

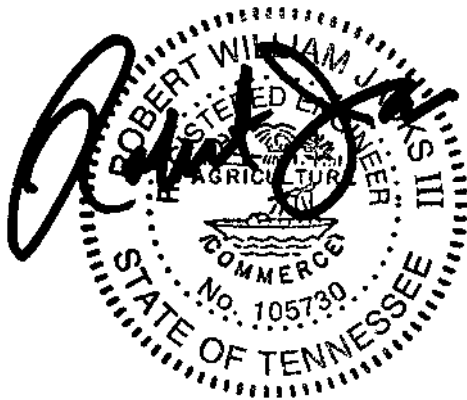


# Transportation Impact Study Hatmaker Lane Subdivision Knox County, Tennessee



Revised April 2020

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## EXECUTIVE SUMMARY

### **Preface:**

S&E Properties, LLC is proposing to construct a residential development at the end of Hatmaker Lane in West Knox County, TN. In this report, the name of this proposed residential development is referred to as “Hatmaker Lane Subdivision” and this development will consist of 153 single-family detached houses on 69.7± acres. This development is anticipated to be fully built-out and occupied by the year 2026. The primary purpose of this study is to determine and evaluate the potential impacts of the Hatmaker Lane Subdivision on the adjacent transportation system with particular interest of the existing intersection of North Campbell Station Road at Fretz Road. This study includes a review of the primary access roads, Fretz Road and Hatmaker Lane, in between the proposed development site and the intersection at North Campbell Station Road. This study also includes the analysis of the potential impact of three other non-related residential subdivisions currently being constructed or proposed to be constructed soon on Fretz Road and Hatmaker Lane. Recommendations and mitigation measures will be offered where traffic operations have been projected to be below traffic engineering standards.

### **Study Results:**

The findings of this study include the following:

- At full build-out and occupancy, the Hatmaker Lane Subdivision with 153 houses is expected to generate approximately 1,538 trips on an average weekday. 114 of these trips are estimated to occur during the AM peak hour and 153 trips in the PM peak hour at full build-out and occupancy in the year 2026.
- Along Fretz Road and Hatmaker Lane, three other non-related residential subdivisions are in various states of construction and development. These adjacent residential developments will consist of single-family detached houses. There is a total of 227 houses yet to be constructed and occupied in these three other developments. An additional 2,384 trips on an average weekday are expected to be generated by these other residential developments. These other developments will add 177 trips during the AM peak hour and 232 trips in the PM peak hour at full build-out and occupancy.
- The addition of the projected trips by all the proposed residential developments is anticipated to increase traffic delays at the studied intersection of North Campbell Station Road at Fretz Road. These expected increased vehicle delays in traffic operations resulted in recommended modifications to the intersection.

- The addition of the projected residential development trips is not anticipated to significantly reduce traffic operations on Fretz Road and Hatmaker Lane. The roadway capacity of Hatmaker Lane and Fretz Road is more than adequate to handle the additional traffic that will be generated by the residential developments. However, improvements are recommended for Fretz Road and Hatmaker Lane to improve road safety.

**Recommendations:**

The following recommendations are offered based on the study analyses. The recommendations marked with an asterisk indicates an existing need:

- Assuming the other three non-related residential developments are fully constructed and occupied on Fretz Road and Hatmaker Lane before the Hatmaker Lane Subdivision, it is recommended that a left-turn lane with 75 feet of vehicle storage be constructed for the Fretz Road approach at North Campbell Station Road. It is estimated that this turn lane will be needed by the time the 72<sup>nd</sup> house is constructed and occupied in the Hatmaker Lane Subdivision. This intersection is under the Town of Farragut jurisdiction; thus, the Town will control when and how the separate left-turn lane on Fretz Road should be installed.
- As listed in the previous traffic impact studies for Windsor Forest Subdivision and Towering Oaks Subdivision (formerly October Park), it is recommended that a northbound left-turn lane be constructed on North Campbell Station Road at the intersection with Fretz Road. The previous studies recommended a 75-foot left-turn lane. Based on the results of this study with the additional traffic generated, this left-turn lane is recommended to have 100 feet of vehicle storage. As stated in the previous studies, this northbound left-turn lane was recommended to be installed once the Windsor Forest Subdivision has 47 houses or the Towering Oaks Subdivision has 46 houses that are constructed and occupied. Based on the current state of these two other developments, the Windsor Forest Subdivision is expected to reach its threshold first.
- It is recommended that the left-turn lane on North Campbell Station Road and the left-turn lane on Fretz Road be constructed concurrently to potentially save on construction costs and delays.
- \* • The previous traffic impact studies recommended widening any existing pavement on Fretz Road and Hatmaker Lane that does not meet a minimum of 20 feet up to their respective proposed entrances. To provide continuity of this road

width, it is recommended that this minimum width standard of 20 feet be continued past the Towering Oaks Subdivision entrance to the end of Hatmaker Lane up to the new Hatmaker Lane Subdivision. Based on the road width measurements taken during the field review past the proposed location of the Towering Oaks Subdivision entrance, Hatmaker Lane already has a road width of 20 feet or greater except for about +/-250 feet. These reduced widths are just past the intersection of Hatmaker Lane at Hopper Lane. There may be other locations

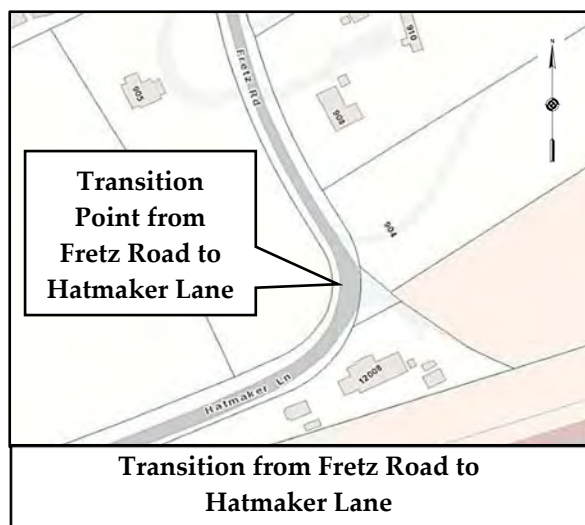
- \* on Hatmaker Lane in between where the measurements were made that are less than 20 feet, but the vast majority already meets this minimum.
- There is an existing need to improve safety on Hatmaker Lane. As recommended in the previous study for the Towering Oaks Subdivision, further evaluation should be made to determine the appropriate means and locations to install traffic signage, guardrails, and/or pavement markings along Hatmaker Lane due to several steep drop-offs and roadside hazards on the sides of Hatmaker Lane.
- \* • The intersection sight distance from Hopper Lane at Hatmaker Lane will need to be improved. Vegetation needs to be removed and will need to be maintained in the future. Vegetation around the Stop Sign (R1-1) for the Hopper Lane approach needs to be removed and maintained.
- \* • It is recommended that the Turn Sign (W1-1R) to the north of the 90° horizontal curve at the transition between Fretz Road and Hatmaker Lane be replaced and the vegetation be removed and maintained. This sign is damaged and obscured by vegetation.
- \* • It is recommended that a Turn Sign (W1-1L) be installed for motorists traveling east on Hatmaker Lane prior to the 90° horizontal curve at the transition between Fretz Road and Hatmaker Lane.
- \* • Once all areas of Fretz Road and Hatmaker Lane are widened to 20 feet, it is recommended that the County consider striping the centerline with double yellow lines and applying white edge lines.
- \* • It is recommended that the large expanse of pavement at the 90° horizontal curve be delineated. This delineation is recommended to be a white edge line or other appropriate means directed by Knox County Engineering.
- It is recommended that a 25-mph speed limit sign be posted on Road “A” and a No Outlet Sign (W14-2) for vehicles traveling into the new residential subdivision.
- Stop Signs (R1-1) and white stop bars should be installed internally on the new streets as shown in the report.

- Sight distance at the new intersections in the Hatmaker Lane Subdivision must not be impacted by new signage or future landscaping. For a posted speed limit of 25-mph, the intersection sight distance requirement is 250 feet. The stopping sight distance required is 155 feet for a level road grade. The road layout designer should ensure that these sight distance lengths are met, and they should be labeled on the plans.
- All drainage grates and covers for the residential development need to be pedestrian and bicycle safe.
- Sidewalks are not shown on the concept plan. If the development does install internal sidewalks, they should have appropriate ADA compliant curbed ramps at intersection corners and the sidewalks are recommended to be 5 feet minimum in width.
- The United States Postal Service (USPS) has recently implemented changes to its guidelines for delivery in new residential subdivisions. If directed by the local post office, the designer should include an area within the development with a parking area for a centralized mail delivery center.
- All road grade and intersection elements internally and externally should be designed to AASHTO, TDOT, and Knox County specifications and guidelines to ensure proper operation.

## DESCRIPTION OF EXISTING CONDITIONS

### ■ STUDY AREA:

The proposed location of this new residential development is shown on a map in Figure 1. This proposed development will be located at the end of Hatmaker Lane in West Knox County, TN. Hatmaker Lane currently ends abruptly at a dead end. The development will be located just to the east of Everett Road and immediately to the north of Interstate 40/75. Subdivision road access will be limited to Hatmaker Lane and vehicle access will not be provided to Everett Road to the



west. Hatmaker Lane transitions to Fretz Road at a sharp horizontal curve approximately 2,350 to the south of the intersection of North Campbell Station Road at Fretz Road. The subdivision will be comprised of three new paved streets (with one of them being an extension of Hatmaker Lane) and will contain a maximum of 153 single-family detached residential houses on approximately 69.7 acres. All vehicle traffic to and from the proposed subdivision will travel through the intersection of North Campbell Station Road at Fretz Road.

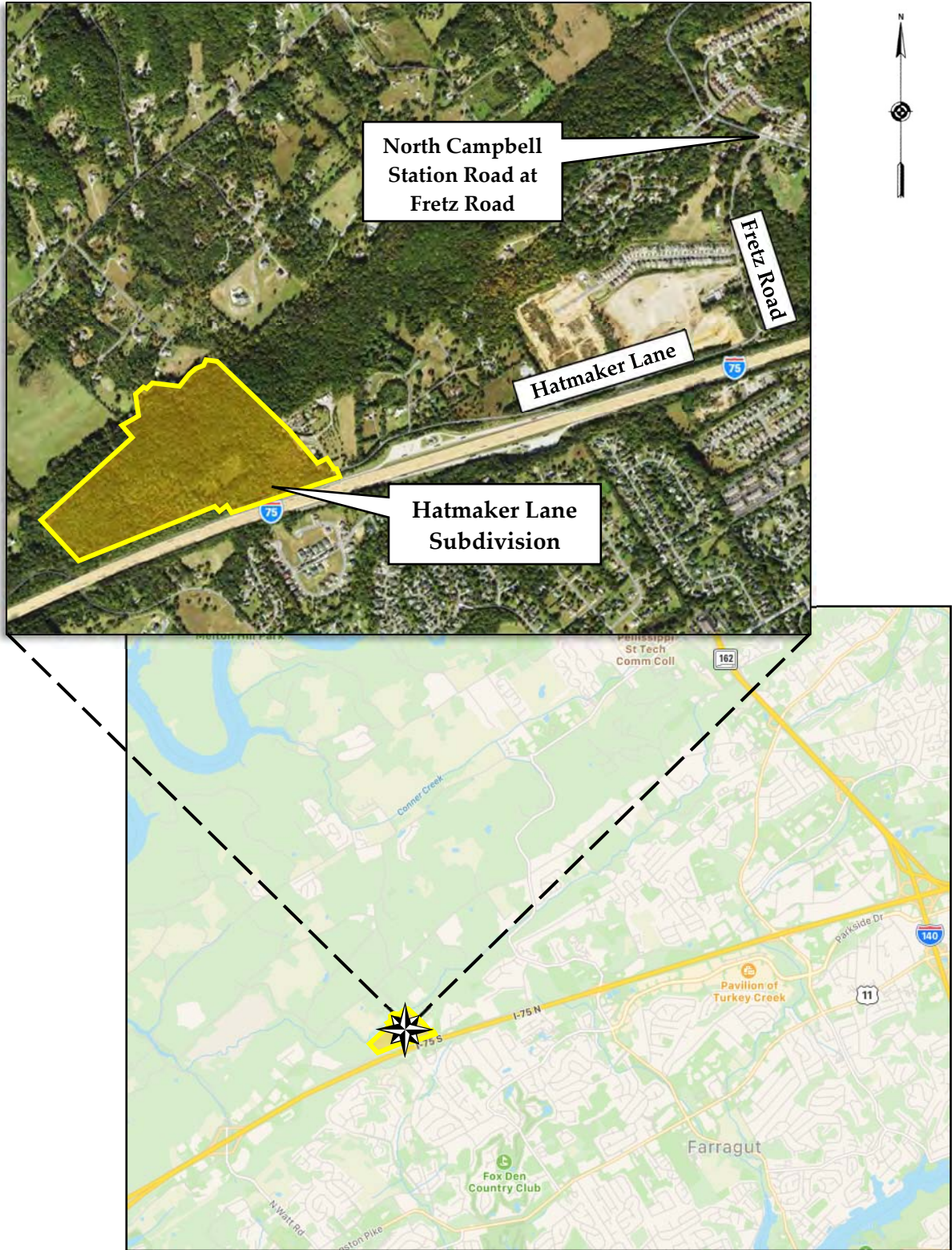
In the study area, there are several other existing residential subdivisions, residential subdivisions under construction, individual residences, and undeveloped properties. Besides two small buildings near the end of Hatmaker Lane, the proposed development property is currently unoccupied and consists almost completely of woodlands.

The site property for the Hatmaker Lane Subdivision is bounded by single-family homes and undeveloped properties to the east, Interstate 40/75 to the south, undeveloped property with a few single-family homes and Hickory Creek to the north, and Everett Road and a single residence to the west.



**Existing Development Site**





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

■ **EXISTING ROADWAYS:**

Table 1 provides the characteristics of the key existing roadways adjacent to the development property and included in the study:

**TABLE 1  
STUDY CORRIDOR CHARACTERISTICS**

NAME	CLASSIFICATION <sup>1</sup>	SPEED LIMIT	LANES	ROAD WIDTH <sup>2</sup>	TRANSIT <sup>3</sup>	PEDESTRIAN FACILITIES	BICYCLE FACILITIES
North Campbell Station Road	Minor Arterial	35 mph	2 undivided	22 feet	None	No sidewalks along roadway	No bike lanes
Fretz Road	Local Street	30 mph	2 undivided	14-24 feet	None	350' sidewalk on west side at North Campbell Station Road	No bike lanes
Hatmaker Lane	Local Street	30 mph	2 undivided	18 - 21 feet	None	No sidewalks along roadway	No bike lanes

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

<sup>2</sup> Edge of curb to edge of curb or edge of pavements near project site

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

**North Campbell Station Road** is classified as a Minor Arterial and traverses in a general north-south direction but makes several turns in direction during its length. On its south side, North Campbell Station Road begins at the signalized intersection of Kingston Pike (US 11/US 70/SR 1) in the Town of Farragut and on its north side, the road terminates at the intersection with Hardin Valley Road for a total length of 4.8 miles. North Campbell Station Road provides access to Interstate 40/75 at Exit 373. This Interstate access is



**North Campbell Station Road –  
NB Vehicle Turning Left at Fretz Road**

1 mile to the southeast of the intersection of North Campbell Station Road at Fretz Road. North Campbell Station Road at the intersection of Fretz Road currently consists of a 2-lane pavement section approximately 22 feet wide. One utility pole streetlight is provided on North Campbell Station Road at Fretz Road. At this intersection, Fretz Road traffic is controlled by a Stop Sign (R1-1) and traffic on North Campbell Station Road operates freely.



**Fretz Road** is a local street and traverses in a general north-south direction for approximately 2,350 feet before it transitions into Hatmaker Lane at a sharp horizontal curve. Fretz Road provides access to a few individual residences, one existing residential single-family subdivision (Brandywine at Turkey Creek), and two residential single-family subdivisions that are under construction (Campbell Crossing and Windsor Forest).



**View of Pavement Widening of Fretz Road at New Intersection – Lillibridge Crossing Lane (Looking North)**

Fretz Road consists of 12-foot lanes with curb and gutter, a 5-foot sidewalk on the west side, and an 8-foot paved walking trail on the east side for approximately 375 feet to the south of North Campbell Station Road. Past the curb and gutter road section, the roadway transitions to a standard road section with 10-foot lanes. For most of its length, Fretz Road has an adequate pavement width. However, prior to the sharp horizontal curve on its south side, Fretz Road has a substandard pavement width. The substandard pavement widths in this section are around 14 - 16 feet for approximately 400 feet. This substandard width was longer than 400 feet, but Fretz Road was recently widened for approximately 250 feet around the entrance for the new Windsor Forest residential subdivision at Lillibridge Crossing Lane.

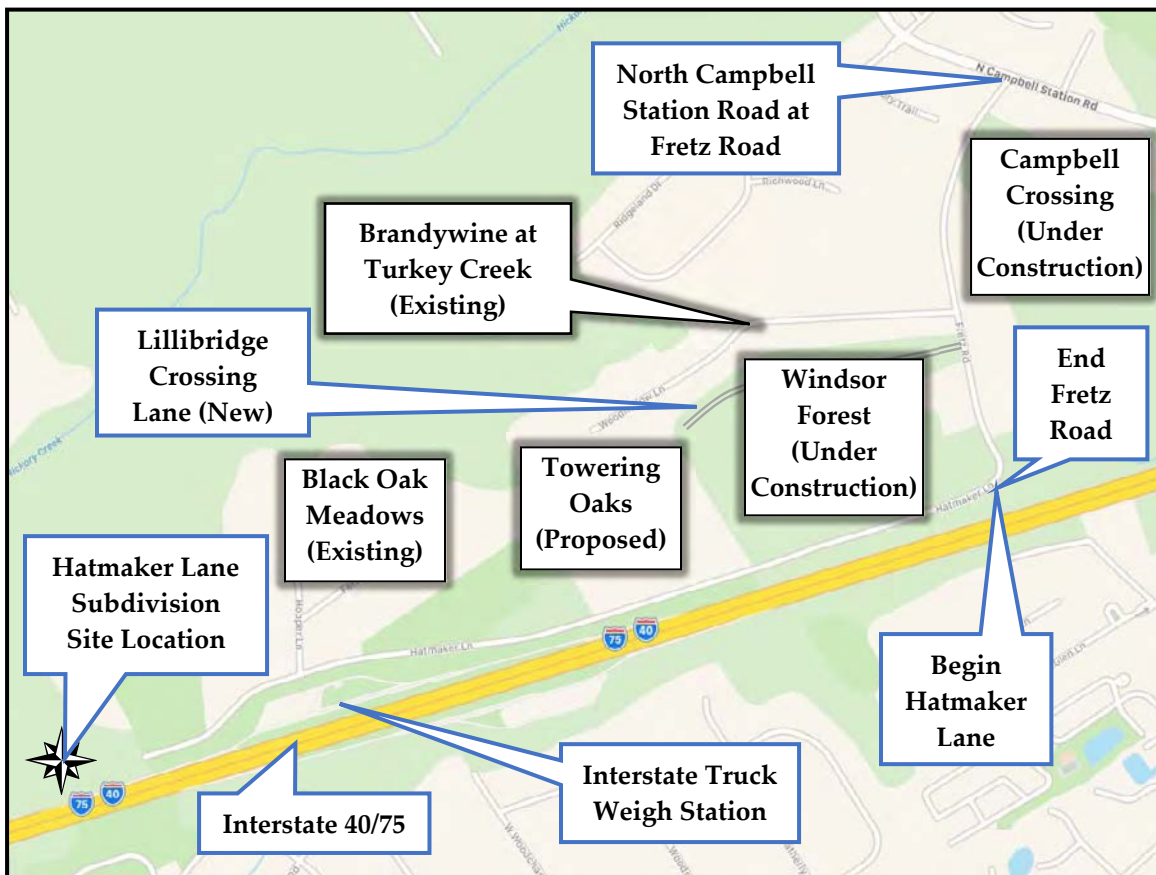


**View of Hatmaker Lane and Fretz Road (Highlighted)**

**Hatmaker Lane** is a local street and continues the roadway past the end of Fretz Road at the sharp horizontal curve. One older established residential subdivision (Black Oak Meadows) exists towards the end of Hatmaker Lane and there are a handful of other single-family homes on the north side of Hatmaker Lane. The proposed Towering Oaks Subdivision will be located midway on Hatmaker Lane and development has resumed after several past unsuccessful

attempts to develop the property. The total length of Hatmaker Lane is just under 1 mile in length and the road roughly parallels Interstate 40/75 on the north side of the Interstate. Hatmaker Lane is straight but the path of Hatmaker Lane shifts towards the north where the westbound/southbound Interstate Truck Weigh Station is located.

