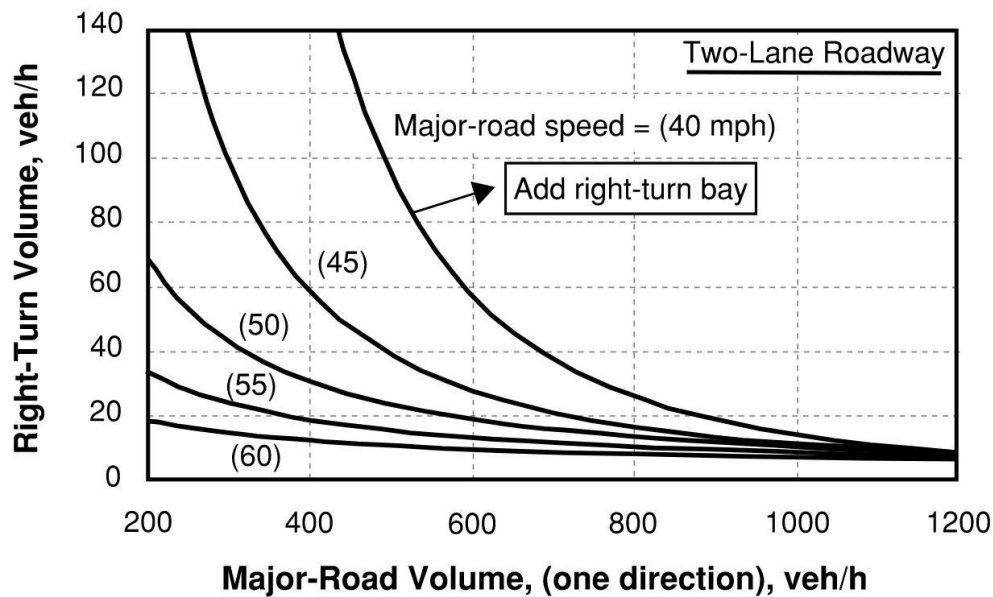
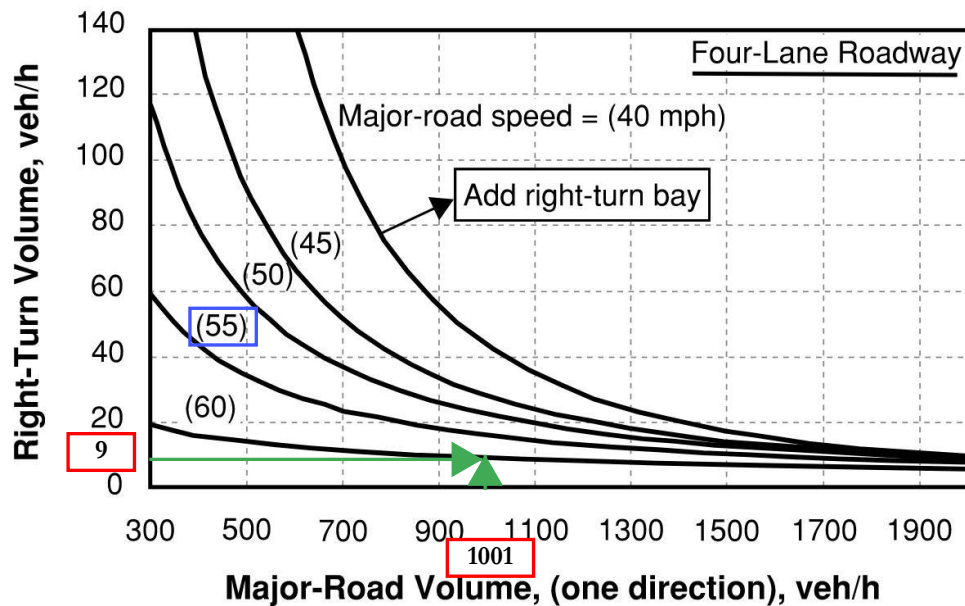


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>24</sup>



Asheville Highway at  
Proposed Entrance

2028 Projected PM  
WB Right Turns = 9

WB Right Turn Lane  
NOT  
Warranted

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

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

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

## **APPENDIX I**

### **RESPONSE LETTER TO ADDRESS COMMENTS – 10.30.24**





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

**October 30, 2024**

**PROJECT NAME: 0 Asheville Highway Subdivision (11-SH-24-C / 11-K-24-DP)**  
**TO: Knoxville-Knox County Planning**  
**SUBJECT: 0 Asheville Highway Subdivision TIS Review**

Knoxville-Knox County Planning, Knox County Engineering and Public Works, and Tennessee Department of Transportation Staff:

The following document addresses a comment in an email from Mike Conger, PE, dated October 18, 2024. This letter is added to the end of the revised report in Appendix I. The comment was regarding the recommended median opening on Asheville Highway at the Proposed Entrance for the 0 Asheville Highway Subdivision. TDOT requested additional information about the location and spacing of this proposed median opening, as shown in the original concept plan.

After discussing this issue further with TDOT, the designer was told that a proposed median opening would need to be shifted further to the west and be mid-way between North Wooddale Road and Cash Road. The designer revised the site plan to show this requested location, which resulted in changes to the interior layout of the proposed subdivision. In addition to revising the proposed entrance further to the west, the number of proposed townhouse lots in the subdivision has decreased from 114 to 111.

Furthermore, the other non-related proposed subdivision to the east at 8014 Asheville Highway was slightly revised with reduced housing units since the original study for the 0 Asheville Highway Subdivision was produced. Thus, this revised TIS included a slight decrease in generated trips from the 0 Asheville Highway Subdivision and the 8014 Asheville Highway Subdivision.

These results required multiple changes in the revised TIS, but the overall recommendations remained the same as the original report.

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

- Updated Title Page
- Updated Table of Contents
- Updated Page Footers and Page Numbers

- Updated trip generation calculations in Appendix F
- Updated worksheets in Appendix E and H
- Added Appendix I to include this response letter
- Minor grammar and commentary changes to improve readability

If you have any questions or further comments, don't hesitate to contact me. We look forward to your final approval.

Sincerely,

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



Ajax Engineering, LLC  
11812 Black Road  
Knoxville, TN 37932  
ajaxengineering@gmail.com  
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CIVIL ENGINEERING / TRAFFIC ENGINEERING