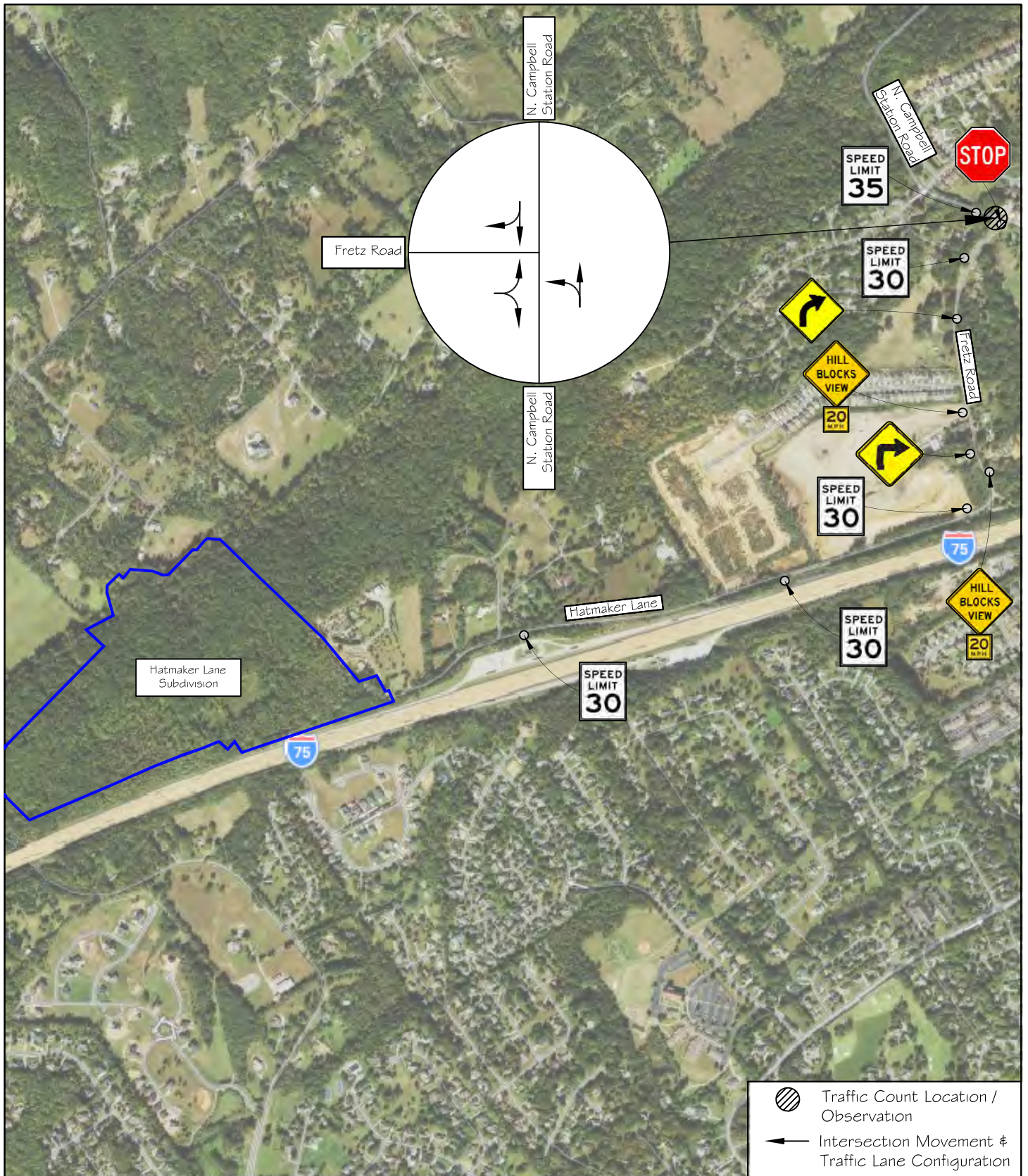
Refer to Figure 2 below for clarification of the current existing road system and residential developments on Fretz Road and Hatmaker Lane.



**Figure 2**  
**Existing Roadways and Adjacent Residential Developments**

Figure 3 on the following page shows the lane configurations at the intersection of North Campbell Station Road at Fretz Road, traffic signage in the study area, and the location where the traffic count was conducted. The pages following Figure 3 provide an overview of the site study area with photographs.





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NOT TO SCALE



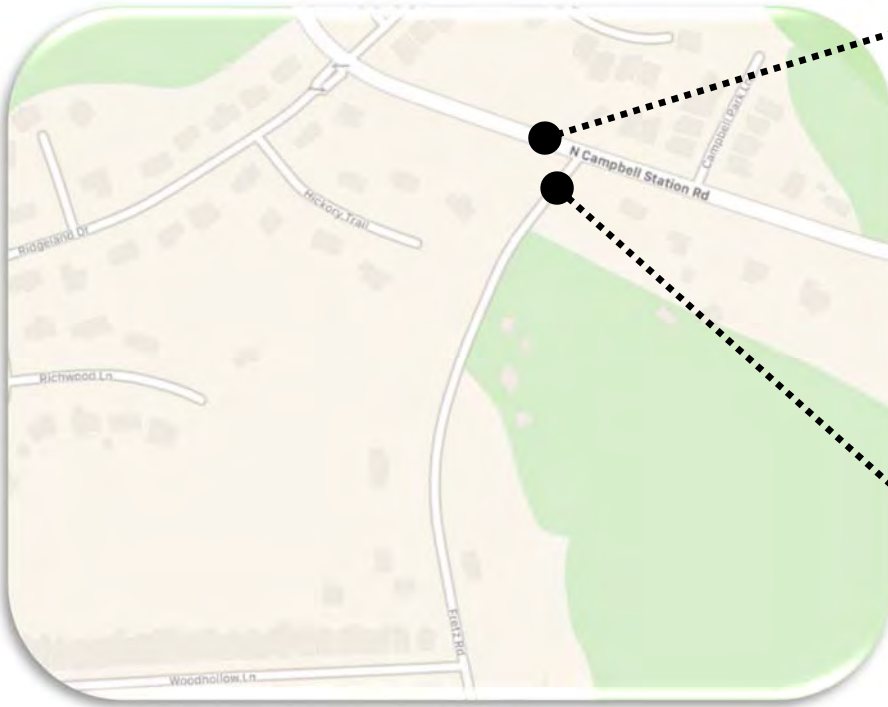
FIGURE 3

Hatmaker Lane Subdivision

Traffic Count Location, Traffic Signage & Existing Lane Configurations



PHOTO EXHIBITS



**North Campbell Station Road at Fretz Road**

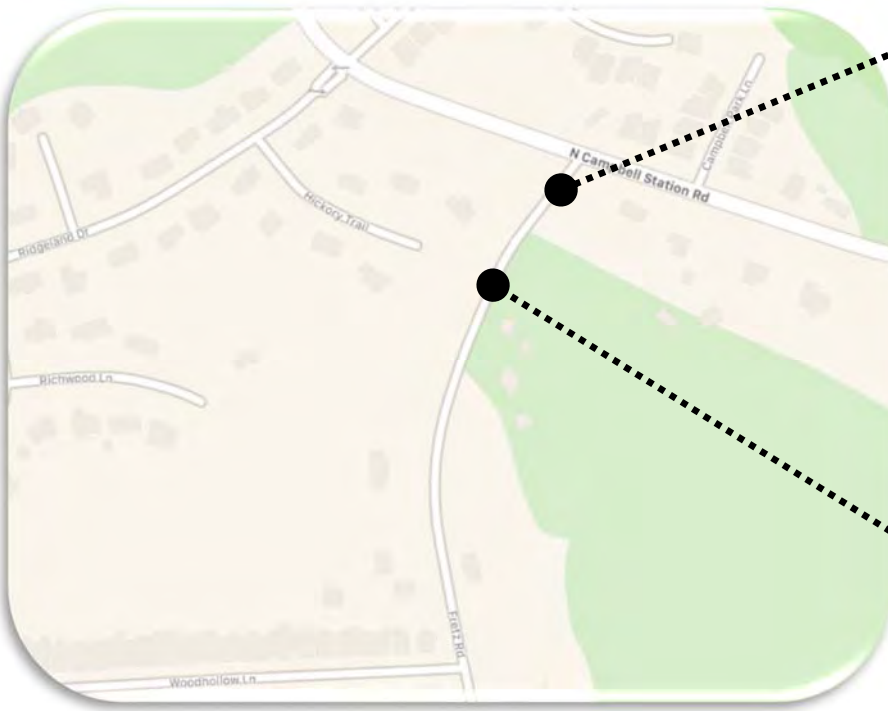


**View of North Campbell Station Road at Fretz Road (Looking Southeast)**



**View of Fretz Road at North Campbell Station Road (Looking Northeast)**





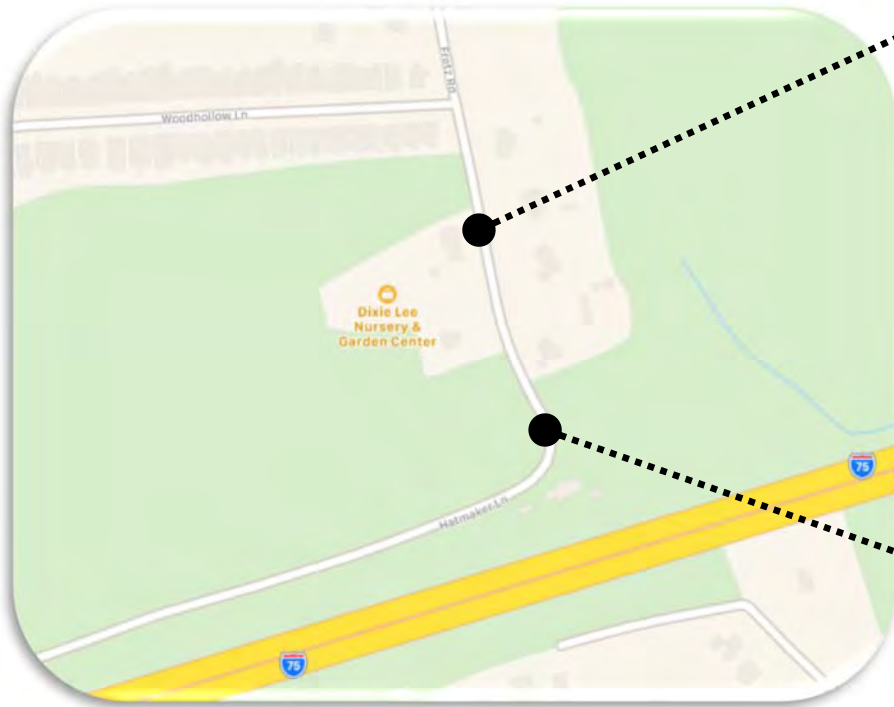
North Campbell Station Road at Fretz Road



View of North Campbell Station Road at Fretz Road (Looking North)



View of End of Curb and Gutter Road Section on Fretz Road (Looking South)



**Fretz Road / Hatmaker Lane Transition Area**

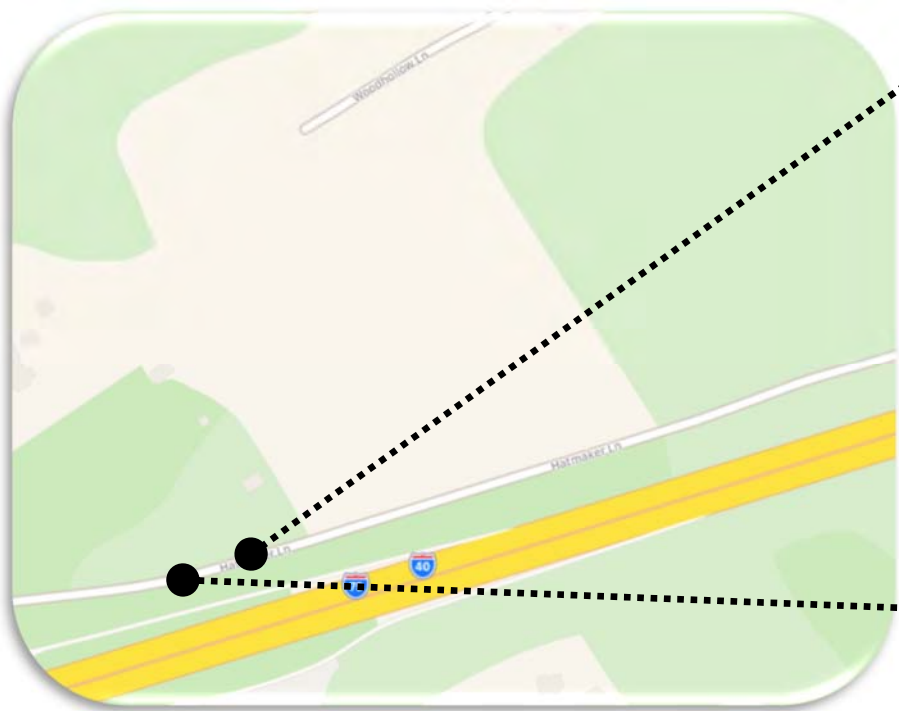


**View of Fretz Road at Substandard Road Width Section (Looking South)**



**View of Fretz Road / Hatmaker Lane Transition Area at Sharp Horizontal Curve (Looking South)**

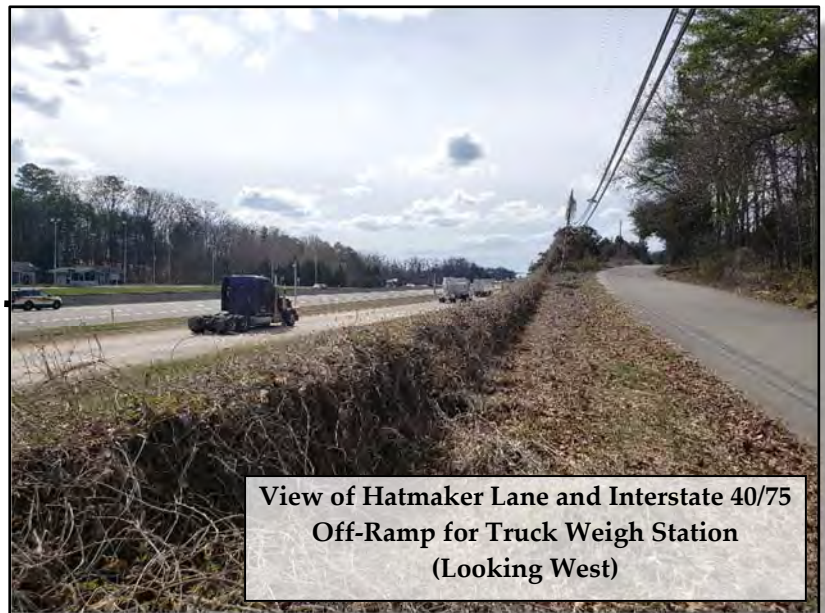




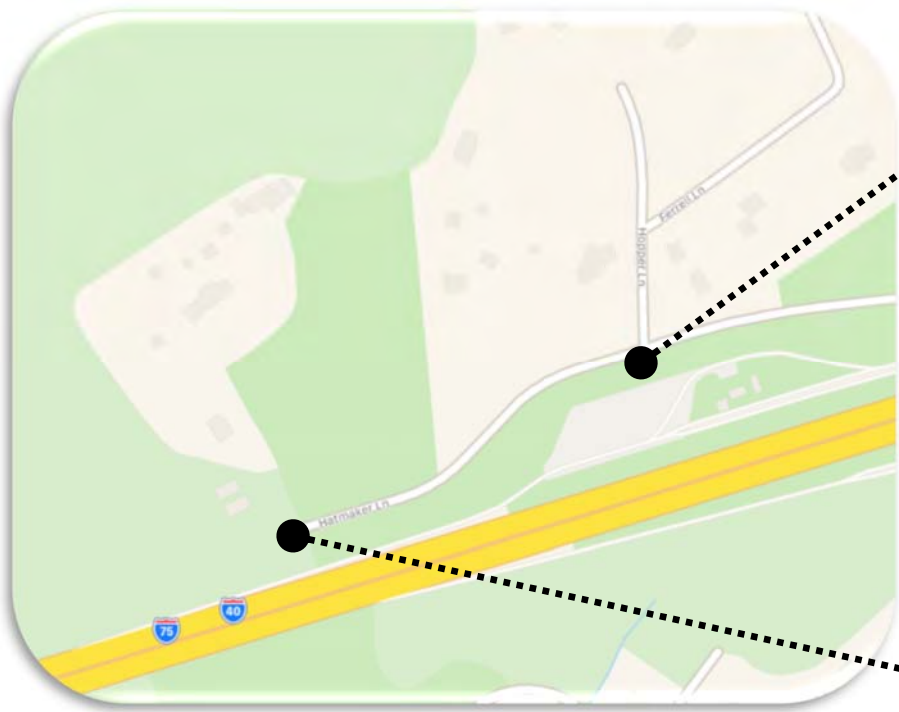
Hatmaker Lane



View of Hatmaker Lane and Interstate 40/75  
Off-Ramp for Truck Weigh Station  
(Looking East)



View of Hatmaker Lane and Interstate 40/75  
Off-Ramp for Truck Weigh Station  
(Looking West)



**End of Hatmaker Lane**



**View of Hatmaker Lane at Hopper Lane (Private) (Looking North)**



**View of End at Hatmaker Lane and Development Property (Looking West)**



■ **EXISTING TRANSPORTATION VOLUMES PER MODE:**

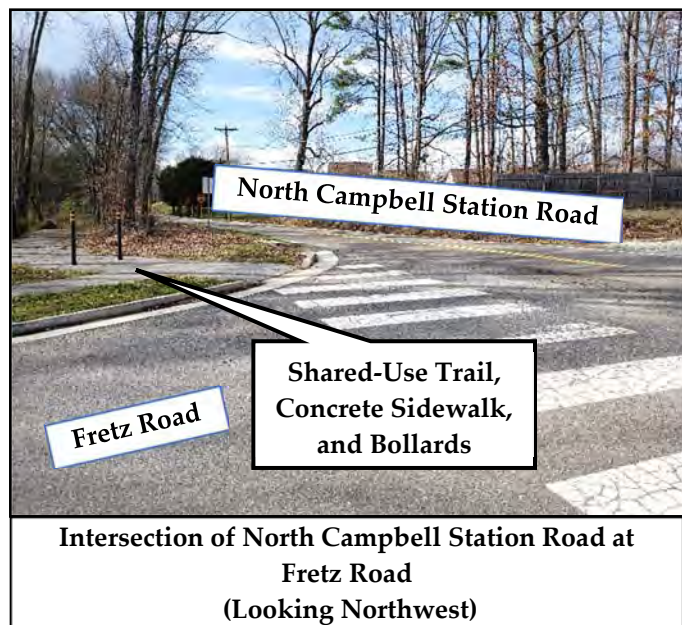
There is one permanent vehicular traffic count location nearby to this project site. Counts at this location are conducted by the Tennessee Department of Transportation (TDOT) every year. The count location data is the following:

- Average Daily Traffic (ADT) on North Campbell Station Road to the north of the intersection of Fretz Road was reported by the TDOT at 5,593 vehicles per day in 2018. From 2008 – 2018, this count station has indicated a +3.8% average annual growth rate. The historical traffic count data for this location can be viewed in Appendix A.

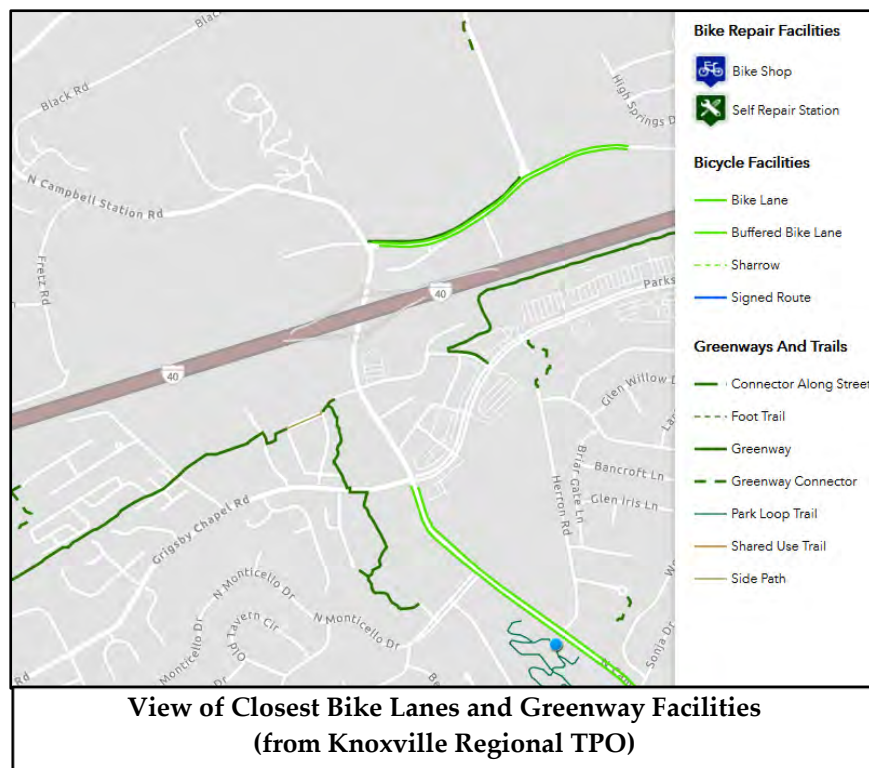
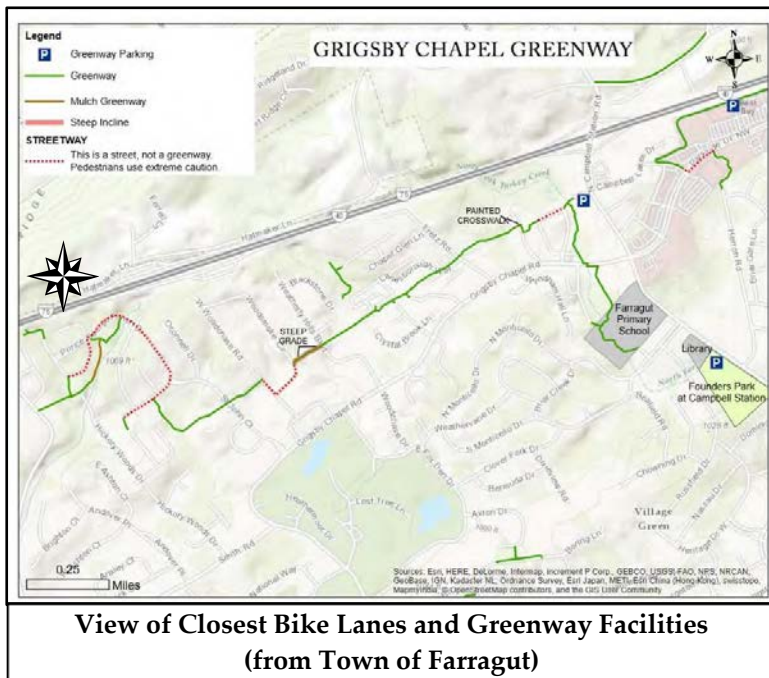
The average daily pedestrian and bicycle traffic along the study corridor is not known. No bicyclists were observed riding along North Campbell Station Road or Fretz Road during the traffic counts. However, one person was observed jogging on Fretz Road up to North Campbell Station Road and then back down Fretz Road.

■ **PEDESTRIAN AND BICYCLE FACILITIES:**

A 5-foot concrete sidewalk is available for a short distance (350') on Fretz Road on the west side of the road at the intersection of North Campbell Station Road. Also, a short section of an 8-foot asphalt paved shared-use trail is constructed roughly parallel on the east side of Fretz Road. A painted white crosswalk is marked on Fretz Road that connects the shared-use trail and the concrete sidewalk on the other side. Bollards are installed at the entrances to the shared-use trail on both sides of Fretz Road to deter motorized vehicles. On the west side of the intersection, the shared-use trail continues for a short distance on North Campbell Station Road but abruptly ends.

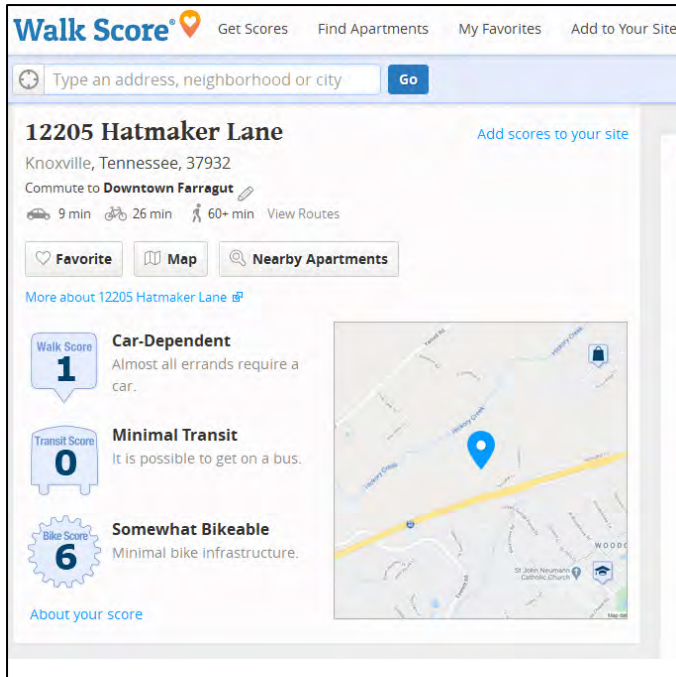


Designated bicycle facilities (lanes) and greenways are not currently available near the project site study area along Hatmaker Lane, Fretz Road, or North Campbell Station Road. Most of the bicycle facilities and greenways in the area are located on the other side of the Interstate and further south on North Campbell Station Road. These greenways include the Grigsby Chapel Greenway and the Parkside Greenway. The closest bike lane and greenway is located approximately 2.1 miles away by roadway on Snyder Road off North Campbell Station Road. The greenway on Snyder Road exists on the north side of the road in between North Campbell Station Road and Outlet Drive. The bike lanes on Snyder Road start at North Campbell Station Road and end past the intersection with Outlet Drive.





■ **WALK SCORE:**



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

Appendix B shows maps and other information for the Walk Score, Bike Score, and Transit Score at the end of Hatmaker Lane (12205 Hatmaker Lane). Based on the project location, the location is given a Walk Score of 1. This Walk Score indicates that the site is completely dependent on vehicles for errands and travel. The site is given a Bike Score of 6, which means that there is minimal bike infrastructure but is somewhat bikeable. Also, based on the project location, the site is given a Transit Score of 0 due to no existing nearby public transportation options.

■ **TRANSIT SERVICES:**

The City of Knoxville has a network of public transit opportunities offered by Knoxville Area Transit (KAT). Bus service is not available in this area of Knox County. The overall KAT bus system map is in Appendix C. The closest public transit bus service is 8 miles away to the east (by roadway) at Parkwest Medical Center. This KAT service is Route 16 “Cedar Bluff Connector”. It operates on weekdays and Saturdays and this route map is also included in Appendix C. Other transit services include the East Tennessee Human Resource Agency (ETHRA) and the Community Action Committee (CAC) which provides transportation services when requested along with private taxis, and ride-sharing opportunities (Uber, etc.).

Knox County school buses were observed traveling along North Campbell Station Road, Fretz Road, and Hatmaker Lane during the traffic counts and field observations. One school bus stop was observed just to the southeast of the intersection of North Campbell Station Road and Fretz Road during the AM and PM traffic counts. A school bus was observed traveling towards the end of Hatmaker Lane for the existing Black Oak Meadows Subdivision. It is assumed that future school buses will also serve schoolchildren in the Hatmaker Lane Subdivision.

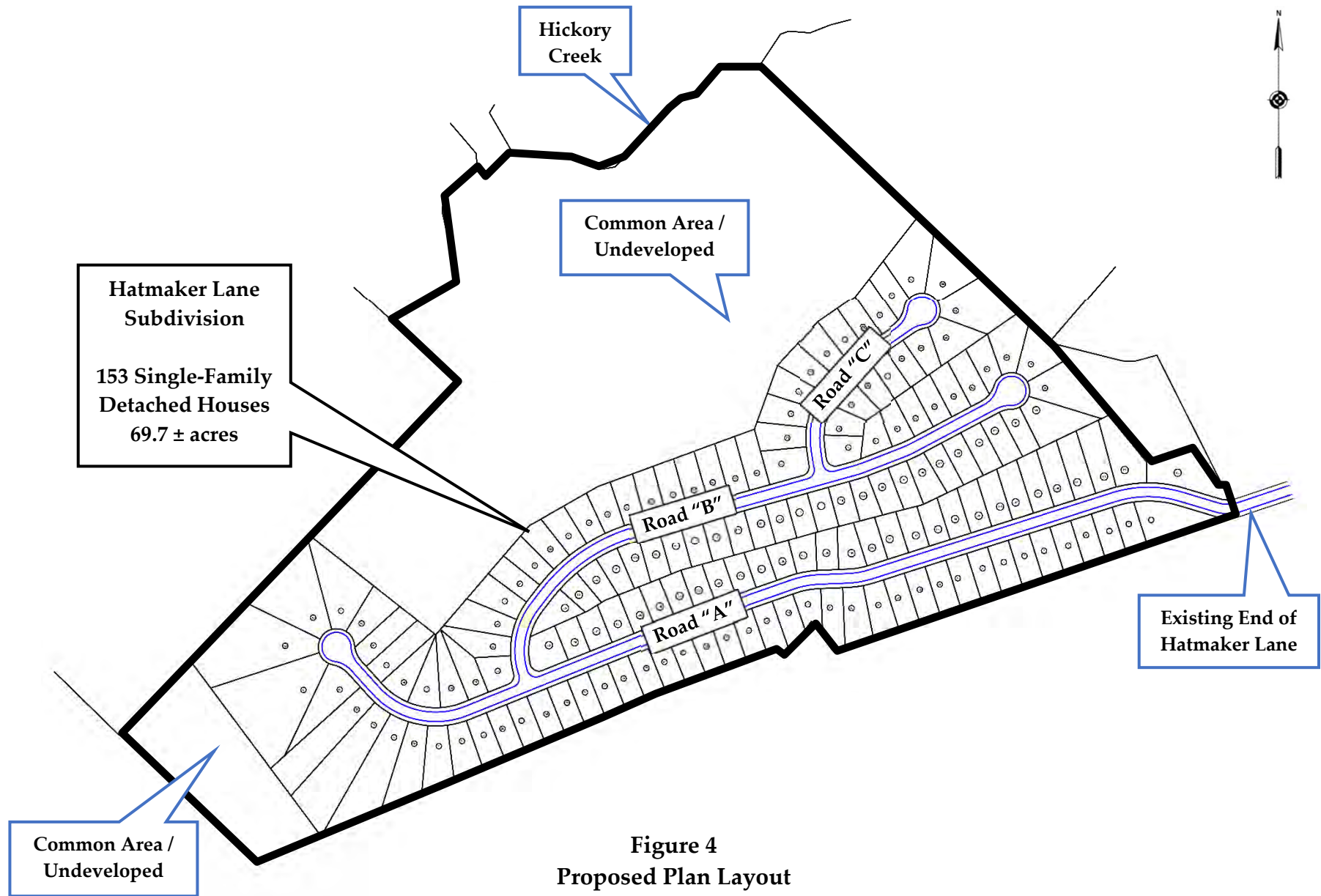
## PROJECT DESCRIPTION

### ■ LOCATION AND SITE PLAN:

The proposed plan layout given by Southland Engineering Consultants, LLC is shown in Figure 4. As can be seen in the figure, three new streets will be constructed and all of them will terminate at cul-de-sacs. The main street, Road "A", in the subdivision will be an extension of Hatmaker Lane and this extension will be approximately 2,815 feet. The other two streets together will be just over 2,275 feet in total length. The residential development will incorporate a portion of the total 69.7 acres with large amounts of open space/common areas. The Hatmaker Lane Subdivision will contain 153 single-family detached lots. The size of the single-family detached lots will average approximately 7,500 square feet (.17 acre) to 10,000 square feet (.23 acre) in size with a handful of lots near 1 acre. Each home will have a garage and driveway.

The existing site is currently unoccupied and nearly completely wooded. Two buildings are located on the property next to the end of Hatmaker Lane and will be removed during the construction of the subdivision. On the north side of the development property, the ground sharply descends to Hickory Creek with slopes greater than 30%. The steep slopes on the north side of the property will remain undeveloped.

The schedule for completion of this new residential development is dependent on economic factors and construction timelines. This project is also contingent on permitting, design, and other issues. However, after consultation with the developer, for this study, it was assumed that the total construction build-out of the development and full occupancy will occur within the next 6 years (2026). The other three residential subdivisions in various stages of development along Fretz Road and Hatmaker Lane are expected to be completed and occupied before this subdivision.



**Figure 4**  
**Proposed Plan Layout**  
**Hatmaker Lane Subdivision**

■ **PROPOSED USES AND ZONING REQUIREMENTS:**

The property for the proposed development is within the Knox County limits (and just outside the Town of Farragut) and is zoned as Planned Residential (PR) with a density of <3 units per acre. The development property currently exists of three separate parcels. The current zoning map is provided in Appendix D. The existing adjacent surrounding land uses are the following:

- The development property is bounded by Interstate 40/75 to the south. All the properties on the other side of the Interstate are within the Town of Farragut and consists of residential homes.
- All the properties to the west and north of the proposed development are zoned as Agricultural (A) and they currently consist of several single-family residences, farm properties, and undeveloped properties. On the north side, the floodplain of Hickory Creek is zoned as Floodway (F). This zone provides protection from the 500-year frequency flood.
- To the northeast of the development property, a single property is zoned as Planned Residential (PR) with a density of 1-1.8 units per acre. This property is completely wooded and undeveloped.
- To the east, a single property is zoned as Agricultural (A) and consists of a single-family residence with several outbuildings. This property is currently the last residence located at the end of Hatmaker Lane.

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

■ **DEVELOPMENT DENSITY:**

The proposed density for the Hatmaker Lane Subdivision is based on a maximum of 153 houses on 69.7 acres. These numbers compute to 2.20 dwelling units per acre which is less than the current zoning that allows up to 3 units per acre.

■ **ON-SITE CIRCULATION:**

The total length of the three new streets within the development will be just over 5,150 feet (0.98 miles) in length and will be designed and constructed to Knox County, TN specifications. The new streets shown in Figure 4 are labeled Road “A”, “B”, and “C”. The internal roadways for the development will be paved with asphalt, include 8” extruded concrete curbs, and the lane widths will be 13 feet for a total of 26-foot pavement width. The street right-of-way within the development will be 50 feet. Based on the typical section show on the concept plan, concrete sidewalks are not being proposed. After construction, the streets will be maintained by Knox County.

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

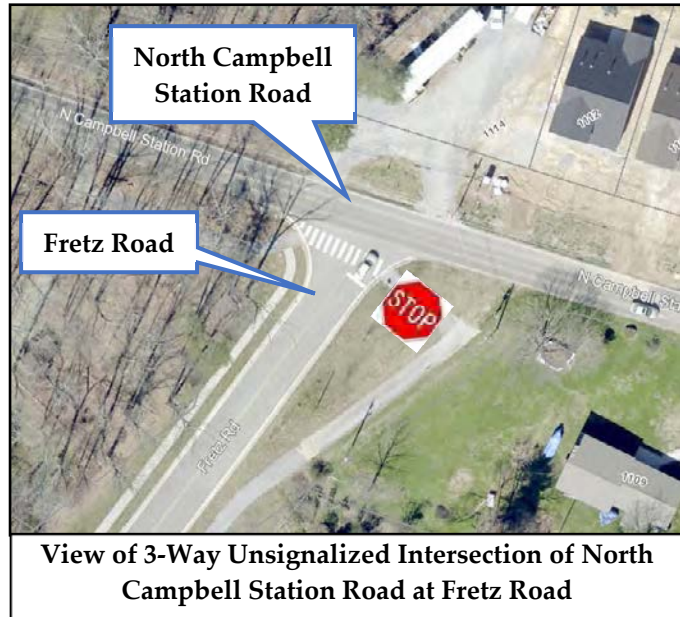
Besides residential passenger vehicles, the new streets will also provide access for service, delivery, maintenance, and fire protection/rescue vehicles. It is not expected that any of these other types of vehicles will impact roadway operations other than when they occasionally enter and exit the development. It is expected that curbside garbage collection services will be available for this residential subdivision. Concerning fire protection and rescue vehicles, the new roads will be designed and constructed to Knox County specifications and thus expected to be adequate in size. The internal roadways in the subdivision are expected to be able to accommodate these larger types of vehicles along with standard passenger vehicles.



## TRAFFIC ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

### ■ EXISTING TRAFFIC CONDITIONS:

Traffic counts were conducted at the intersection of North Campbell Station Road at Fretz Road as requested by Tarren Barrett, PE, Transportation Engineer for Knoxville/Knox County Planning. Traffic counts were obtained on Wednesday, March 4th, 2020, for a total of 5 hours at the intersection. The counts were conducted during the morning and afternoon peak periods from 7 – 9 AM and 3 – 6 PM. Local schools were in session when the traffic counts were conducted. The traffic counts were also conducted

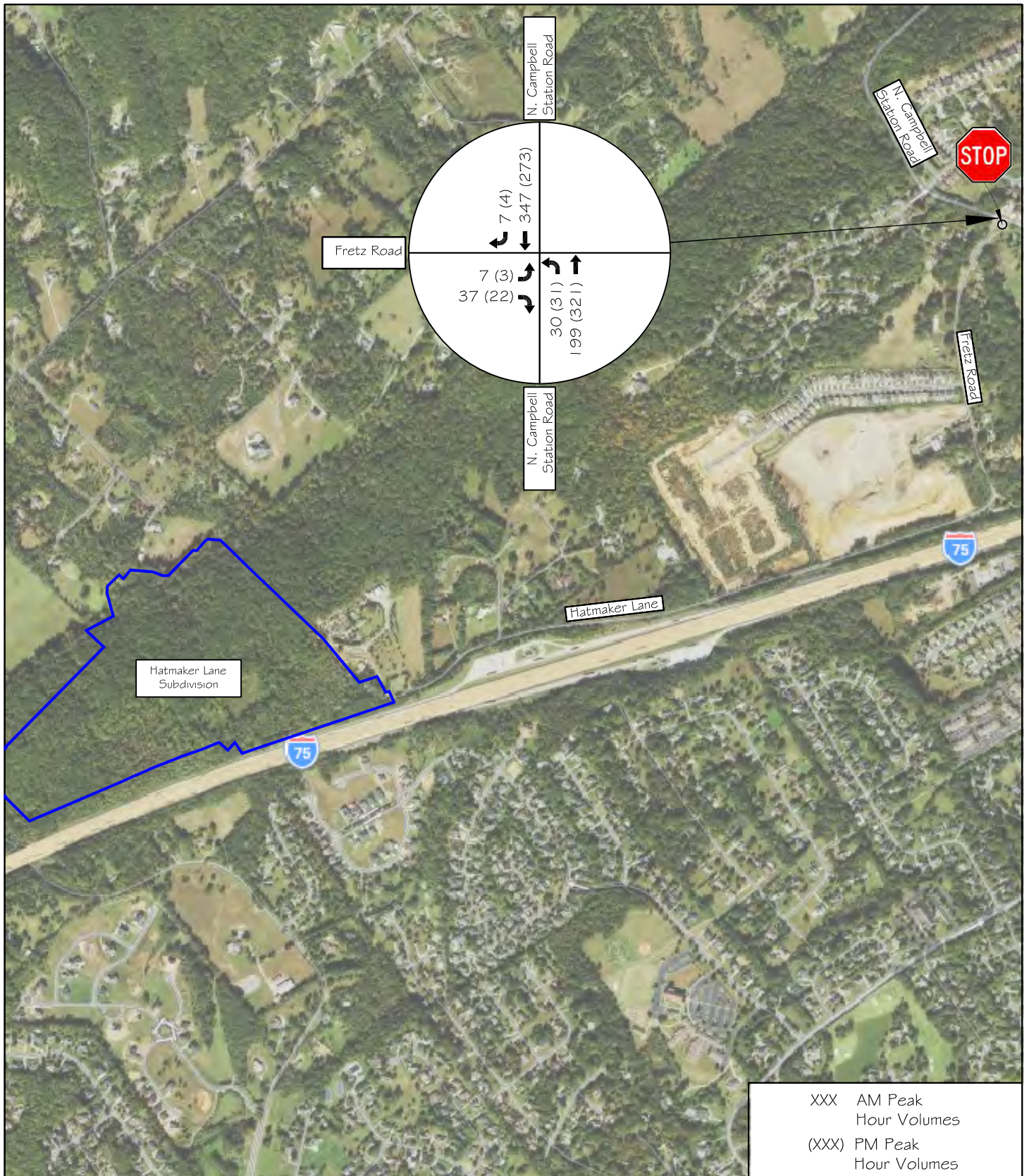


before the announcement of the national emergency (coronavirus). Based on the traffic volumes counted, the AM and PM peak hour of traffic were observed at the following times:

- North Campbell Station Road at Fretz Road  
7:15 – 8:15 AM / 5:00 – 6:00 PM

The manual tabulated traffic counts can be reviewed in Appendix E. In Figure 5, the volumes shown are from the existing traffic counts during the AM and PM peak hours observed at the intersection. Several school buses were observed during the traffic counts. Most of the traffic observed during the traffic counts were typical passenger vehicles but there was a fair amount of large construction vehicles observed that is associated with the nearby home construction activity.





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FIGURE 5

Hatmaker Lane Subdivision

2020 Peak Hour Traffic Volumes -  
 EXISTING TRAFFIC CONDITIONS

Capacity analyses were undertaken to determine the existing Level of Service (LOS) for the intersection of North Campbell Station Road at Fretz Road for vehicular traffic. The capacity analyses were calculated by following the methods outlined in the Highway Capacity Manual (HCM) and using Synchro Traffic Software (Version 8).

Methodology:

LOS is a qualitative measurement developed by the transportation profession to express how well an intersection or roadway performs based on a driver's perception. LOS designations include LOS A through LOS F. The designation of LOS A signifies a roadway or intersection operating at best, while LOS F signifies road operations at worst. This grading system provides a reliable straightforward means to communicate road operations to the public. The HCM lists level of service criteria for unsignalized intersections and signalized intersections.



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

For unsignalized intersections, LOS is measured in terms of delay (in seconds). This measure is an attempt to quantify delay that includes travel time, driver discomfort, and fuel consumption. For unsignalized intersections, the analysis assumes that the mainline



thru and right-turn traffic does not stop and is not affected by the traffic on the minor side streets. Thus, the LOS for a two-way stop (or yield) controlled intersection is defined by the delay for each minor approach and major street left-turn movements. Table 2 lists the level of service criteria for unsignalized intersections. The analysis results of unsignalized intersections using the HCM methodologies are conservative due to the larger vehicle gap parameters used in the methodology. 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 larger 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.

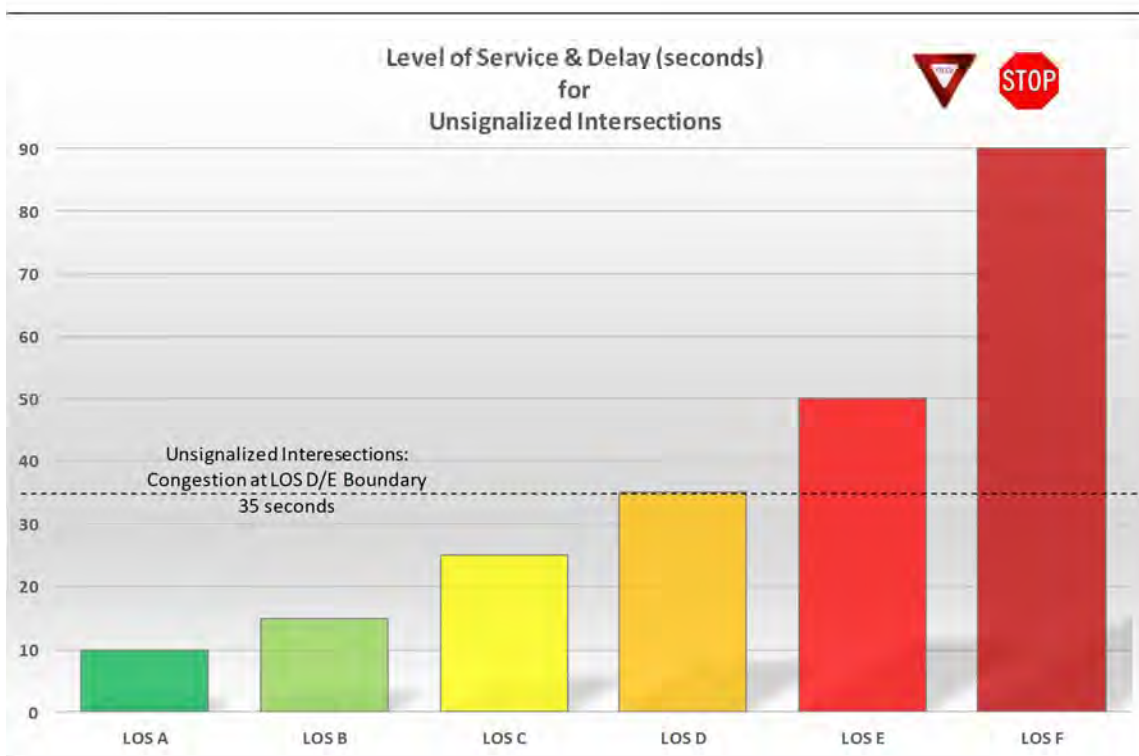
From the capacity calculations, the results from the existing peak hour vehicular traffic can be seen in Table 3 for the intersection. The intersection in the table is shown with a LOS designation, delay (in seconds), and v/c ratio (volume/capacity) for the AM and PM peak hours. Appendix F includes the worksheets from the capacity analyses for the existing peak hour vehicular traffic. As can be seen in Table 3, the studied intersection is shown to operate at good levels (low vehicle delays) during the existing AM and PM peak hours.

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



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

Source: Highway Capacity Manual, 6th Edition



**TABLE 3**  
**2020 INTERSECTION CAPACITY ANALYSIS RESULTS -**  
**N. CAMPBELL STATION ROAD AT FRETZ ROAD**  
**EXISTING TRAFFIC CONDITIONS**

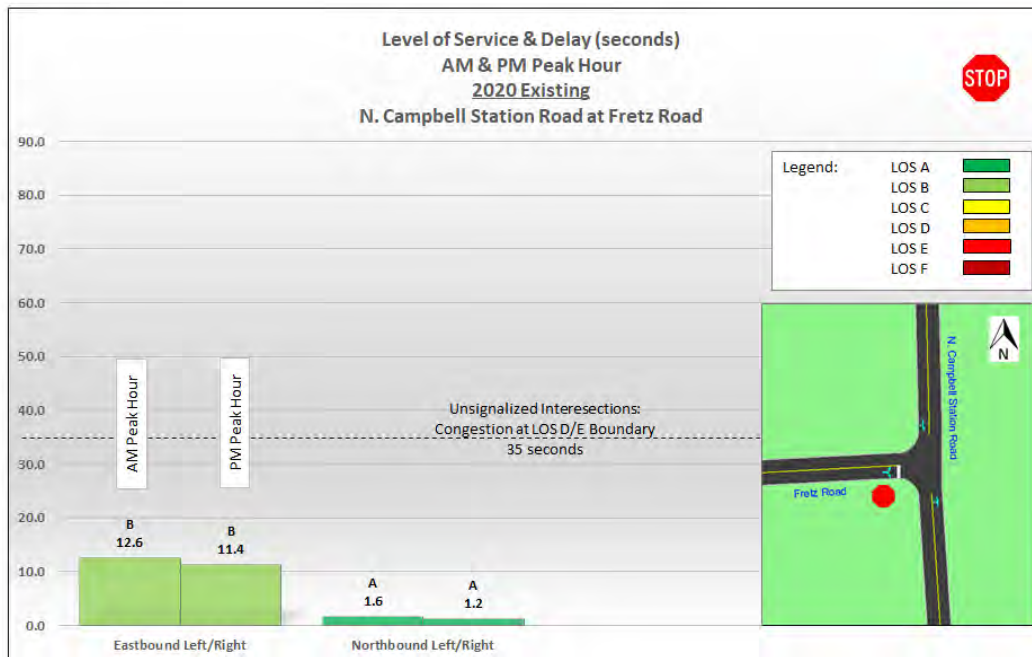
INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
N. Campbell Station Road at Fretz Road	 Unsignalized	Eastbound Left/Right	B	12.6	0.130	B	11.4	0.060
		Northbound Left/Right	A	1.6	0.040	A	1.2	0.040

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2000 intersection methodology

<sup>a</sup> Level of Service

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

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





■ **TRIP GENERATION:**

The estimated amount of traffic that will be generated by the proposed residential development was calculated based upon rates and equations for peak hour trips provided by Trip Generation Manual, 10th Edition, a publication of the Institute of Transportation Engineers (ITE). A generated trip is a single or one-direction vehicle movement that is either entering or exiting the study site. The Trip Generation Manual is the traditional and most popular resource for determining trip generation rates when traffic impact studies are produced. The Manual lists and includes data for a variety of land uses and correlates trips generated based on different variables such as dwelling units, square footage, etc. The data from ITE for the proposed land use is shown in Appendix G. A summary of this information is presented in the following table:

**TABLE 4**  
**TRIP GENERATION FOR HATMAKER LANE SUBDIVISION**  
**153 Single-Family Detached Houses**

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	153 Houses	1,538	25%	75%		63%	37%	
				28	86	114	96	57	153
Total New Volume Site Trips			1,538	28	86	114	96	57	153

ITE Trip Generation Manual, 10th Edition  
 Trips calculated by using Fitted Curve Equation

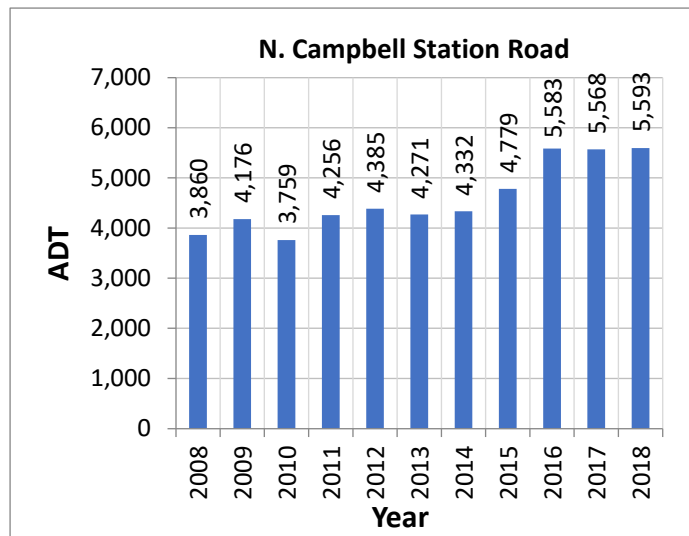
For Hatmaker Lane Subdivision, with a maximum of 153 single-family detached houses, it is estimated that 28 vehicles will enter and 86 will exit, for a total of 114 generated trips during the AM Peak Hour in the year 2026. Similarly, it is estimated that 96 vehicles will enter and 57 will exit, for a total of 153 generated trips during the PM Peak Hour in the year 2026. The calculated trips generated for an average weekday could be expected to be approximately 1,538 vehicles for the proposed development in the year 2026. No trip reductions were included in the analysis.

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

Opening year traffic volume estimates represent the future condition the proposed study area is potentially subject to even without the proposed project being developed (no-build option). As previously stated, the build-out and full occupancy for this proposed new residential development is assumed to occur in the year 2026. This corresponds to six years for the development to reach full capacity and occupancy.

Average Daily Traffic (ADT) on North Campbell Station Road was reported by the TDOT at 5,593 vehicles per day in 2018 (historical traffic data is shown in Appendix A). From 2008 – 2018, this count station has indicated a +3.8% average annual growth rate.

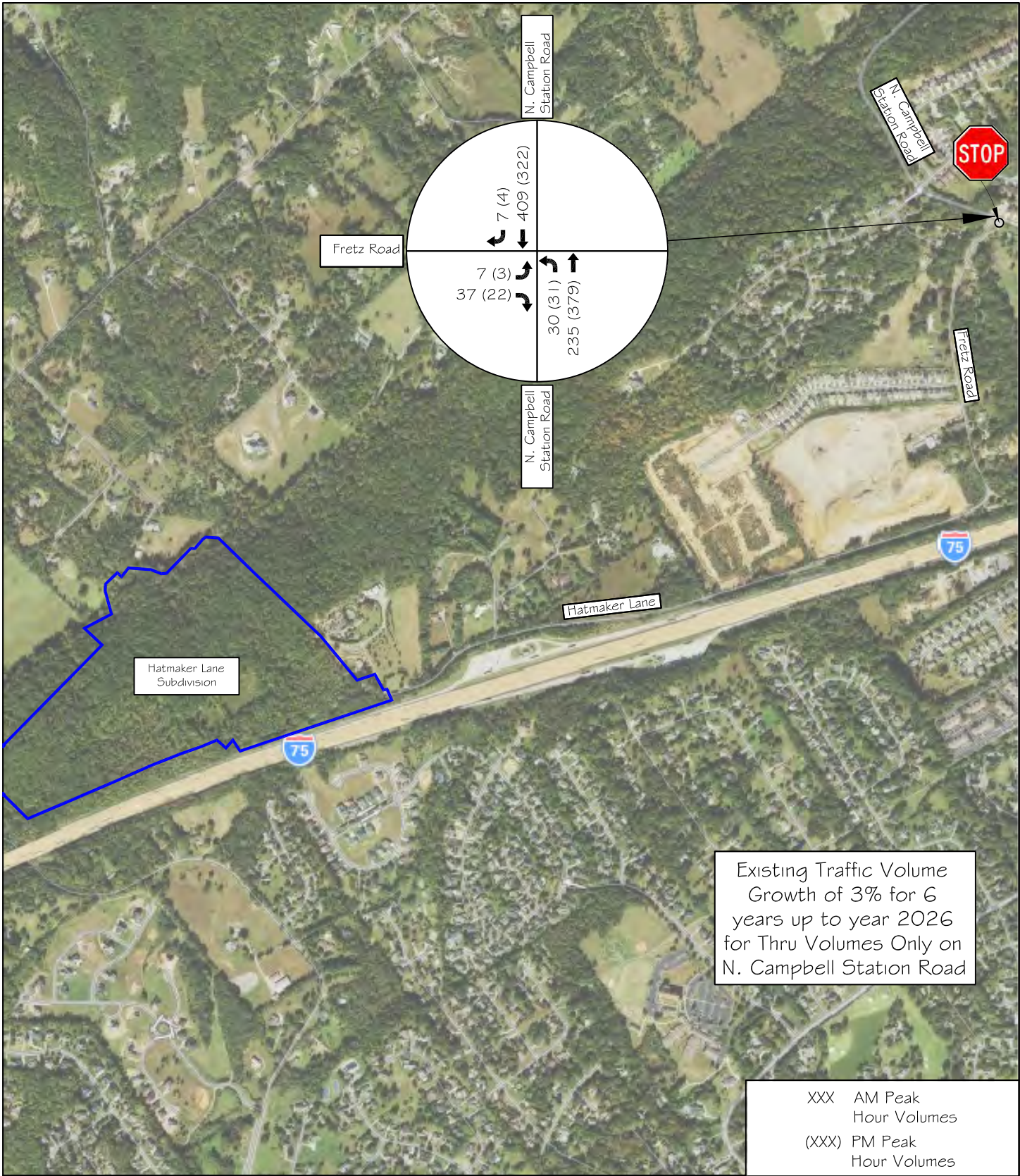
To ensure a reasonable estimate for this study, a +3% annual growth rate was used to consider any future development in the area and potential rising travel volumes. (A growth rate of 3% was also used in the previous studies for the other non-related residential subdivisions on Fretz Road and Hatmaker Lane). Figure 6a shows the projected opening year traffic volumes for the year 2026 during the AM and PM peak hours based on an assumed annual growth rate of +3%. In Figure 6a, the only



existing volumes from Figure 5 that are increased are the thru volumes on North Campbell Station Road at the intersection of Fretz Road. The future traffic growth on Fretz Road and the turning movements on North Campbell Station Road will be accounted for in the following section. The volumes shown in Figure 6a could potentially exist in the future even if the proposed residential project is not constructed and assumes that no houses are constructed in the other non-related residential subdivisions on Fretz Road and Hatmaker Lane.

Overall, with the addition of three other non-related residential subdivisions being proposed on Fretz Road and Hatmaker Lane, the traffic volumes for the turning movements at the intersection will see substantial growth by the year 2026.





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FIGURE 6a

Hatmaker Lane Subdivision

2026 Peak Hour Traffic Volumes -  
OPENING YEAR TRAFFIC (WITHOUT  
PROJECT)



The other subdivisions are in different stages of development, but all are expected to be built-out and occupied before the Hatmaker Lane Subdivision. Currently, no houses have been fully constructed in any of these three subdivisions, but 21 houses are under construction in Windsor Forest and it appears that home construction is ready to begin in the Campbell Crossing Subdivision. Towering Oaks is in the process of seeking approval due to changes to the original plans submitted back in 2018. This subdivision was previously known as October Park. A summary of these other subdivisions is shown in Table 5.

**TABLE 5**  
**ADJACENT NON-RELATED RESIDENTIAL SUBDIVISIONS**  
**Fretz Road and Hatmaker Lane**

NAME	LOCATION	# OF UNITS	APPROVAL	STATUS	TRAFFIC STUDY COMPLETED?	TRAFFIC STUDY ASSUMED COMPLETION DATE
Campbell Crossing	Off Fretz Road - Just south of intersection of North Campbell Station Road at Fretz Road	21 Houses	Town of Farragut - Approved 2019	Infrastructure and Roads Built - No Houses Constructed	No - Not Required	N/A
Windsor Forest	Off Fretz Road - Just south of intersection of Fretz Road at Woodhollow Lane	121 Houses	Knox County - Approved 2019	Infrastructure and Roads Being Built - 21 Houses Under Construction	Yes - In 2017	2020
Towering Oaks (previously October Park)	Off Hatmaker Lane - Just west of Windsor Forest Subdivision	85 Houses	Knox County - Seeking Approval 2020	Re-submitted for approval	Yes - In 2018	2021



**Campbell Crossing Subdivision**



**Windsor Forest Subdivision**



**Towering Oaks Subdivision**



To account for the traffic growth due to these other residential subdivisions, calculations were made to estimate the number of trips that will be generated by these other subdivisions. Only two of these three subdivisions had traffic impact studies completed and neither one of the studies took into account the impacts of each other. These calculations followed the same methodology that was used for determining the number of trips calculated by the proposed Hatmaker Lane Subdivision. The calculations from ITE for the other proposed subdivisions are shown in Appendix G. A summary of this information is presented in the following table:

**TABLE 6**  
**TRIP GENERATION FOR OTHER RESIDENTIAL SUBDIVISIONS ON FRETZ ROAD AND HATMAKER LANE**

21 Single-Family Detached Houses in Campbell Crossing Subdivision  
121 Single-Family Detached Houses in Windsor Forest Subdivision  
85 Single-Family Detached Houses in Towering Oaks Subdivision

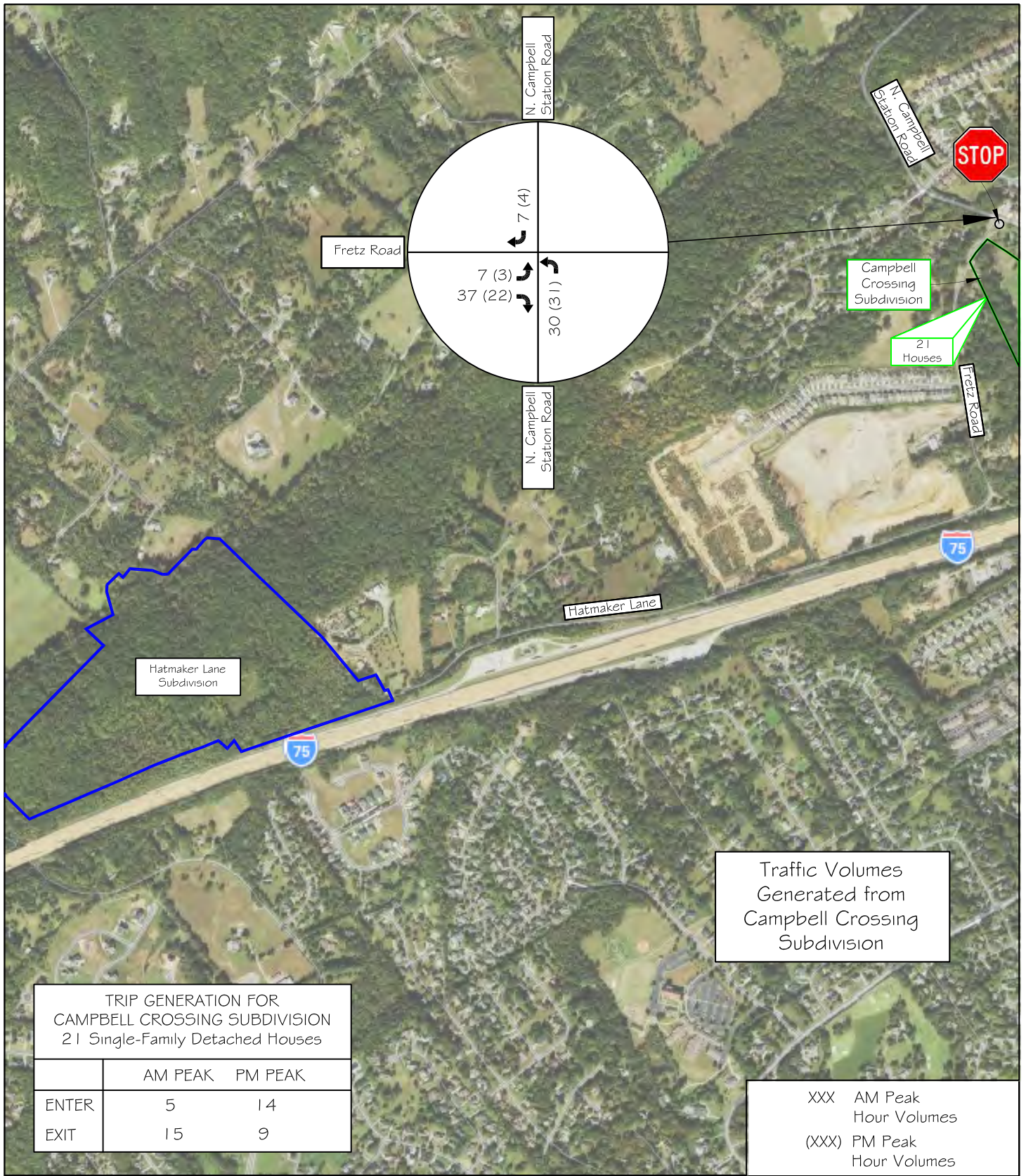
ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	Campbell Crossing - 21 Houses	248	25%	75%		63%	37%	
				5	15	20	14	9	23
#210	Single-Family Detached Housing	Windsor Forest - 121 Houses	1,240	25%	75%		63%	37%	
				23	68	91	77	45	122
#210	Single-Family Detached Housing	Towering Oaks - 85 Houses	896	25%	75%		63%	37%	
				16	50	66	55	32	87
Total New Volume Site Trips			2,384	44	133	177	146	86	232

ITE Trip Generation Manual, 10th Edition

Trips calculated by using Fitted Curve Equation

For the three other residential subdivisions, with a total of 227 houses, it is estimated that a total of 177 generated trips will occur in the AM Peak Hour when constructed and occupied. Similarly, it is estimated that a total of 232 generated trips will occur in the PM Peak Hour when constructed and occupied. The projected trips that are shown in Figures 6b, 6c, and 6d account for just the projected traffic growth in the area that will be contributed by the other new residential subdivisions. The volumes shown are distributed based on the existing patterns observed during the manual traffic count at the intersection of North Campbell Station Road at Fretz Road. This traffic volume distribution methodology is discussed further in the next section of the report, "Trip Distribution and Assignment". Figures 6b thru 6d show the projected traffic volumes generated by each individual subdivision separately.





TRIP GENERATION FOR  
CAMPBELL CROSSING SUBDIVISION  
21 Single-Family Detached Houses

	AM PEAK	PM PEAK
ENTER	5	14
EXIT	15	9

Traffic Volumes  
Generated from  
Campbell Crossing  
Subdivision

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

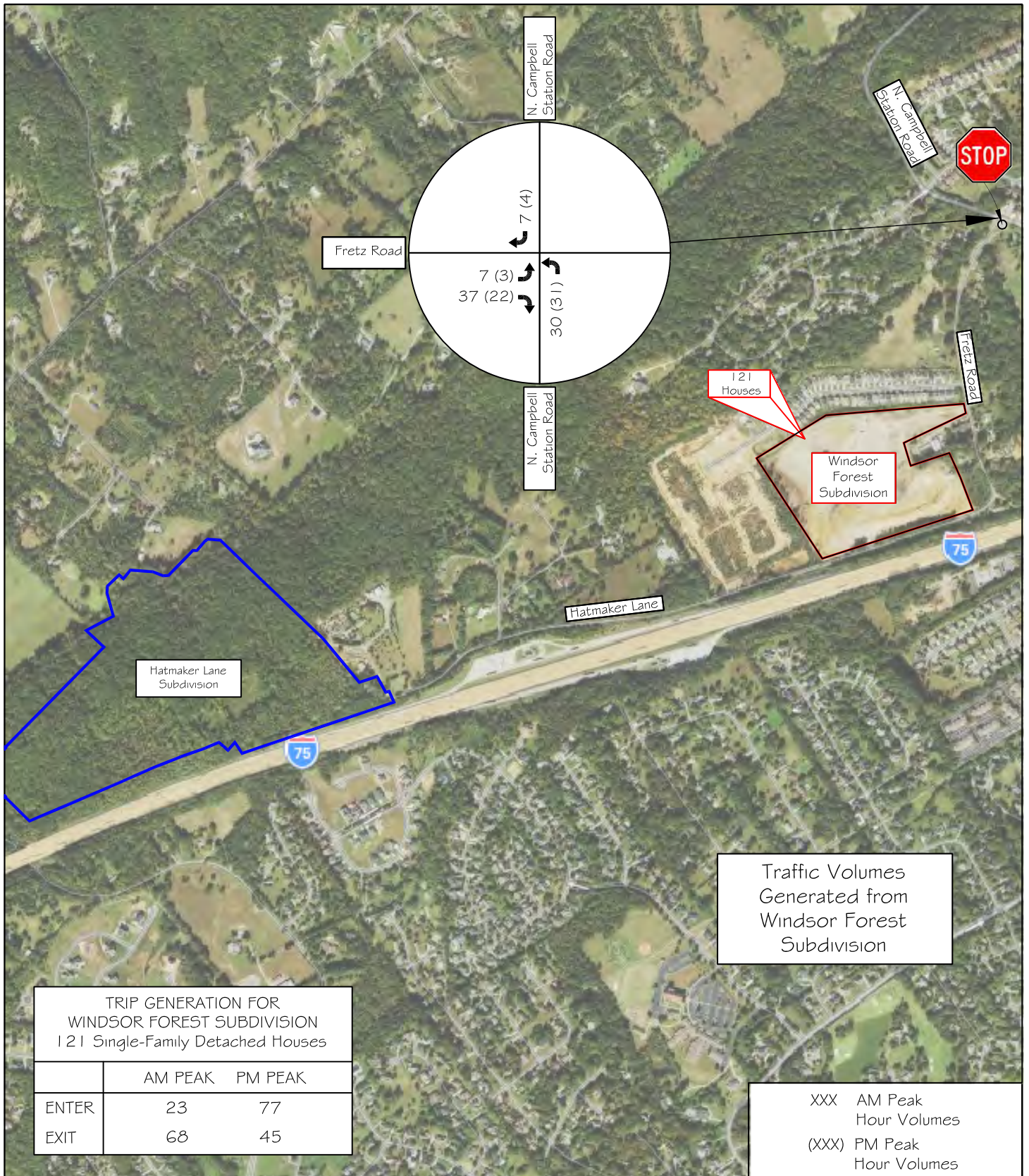

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NORTH

FIGURE 6b  
Hatmaker Lane Subdivision  
Traffic Generated by Campbell Crossing  
Subdivision (21 Houses)




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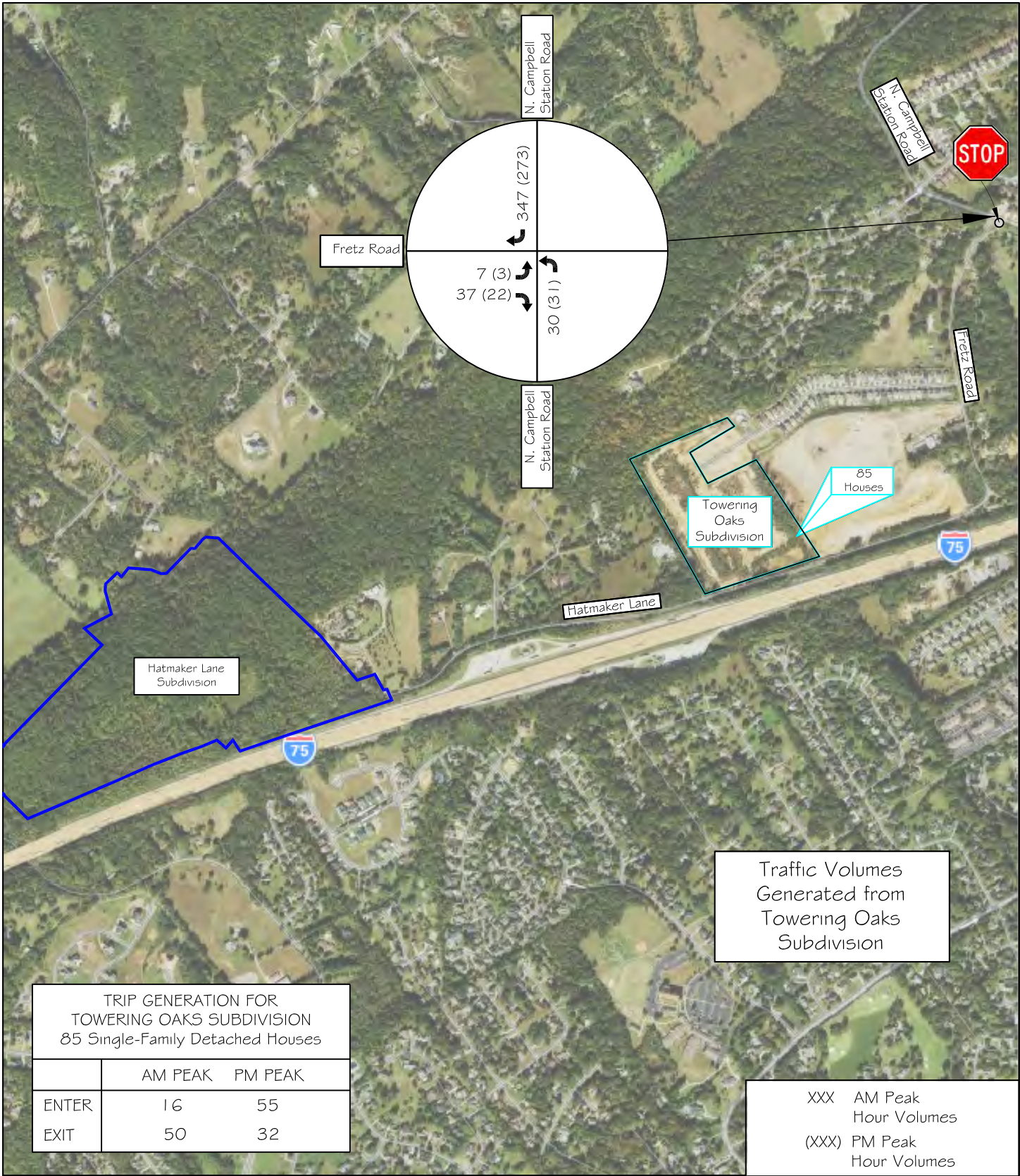
**NORTH**

**FIGURE 6c**

Hatmaker Lane Subdivision

Traffic Generated by Windsor Forest Subdivision (121 Houses)





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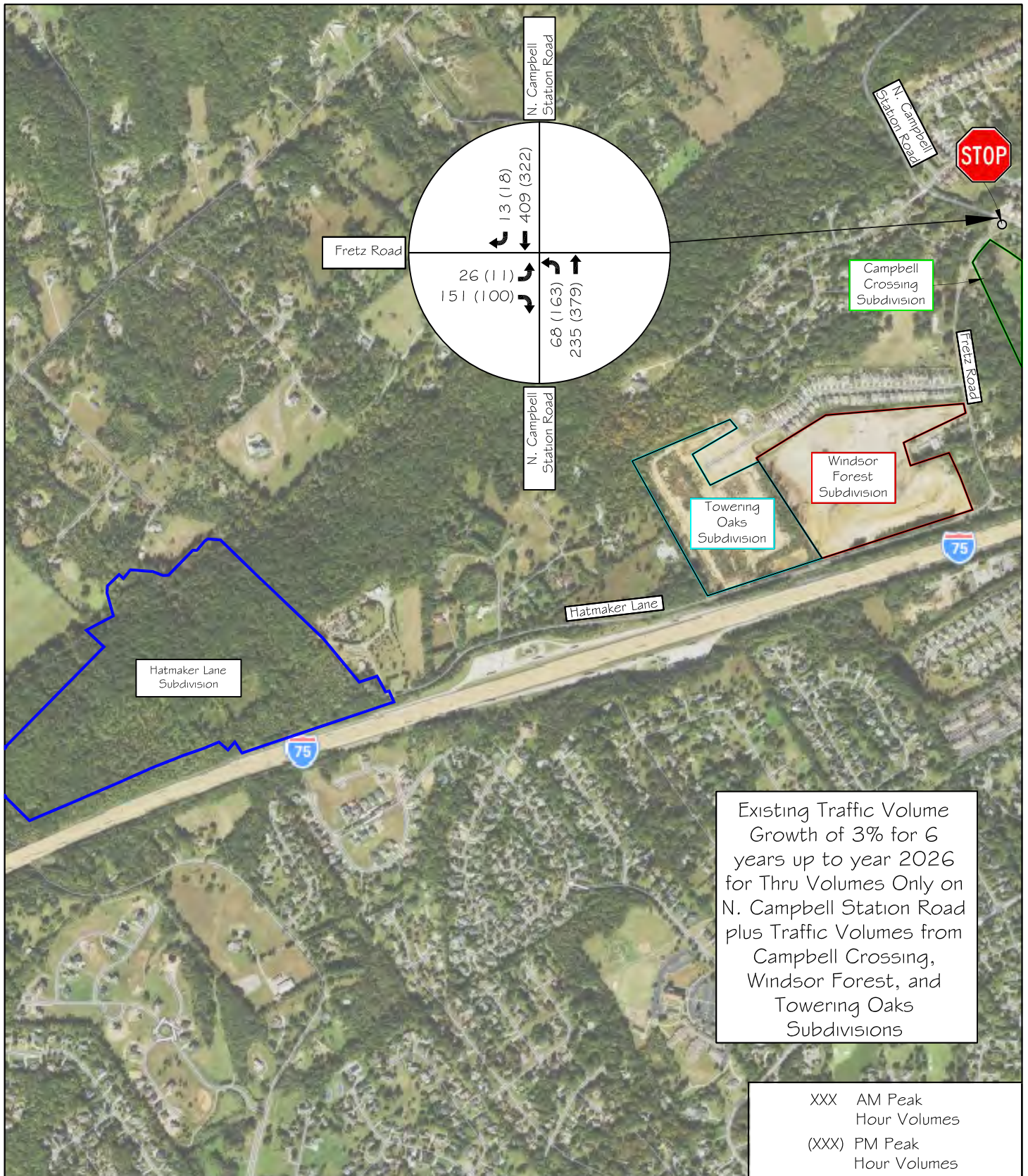
FIGURE 6d  
Hatmaker Lane Subdivision  
Traffic Generated by Towering Oaks Subdivision (85 Houses)

Lastly, Figure 6e shows the combination of the 3% growth applied to the thru traffic volumes on North Campbell Station Road shown in Figure 6a plus the existing traffic entering and exiting Fretz Road at North Campbell Station Road generated by the new subdivisions shown in Figures 6b, 6c, and 6d. The volumes shown in Figure 6e represent the potential volumes at the intersection that could exist in the year 2026 even if the proposed Hatmaker Lane Subdivision is not constructed but with the others fully constructed and occupied.

As stated earlier, only two of the three new subdivisions had traffic impact studies completed for their approval process. These two subdivisions were the Windsor Forest Subdivision (121 houses) and the Towering Oaks Subdivision (85 houses). Somehow these studies did not take into account the results of each other even though they were completed within a year of each other. Each of these studies recommended a northbound left-turn lane be constructed on North Campbell Station Road at Fretz Road. In particular, the traffic study for Windsor Forest recommended a turn lane based on a threshold of 47 houses being constructed and occupied and the other study for Towering Oaks recommended a turn lane based on a threshold of 46 houses being constructed and occupied. Both studies recommended the northbound left-turn lane on North Campbell Station Road at Fretz Road to have a storage length of 75 feet.

Since it is assumed that these other residential subdivisions will be constructed before the Hatmaker Lane Subdivision, the capacity analyses for the studied intersection in the year 2026 without the Hatmaker Lane Subdivision included a northbound left-turn lane on North Campbell Station Road. The capacity analyses for the studied intersection with these increased volumes for the year 2026 are shown in Appendix F. For vehicular traffic in the year 2026, and as expected, the intersection was calculated to operate with higher but manageable delays as compared to the existing conditions during the AM and PM peak hours. The results are shown in Table 7.





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FIGURE 6e

Hatmaker Lane Subdivision

Total 2026 Peak Hour Traffic Volumes - OPENING YEAR TRAFFIC (WITHOUT PROJECT) Plus Traffic Generated by Other Subdivisions on Fretz Road and Hatmaker Lane

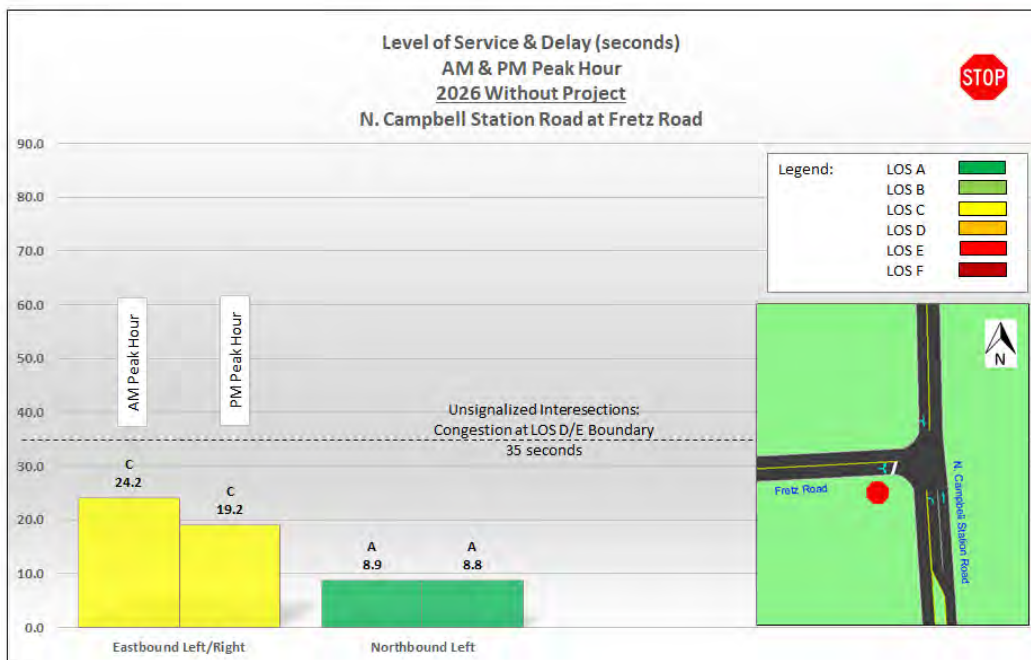


**TABLE 7**  
**2026 INTERSECTION CAPACITY ANALYSIS RESULTS -**  
**N. CAMPBELL STATION ROAD AT FRETZ ROAD**  
**OPENING YEAR (WITHOUT PROJECT)**

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
N. Campbell Station Road at Fretz Road	 Unsignalized	Eastbound Left/Right	C	24.2	0.600	C	19.2	0.380
		Northbound Left	A	8.9	0.100	A	8.8	0.200

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2000 intersection methodology

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



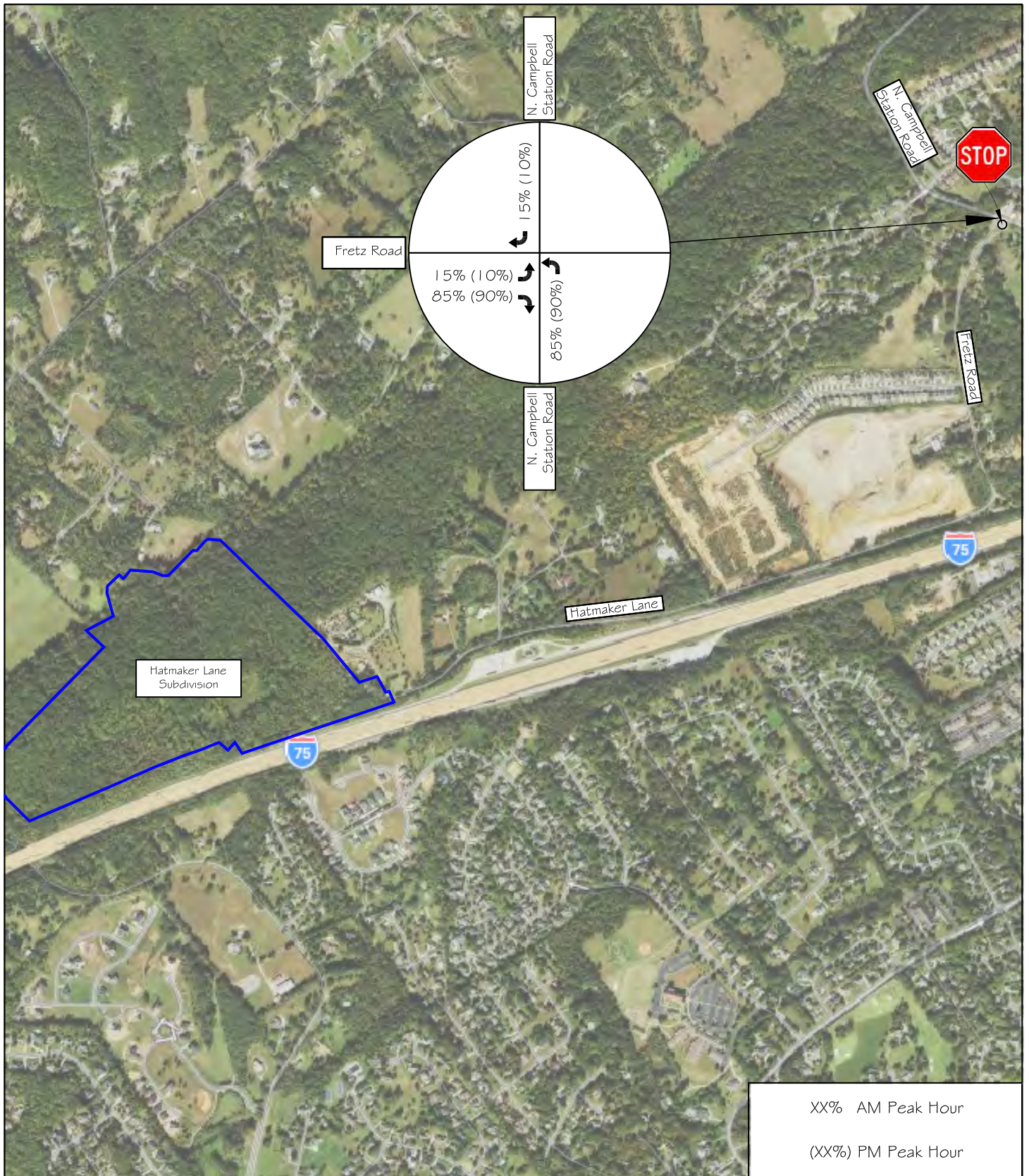
■ **TRIP DISTRIBUTION AND ASSIGNMENT:**

Figure 7 shows the projected distribution for traffic entering and exiting at the intersection of North Campbell Station Road at Fretz Road for the Hatmaker Lane Subdivision. It also shows the distribution that was used for the adjacent residential developments on Fretz Road and Hatmaker Lane during the future AM and PM peak hours. The percentages that are shown only pertain to the trips generated by the new proposed dwellings in the residential developments on Fretz Road and Hatmaker Lane that were calculated from the ITE Trip Generation Manual. Overall, it is assumed that most of the residential development traffic (85% - 90%) will travel to and from the south at the intersection of North Campbell Station Road at Fretz Road. The existing traffic counts that were conducted for the study are assumed as a good analogue for the future distribution of trips to and from the proposed residential development.

There are a variety of nearby developments that will potentially “attract” the projected generated traffic to and from the residential subdivisions. All these large “attractors” are located to the south of the proposed residential developments and accessible via North Campbell Station Road. Interstate 40/75 will be the major adjacent access for further destinations in the surrounding Knoxville area. In addition to employment centers and commercial development, some traffic will travel to and from a variety of public and private elementary, middle, and high schools. This site development property is currently zoned for Hardin Valley Elementary School, Hardin Valley Middle School, and Hardin Valley High School. These schools are located to the north of the proposed residential developments and would suggest there would be residential traffic to and from the north on North Campbell Station Road for those who do not utilize public school bus transportation.

Figure 8 shows the Traffic Assignment of the computed trips that will be generated by the Hatmaker Lane Subdivision (from Table 4) and applied to the intersection movements based on the assumed distribution of trips shown in Figure 7.





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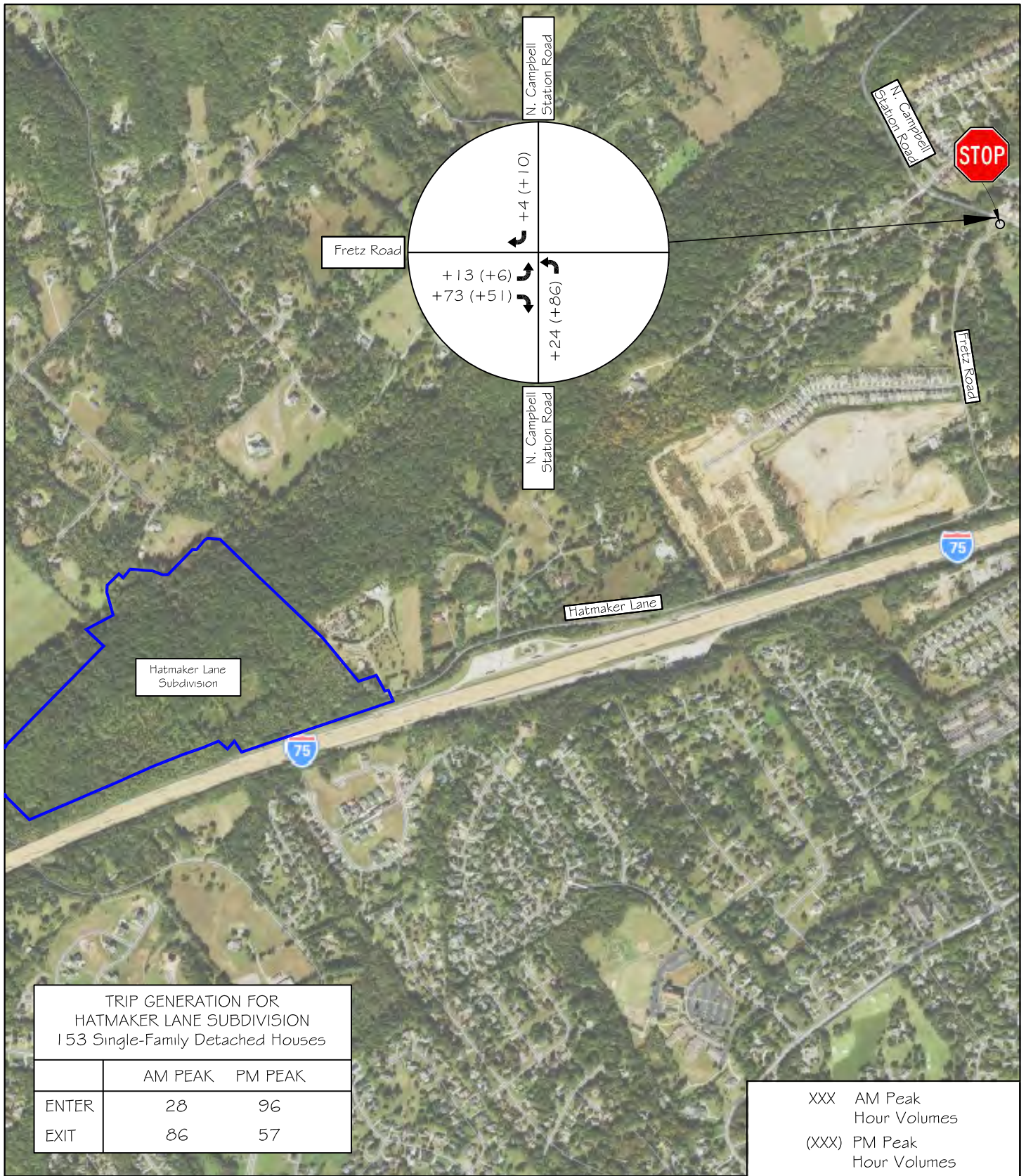


FIGURE 7

Hatmaker Lane Subdivision

Directional Distribution of Generated Traffic during AM and PM Peak Hour





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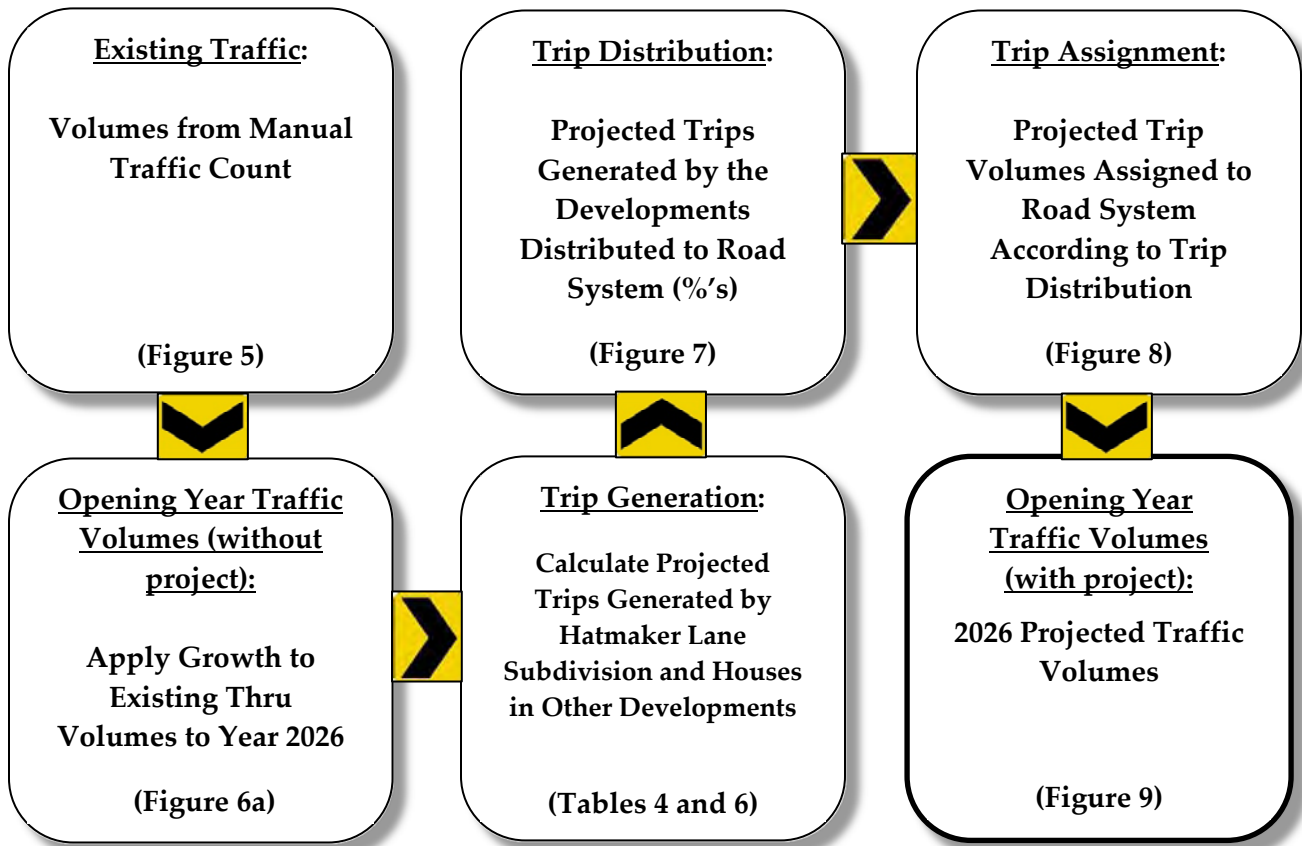
FIGURE 8

Hatmaker Lane Subdivision

Traffic Assignment of Generated Traffic during AM and PM Peak Hour

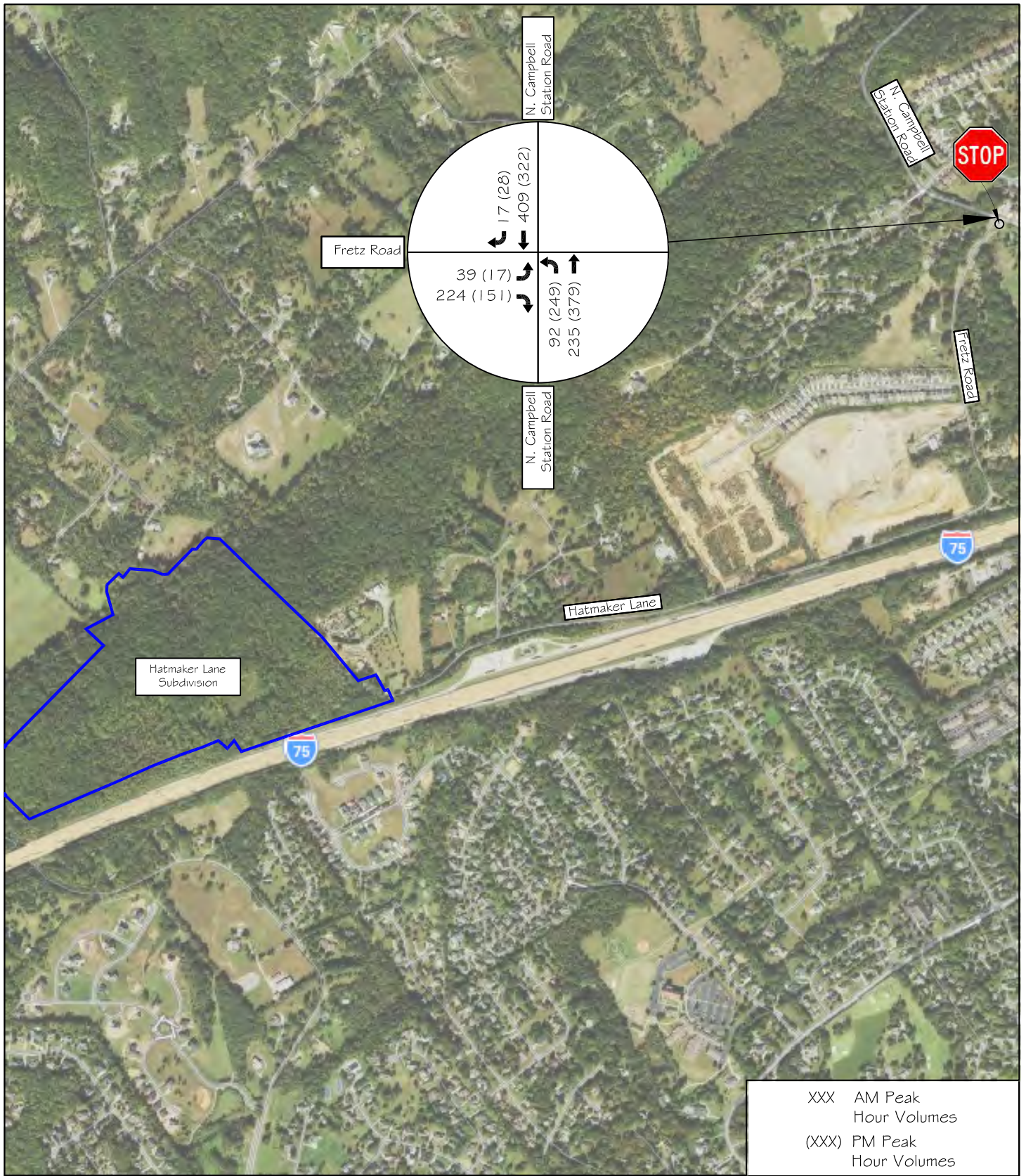
■ **OPENING YEAR TRAFFIC CONDITIONS (WITH PROJECT):**

Overall, several additive steps were taken to estimate the total opening year projected traffic volumes at the studied intersection of North Campbell Station Road at Fretz Road when all the residential developments on Fretz Road and Hatmaker Lane are fully constructed and occupied by the year 2026. The steps are illustrated below for clarity:



To calculate the total future projected traffic volumes at the studied intersection, the calculated peak hour traffic (from ITE Trip Generation) generated by the new Hatmaker Lane Subdivision and the houses in the other residential subdivisions on Fretz Road and Hatmaker Lane were added to the 2026 opening year traffic (shown in Figure 6a) by following the predicted directional distributions and assignments (shown in Figures 7 and 8). This procedure was necessary to obtain the total projected traffic volumes at the time all the developments are fully built-out. Figure 9 shows the total projected AM and PM peak hour volumes at the studied intersection for the year 2026.





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FIGURE 9

Hatmaker Lane Subdivision

2026 Peak Hour Traffic Volumes -  
 OPENING YEAR TRAFFIC (WITH  
 PROJECT)




Capacity analyses were conducted to determine the projected Level of Service for vehicles at the studied intersection for the year 2026 with the traffic growth and the development traffic from all the subdivisions. Appendix F includes the worksheets for these capacity analyses.

The results of the capacity calculations for the projected 2026 peak hour vehicular traffic volumes at the intersection of North Campbell Station Road at Fretz Road can be seen in Tables 8a and 8b for the AM and PM peak hours.

Table 8a reports the calculations for North Campbell Station Road at Fretz Road in the projected 2026 conditions. Table 8b shows a summary comparison of North Campbell Station Road at Fretz Road for the existing conditions, the projected conditions in 2026 without the Hatmaker Lane Subdivision being constructed, and the projected opening year conditions with all the projects constructed and occupied in the year 2026. The vehicle delays at this intersection were projected to be increased to LOS F in the year 2026 for the Fretz Road approach in the AM peak hour and LOS E in the PM peak hour due to the addition of all the traffic volumes generated by the residential developments.

**TABLE 8a**  
**2026 INTERSECTION CAPACITY ANALYSIS RESULTS -**  
**N. CAMPBELL STATION ROAD AT FRETZ ROAD**  
**OPENING YEAR (WITH PROJECT)**

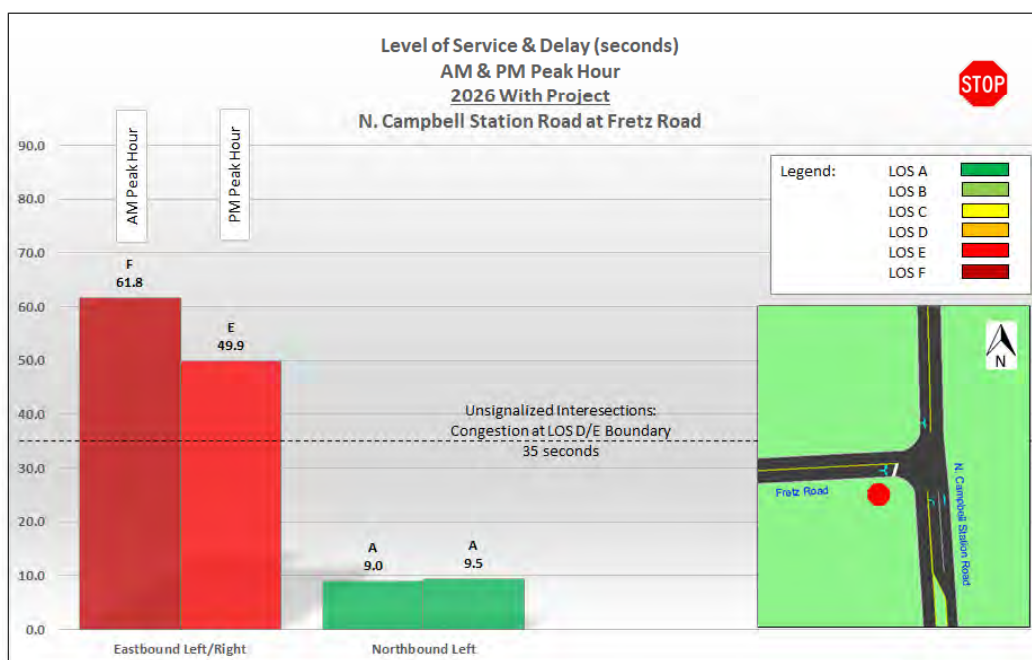
INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
N. Campbell Station Road at Fretz Road	 Unsignalized	Eastbound Left/Right	F	61.8	0.940	E	49.9	0.790
		Northbound Left	A	9.0	0.130	A	9.5	0.310

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2000 intersection methodology


<sup>a</sup> Level of Service

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

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



**TABLE 8b**  
**INTERSECTION CAPACITY ANALYSIS SUMMARY**  
**N. CAMPBELL STATION ROAD AT FRETZ ROAD**

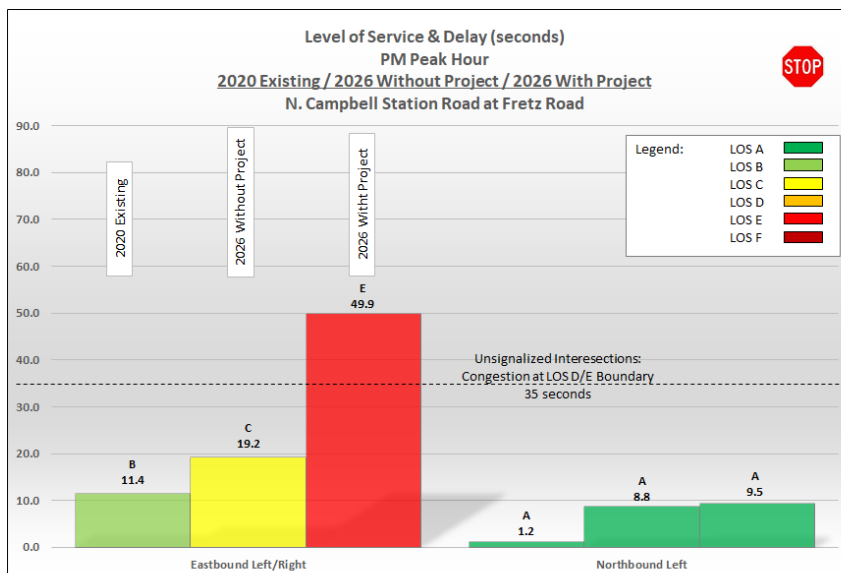
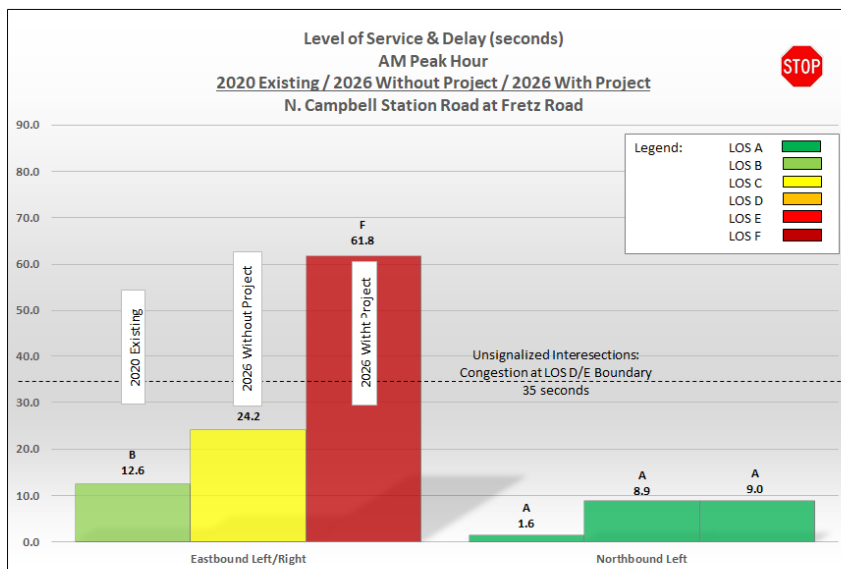
LOCATION / PEAK HOUR MOVEMENT	2020 EXISTING			2026 WITHOUT PROJECT			2026 WITH PROJECT		
	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>
<b>N. Campbell Station Road at Fretz Road</b> 									
<u>AM Peak</u>									
Eastbound Left/Right	B	12.6	0.130	C	24.2	0.600	F	61.8	0.940
Northbound Left/Right	A	1.6	0.040	A	8.9	0.100	A	9.0	0.130
<u>PM Peak</u>									
Eastbound Left/Right	B	11.4	0.060	C	19.2	0.380	E	49.9	0.790
Northbound Left/Right	A	1.2	0.040	A	8.8	0.200	A	9.5	0.310

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2000 intersection methodology

<sup>a</sup> Level of Service

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

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





▪ **POTENTIAL SAFETY ISSUES:**

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

■ **EVALUATION OF TURN LANE THRESHOLDS**

As stated earlier, the previous traffic impact studies conducted for Windsor Forest and Towering Oaks recommended a northbound left-turn lane on North Campbell Station Road at Fretz Road once they met certain thresholds based on the number of houses constructed and occupied. The studies recommended constructing a left-turn lane with 75 feet of storage. The threshold for Windsor Forest was 47 houses and the threshold for Towering Oaks was 46 houses. Nonetheless, the North Campbell Station Road at Fretz Road intersection was evaluated in this study to confirm the need for a separate turn lane on North Campbell Station Road for vehicles turning onto Fretz Road in the year 2026. The design policy that was used for these turn lane evaluations is based on “Knox County’s Access Control and Driveway Design Policy”. This design policy by Knox County relates vehicle volume thresholds based on prevailing speeds for two-lane and four-lane roadways. This Knox County policy is based on TDOT and nationally accepted guidelines for unsignalized intersections. Using these criteria, a determination was made whether turn lanes are warranted.

Based on the projected 2026 traffic volumes at the intersection on North Campbell Station Road and according to “Knox County’s Access Control and Driveway Design Policy”, a separate northbound left-turn lane will be warranted on North Campbell Station Road for vehicles turning onto Fretz Road. A separate southbound right-turn lane will not be warranted. The Knox County turn lane policy worksheets are in Appendix H and the results that are shown in the Appendix are based on the projected volumes during the AM and PM peak hour volumes at the intersection in the year 2026.

The design policy for turn lane warrants relates volume thresholds based on prevailing speeds for two-lane roadways. The speed classification that was chosen for this evaluation was based on the posted speed limit of 35 mph. Assuming this speed limit is regularly exceeded and to ensure a conservative assessment, this study evaluation used the Knox County classification for speeds of 36 to 45 mph with the calculated projected volumes.

➤ **EVALUATION OF SIGHT DISTANCE**

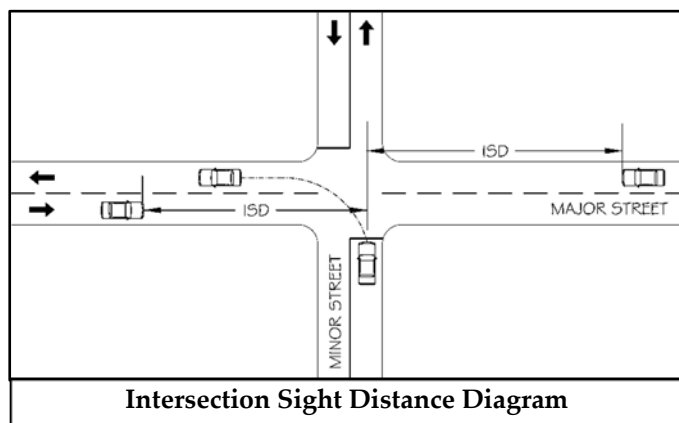
For evaluating intersections, sight distance evaluations can be categorized into two categories: Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD).

Methodology:

SSD is the distance required for a motorist to perceive, react, and for their vehicle to come to a complete stop before colliding with an object in 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.

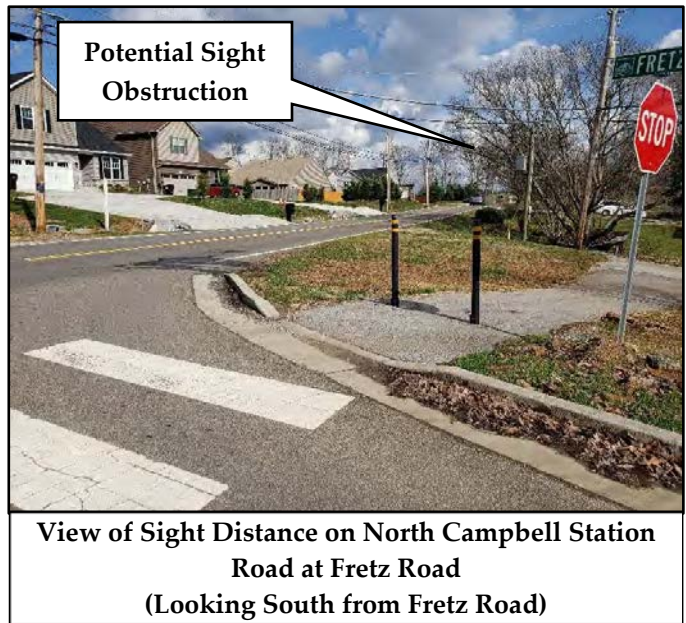
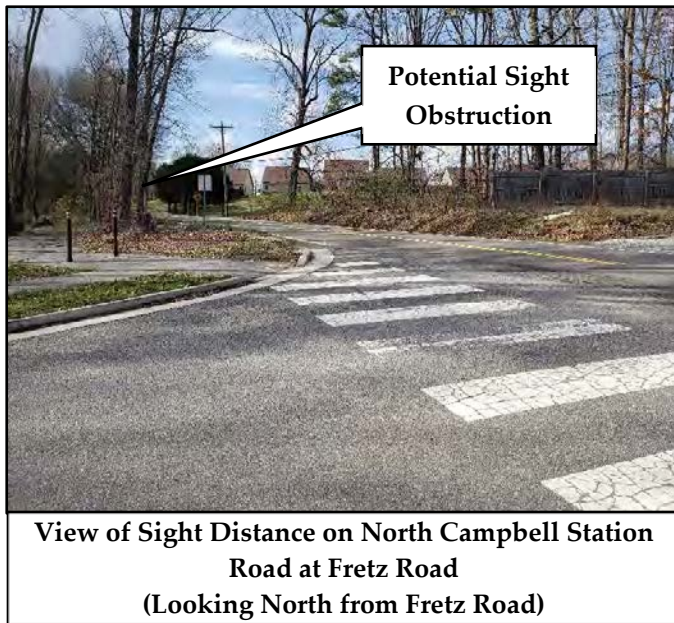
ISD is based on the time required to perceive, react, and complete the desired traffic maneuver once a motorist on a minor street decides to perform a traffic maneuver. Three traffic maneuvers are available for vehicles stopped on a minor street at a 4-way intersection: left-turn from the minor road,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

SSD can be considered the desirable visibility distance standard for evaluating the safety of an intersection. In general, SSD is generally more important than ISD; however, the ISD must be at least the same distance or greater than SSD to provide safe operations at an intersection.



Based on a posted speed limit of 35 mph on North Campbell Station Road; the required intersection sight distance would be 350 feet looking each direction at the intersection of North Campbell Station Road at Fretz Road based on Knox County policy of requiring 10 feet of sight distance per 1 mph of speed. Based on a posted speed limit of 35 mph on North Campbell Station Road and a level grade, the SSD is calculated to be 250 feet.

A cursory examination of the sight distances on North Campbell Station Road was undertaken. Based on visual observation, it appears that the intersection sight distance from the Fretz Road approach at North Campbell Station Road looking to the north and south on North Campbell Station Road is adequate. However, vegetation growth during the growing season could impact the available distance. Using a Nikon Laser Rangefinder at the intersection, the intersection sight distance was estimated to be approximately +350 feet to the north and +400 feet to the south looking from Fretz Road.



Another location where sight distance is an issue is at the intersection of Hatmaker Lane at Hopper Lane. Hopper Lane is a private drive near the end of Hatmaker Lane that provides access to about a dozen homes in the Black Oak Meadows Subdivision. Currently, residents who are leaving Black Oak Meadows do not have much of an issue turning onto Hatmaker Lane from Hopper Lane since there are very few vehicles traveling at the end of Hatmaker Lane. Only a couple of homes exist past this intersection on Hatmaker Lane. However, once the Hatmaker Lane Subdivision is developed, there will be a much larger possibility for vehicle conflicts as motorists travel to and from the new subdivision. During the field review, it was noted that the



sight distance at this intersection is greatly diminished due to vegetation and is virtually non-existent when evaluated at 15 feet from the edge of the roadway per Knox County subdivision regulations (Section 3.04.J.5). This vegetation is recommended to be removed. This is especially important for vehicles looking towards the west from Hopper Lane.



**View of Sight Distance on Hatmaker Lane at  
Hopper Lane  
(Looking East from Hopper Lane)**



**View of Sight Distance on Hatmaker Lane at  
Hopper Lane  
(Looking West from Hopper Lane)**

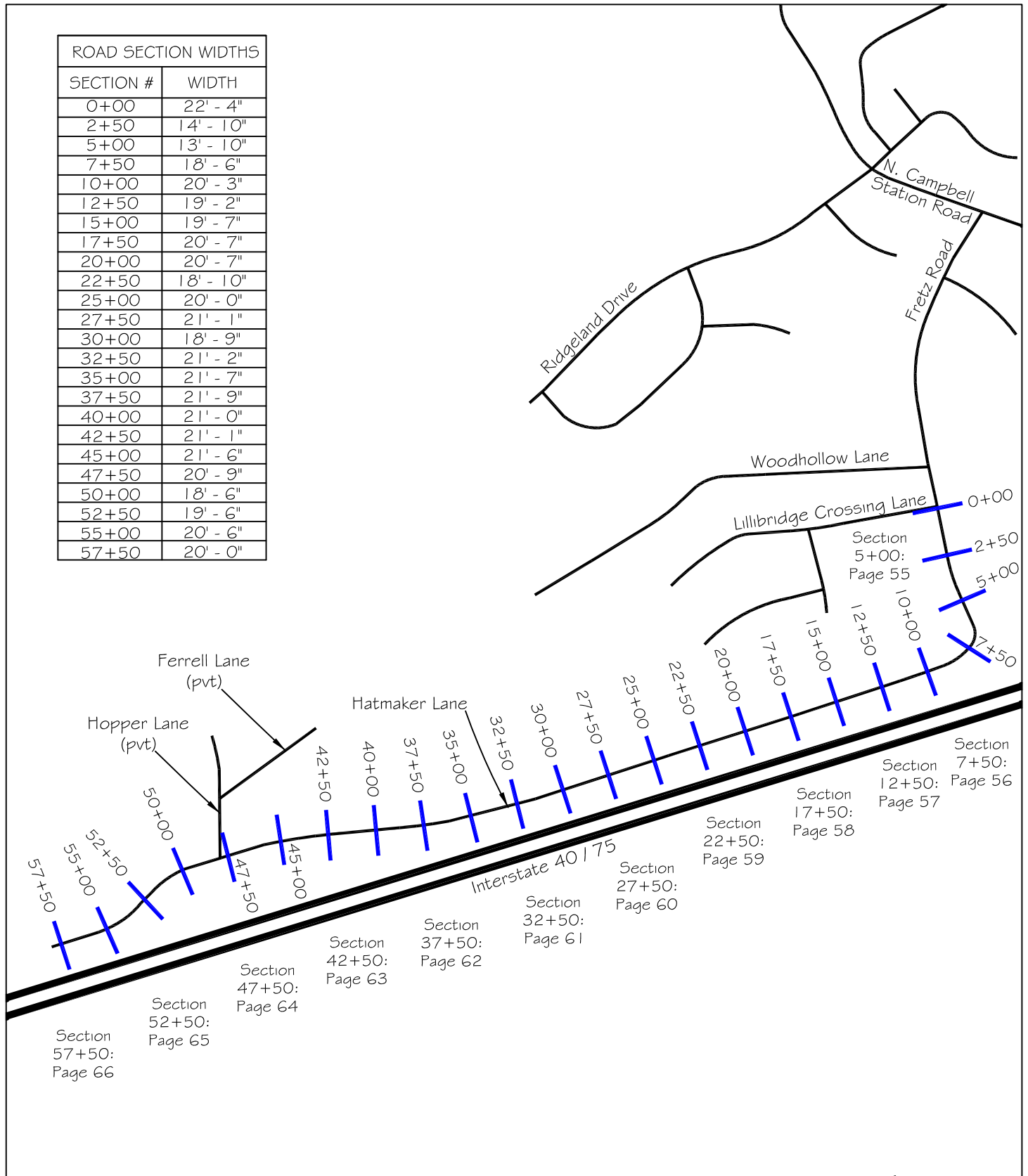
► **PAVEMENT WIDTH OF FRETZ ROAD AND HATMAKER LANE**

Pavement widths along Fretz Road and Hatmaker Lane are variable and fluctuate between 14 feet up to 24 feet in between the proposed Hatmaker Lane Subdivision and the intersection of North Campbell Station Road at Fretz Road. The larger 24-foot wide pavement widths on Fretz Road occur within a curb and gutter road section near North Campbell Station Road. This curb and gutter section on Fretz Road exists for a length of about 350 feet off North Campbell Station Road and then transitions to a narrower road section without curb and gutter. The smaller 14-foot road widths occur on Fretz Road just south of the new street for Windsor Forest, Lillibridge Crossing Lane.

Pavement widths were measured every 250 feet along the main access route in between the intersection of Fretz Road at Lillibridge Crossing Lane and the proposed site at the end of Hatmaker Lane.

The information shown on the following pages lists the pavement width measurements at the 250-foot sections and shows photographs at twelve of these road width measurements sections spaced at 500 feet. These pages also show the location of existing culverts found during the field review and areas where the sides of the road have steep drop-offs that were documented. These road measurements are not the absolute minimum and maximum widths but are a representative sample of the road. Figure 10 gives an overview of the pavement width measurement locations and the width measurements along Fretz Road and Hatmaker Lane.

ROAD SECTION WIDTHS	
SECTION #	WIDTH
0+00	22' - 4"
2+50	14' - 10"
5+00	13' - 10"
7+50	18' - 6"
10+00	20' - 3"
12+50	19' - 2"
15+00	19' - 7"
17+50	20' - 7"
20+00	20' - 7"
22+50	18' - 10"
25+00	20' - 0"
27+50	21' - 1"
30+00	18' - 9"
32+50	21' - 2"
35+00	21' - 7"
37+50	21' - 9"
40+00	21' - 0"
42+50	21' - 1"
45+00	21' - 6"
47+50	20' - 9"
50+00	18' - 6"
52+50	19' - 6"
55+00	20' - 6"
57+50	20' - 0"



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NOT TO SCALE



FIGURE 10

Hatmaker Lane Subdivision

Fretz Road and Hatmaker Lane south  
 of Lillibridge Crossing Lane  
 (Section every 250 feet)



Section 5+00 Information:  
Pavement Width = 13' - 10"

55



Section 5+00 – Fretz Road



View of Fretz Road  
(Looking Northwest)

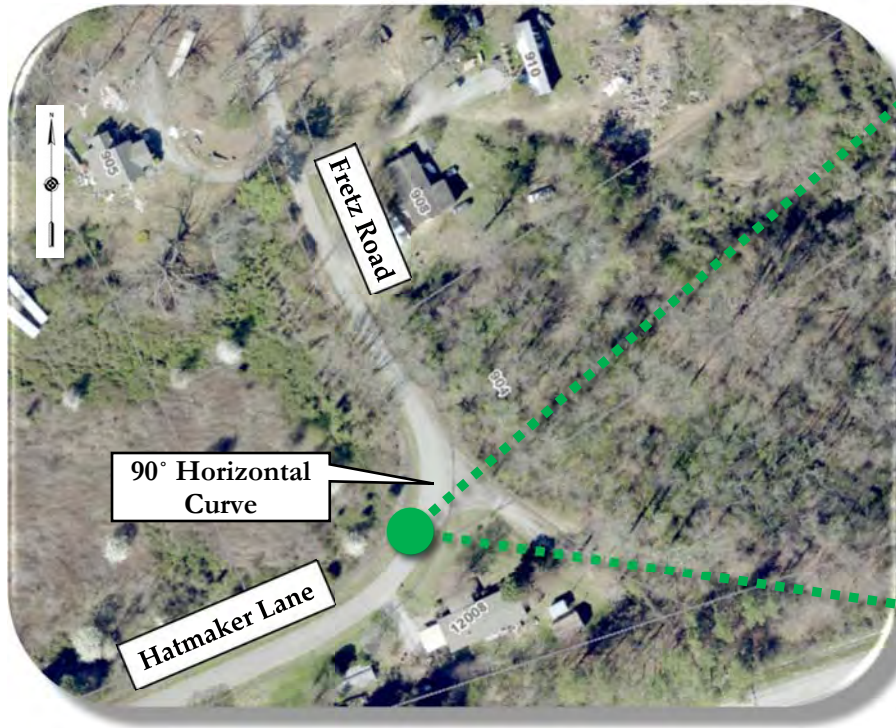


View of Fretz Road  
(Looking Southeast)

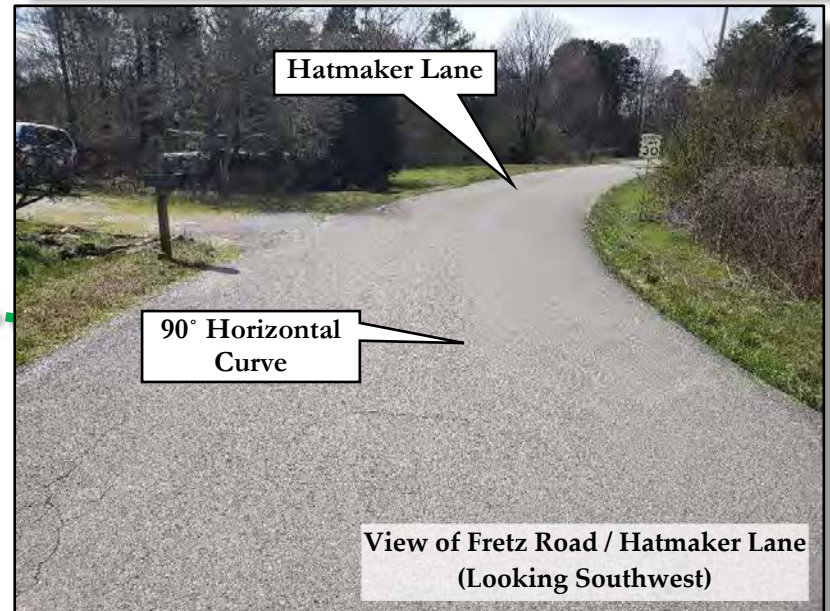


Section 7+50 Information:  
Pavement Width = 18' - 6"

56



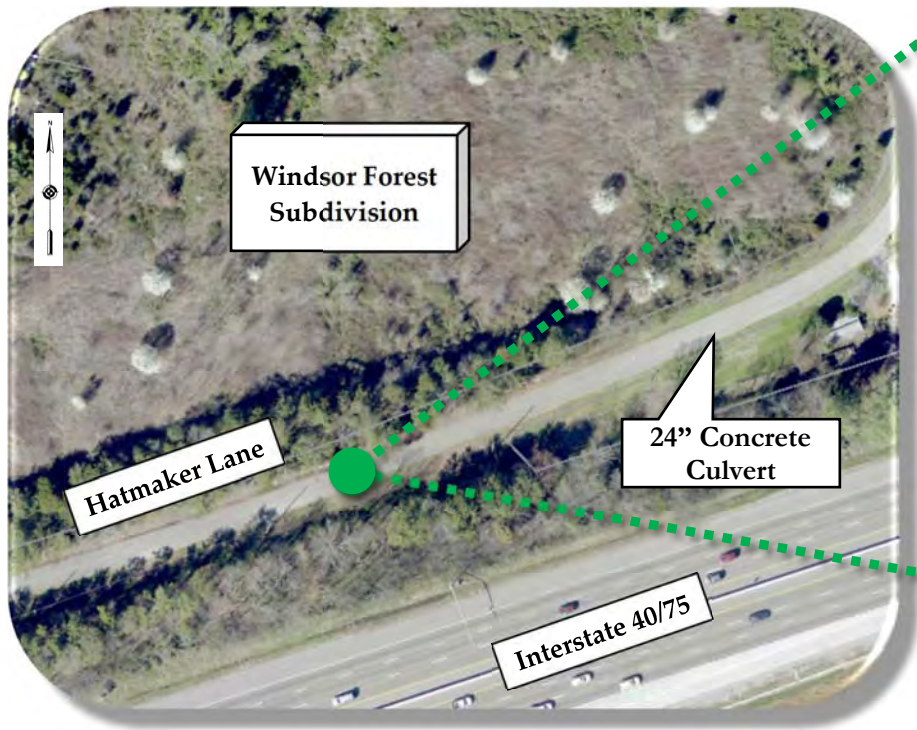
Section 7+50 – Fretz Road / Hatmaker Lane





Section 12+50 Information:  
Pavement Width = 19' - 2"

57



Section 12+50 – Hatmaker Lane



View of Hatmaker Lane  
(Looking Northeast)

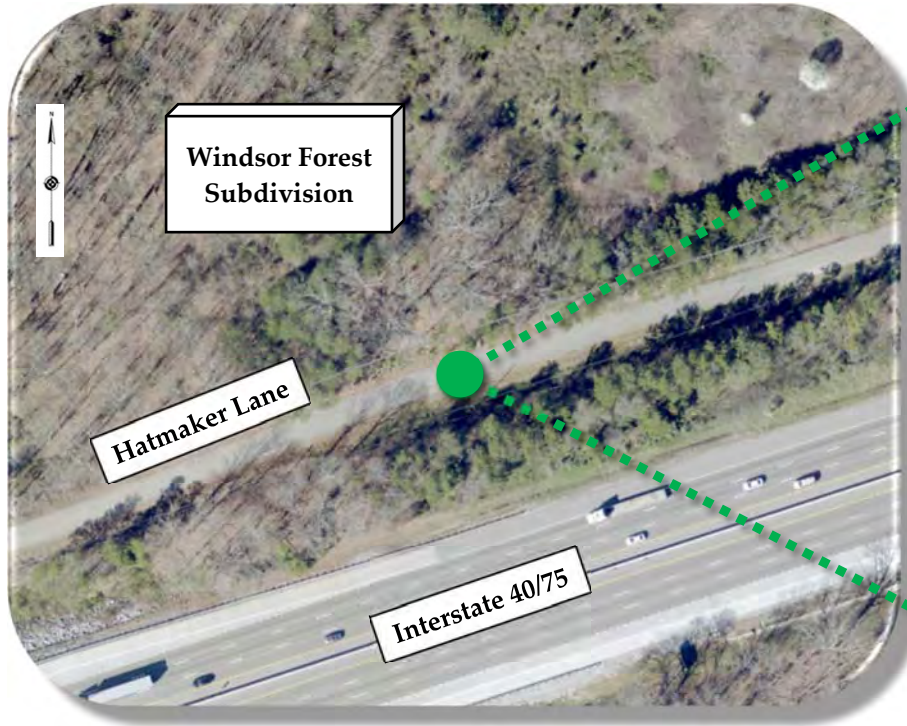


View of Hatmaker Lane  
(Looking Southwest)



Section 17+50 Information:  
Pavement Width = 20' - 7"

58



Section 17+50 – Hatmaker Lane



View of Hatmaker Lane  
(Looking Northeast)

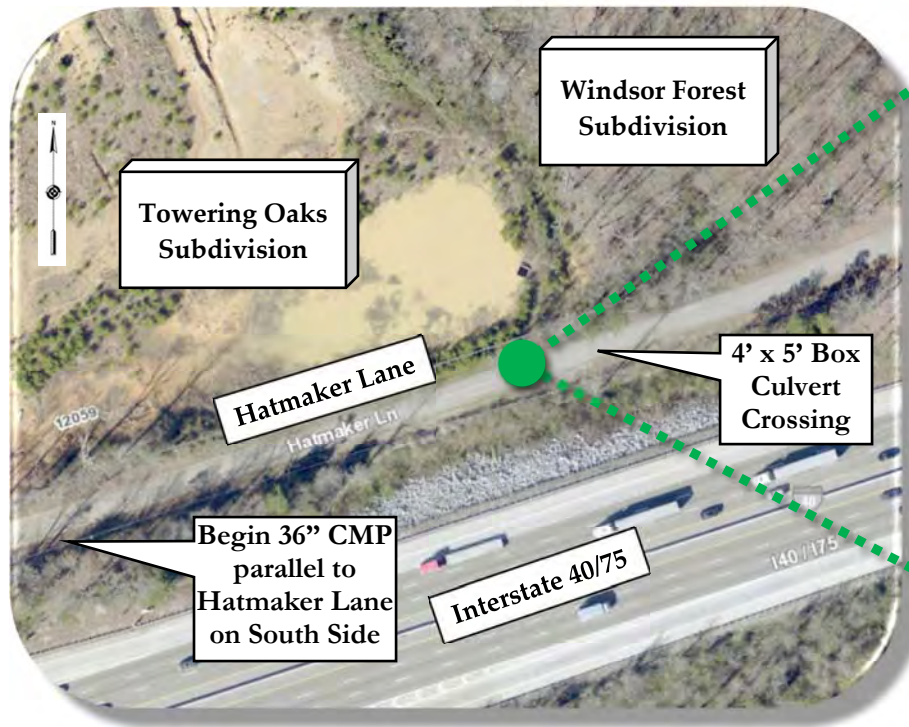


View of Hatmaker Lane  
(Looking Southwest)



Section 22+50 Information:  
Pavement Width = 18' - 10"

59



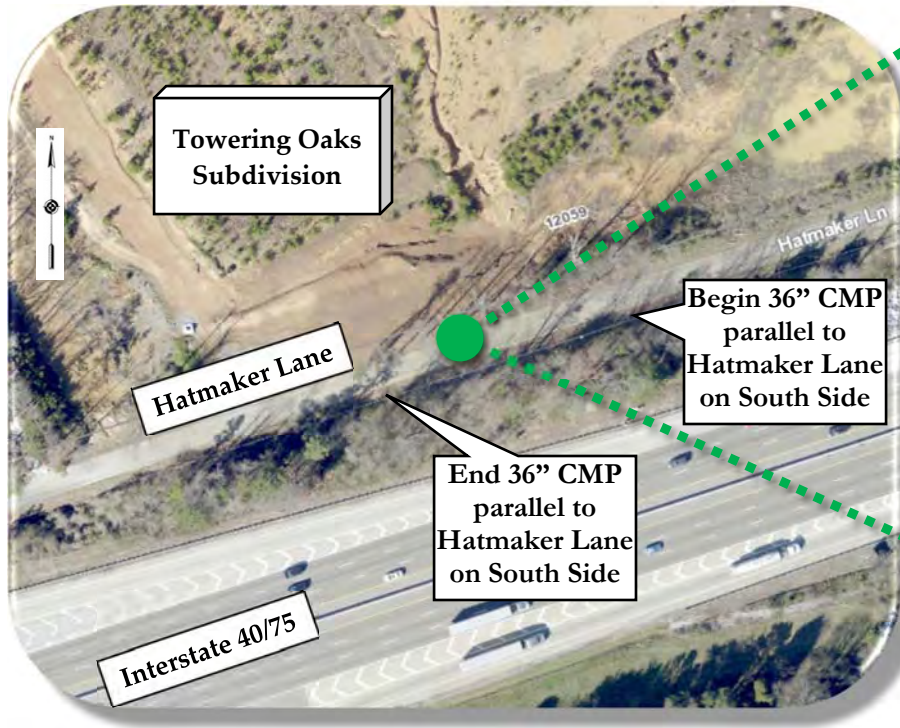
Section 22+50 - Hatmaker Lane



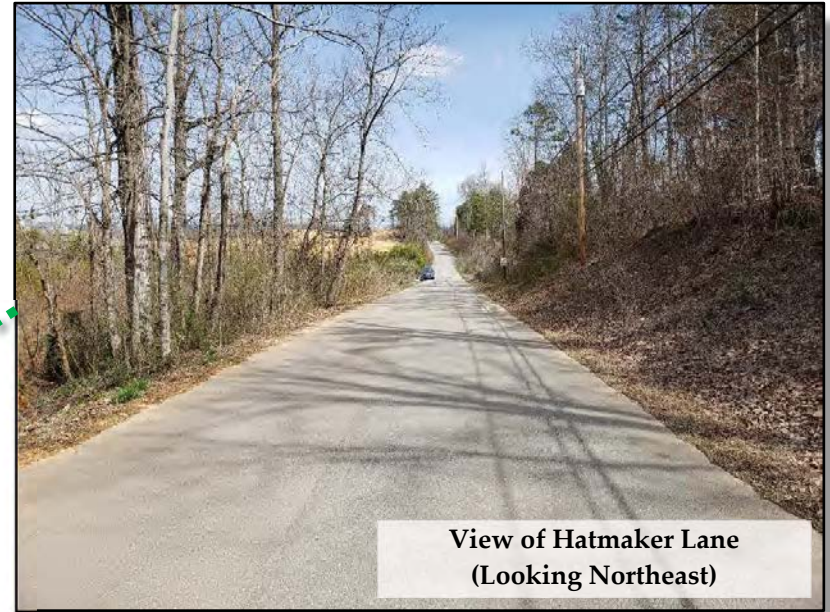


Section 27+50 Information:  
Pavement Width = 21' - 1"

09



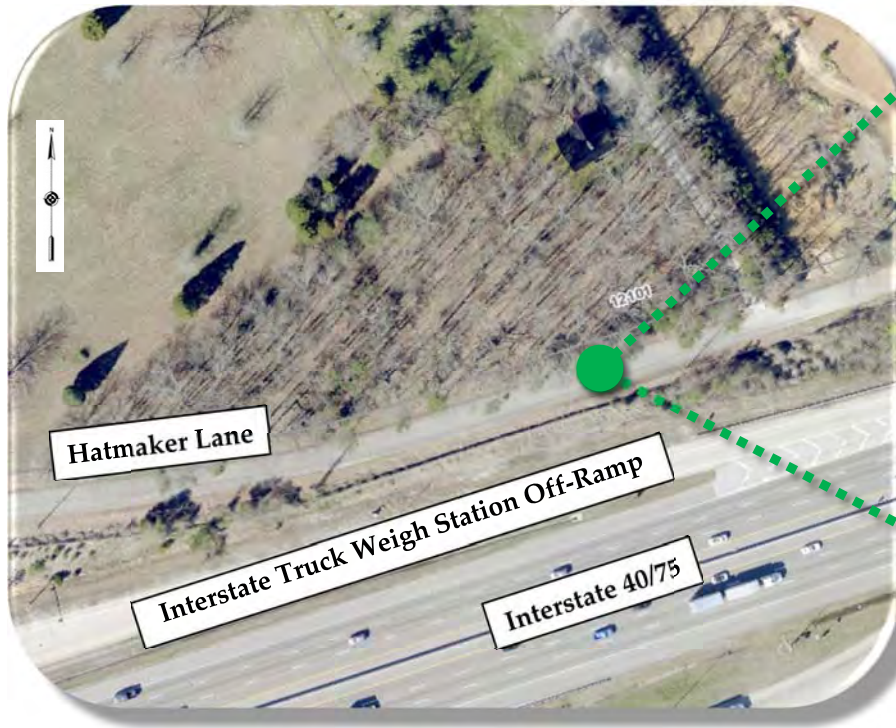
Section 27+50 – Hatmaker Lane





Section 32+50 Information:  
Pavement Width = 21' - 2"

19



Section 32+50 – Hatmaker Lane



View of Hatmaker Lane  
(Looking Northeast)



View of Hatmaker Lane  
(Looking Southwest)



Section 37+50 Information:  
Pavement Width = 21' - 9"

62



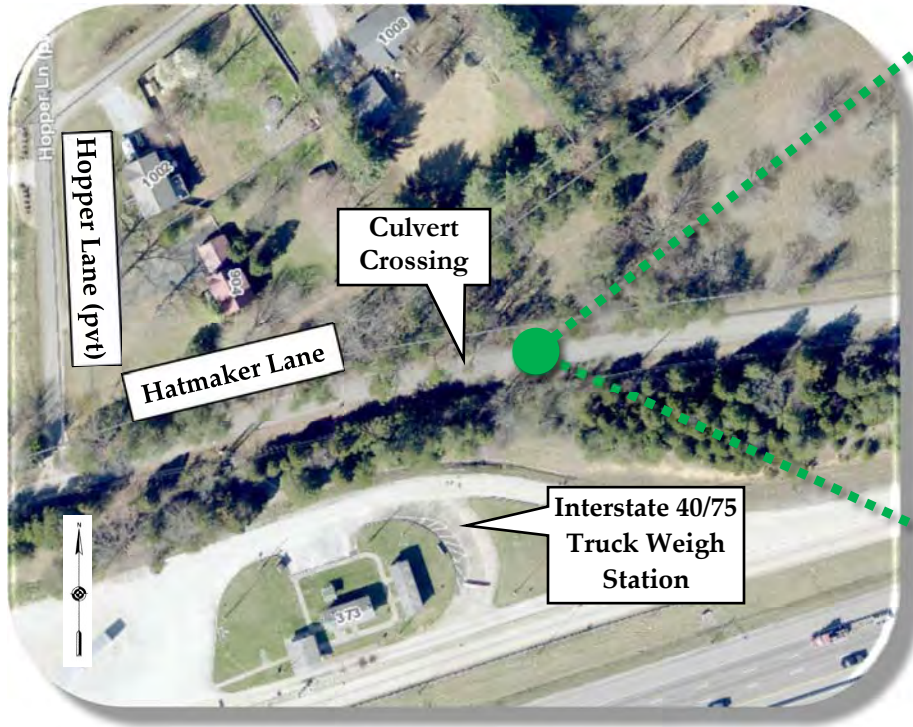
Section 37+50 – Hatmaker Lane





Section 42+50 Information:  
Pavement Width = 21' - 1"

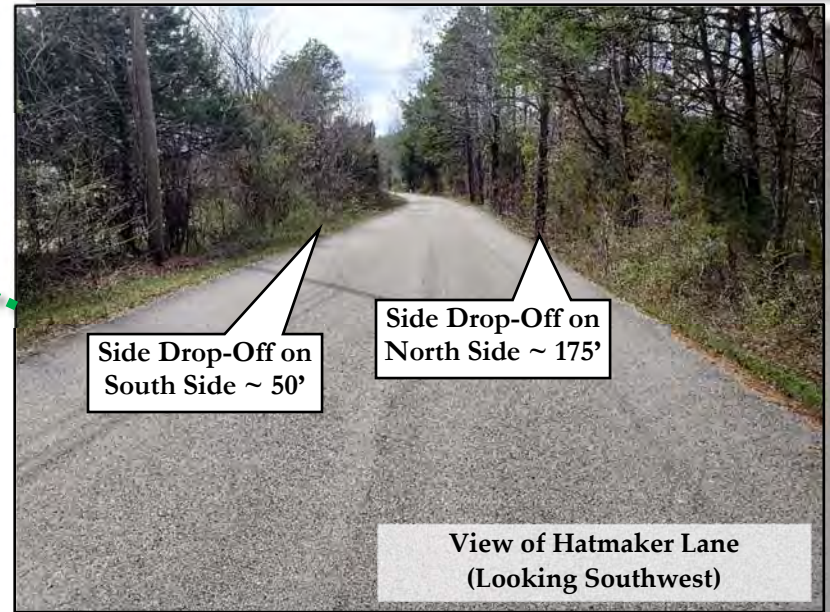
63



Section 42+50 – Hatmaker Lane



View of Hatmaker Lane  
(Looking Northeast)

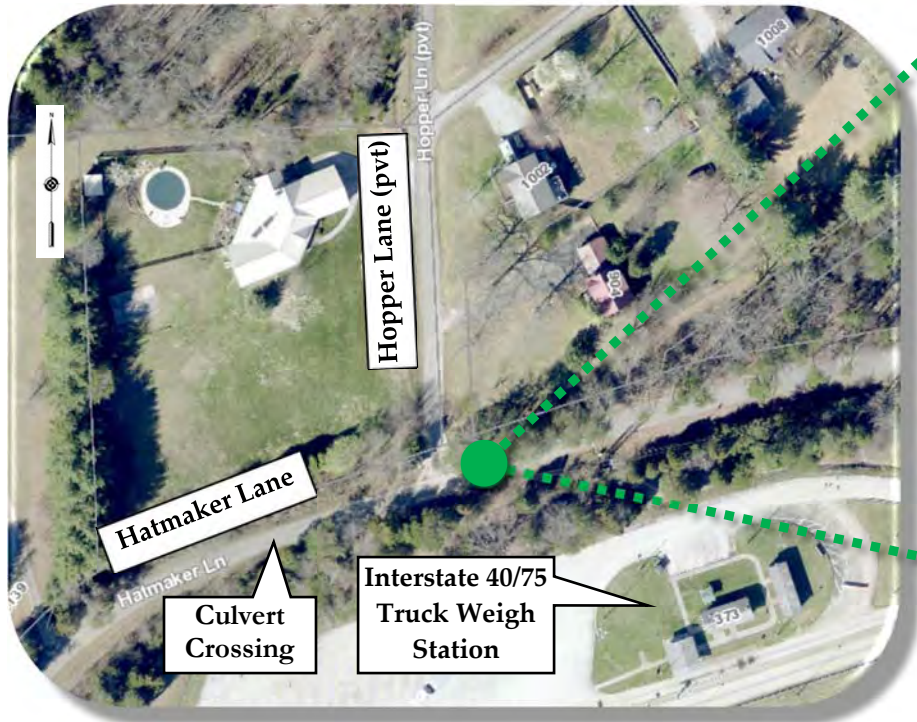


View of Hatmaker Lane  
(Looking Southwest)



Section 47+50 Information:  
Pavement Width = 20' - 9"

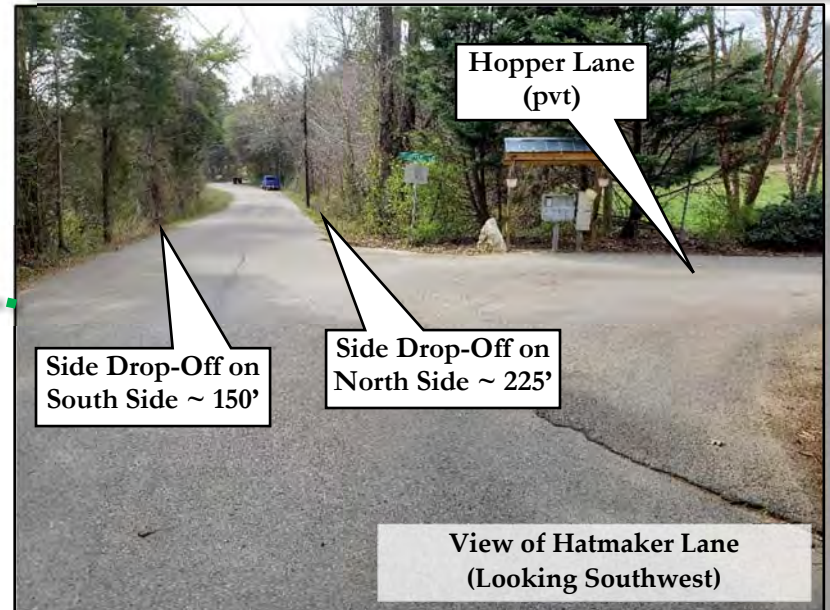
64



Section 47+50 – Hatmaker Lane



View of Hatmaker Lane  
(Looking Northeast)

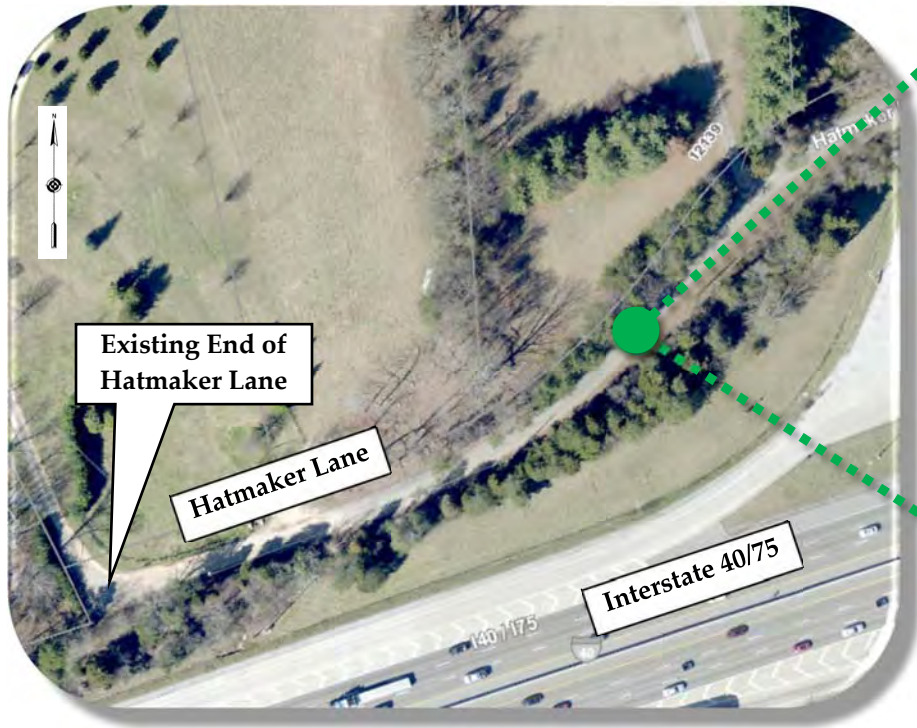


View of Hatmaker Lane  
(Looking Southwest)



Section 52+50 Information:  
Pavement Width = 19' - 6"

65



Section 52+50 – Hatmaker Lane



View of Hatmaker Lane  
(Looking Northeast)

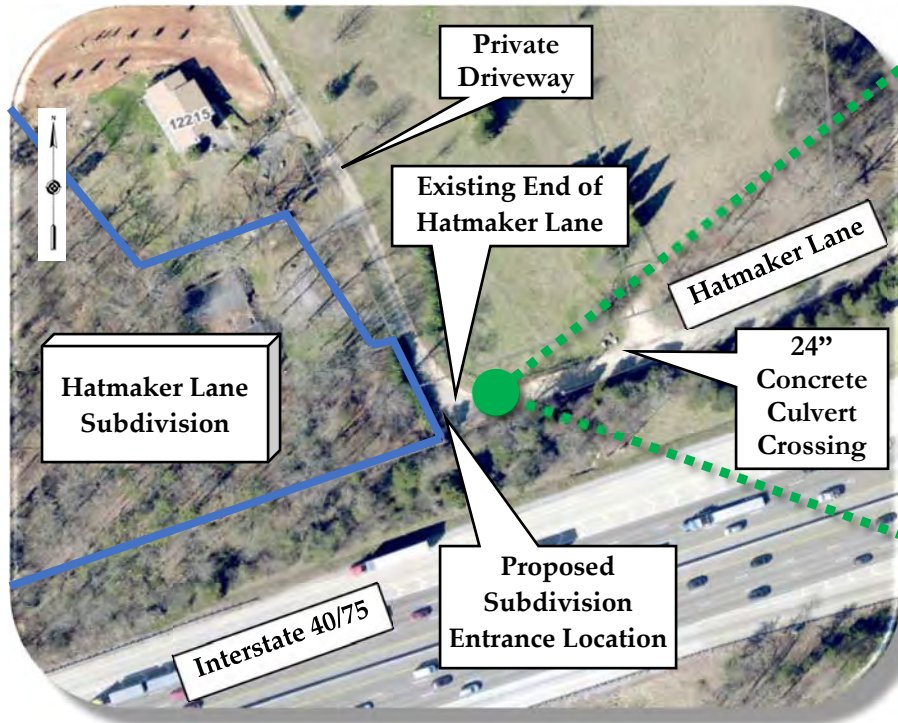


View of Hatmaker Lane  
(Looking Southwest)



Section 57+50 Information:  
Pavement Width = 20' - 0"

99



Section 57+50 – End of Hatmaker Lane





## CONCLUSIONS & RECOMMENDATIONS

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




**North Campbell Station Road at Fretz Road:** Once the Hatmaker Lane Subdivision and all of the other residential developments on Fretz Road and Hatmaker Lane are completed and occupied, the Fretz Road approach with one shared left/right-turn lane is projected to operate at LOS F (AM peak hour) and E (PM peak hour) in the year 2026 as shown in Tables 8a and 8b. Even though the vast majority of turns at this approach will be right-turns towards the south, the few motorists making left-turns will impede right-turn movements due to small gaps in traffic on North Campbell Station Road due to the projected large volumes on North Campbell Station Road.

To remediate this projected situation, it is recommended that a left-turn lane with 75 feet of storage be constructed on Fretz Road at North Campbell Station Road to separate the smaller left-turn volumes from the larger amounts of right-turn movements. The taper length is recommended to be a minimum of 120 feet. The threshold point for this turn lane is estimated to be once 72 houses are constructed and occupied in the Hatmaker Lane Subdivision. This intersection is under the Town of Farragut jurisdiction; thus, the Town will control when and how the separate left-turn lane on Fretz Road should be installed.

With all these proposed residential developments and entering the housing market, it is difficult to predict when this lane will be needed. To simplify the estimate, it was assumed that all the other new subdivisions are fully build-out and occupied prior to the Hatmaker Lane Subdivision and the thru traffic with +3% growth up to the year 2026 on North Campbell Station Road is fully realized. The estimation of the threshold was determined by iteration. The iterative method inputted an increasing number of houses to determine the trips generated by the houses in the subdivision. The trips were then distributed, assigned, and applied to the capacity analysis up to the threshold point when the shared single lane on Fretz Road reached the LOS D/E boundary (35 seconds). These iterative calculations were conducted for the AM peak hour since this period has the greatest amount of left-turn movements on Fretz Road. Some of the iterative calculations are shown in Appendix I.

Once the remaining houses are constructed and occupied (~92 houses) in the Hatmaker Lane Subdivision by the year 2026, the Fretz Road approach will operate quite well for right-turn movements but will eventually reach LOS F for the left-turn lane movement based on the projections. The capacity analysis results of the projected conditions in the year 2026 will all the residential developments constructed and occupied with the recommended turn lanes are shown in Table 9. Even though it is projected that the eastbound left-turn lane will operate at LOS F in the PM peak hour, it is expected that it could operate slightly better due to the gaps created by the adjacent all-way stop at the intersection of North Campbell Station Road at Ridgeland Drive. To potentially save on construction costs and reduce construction delays, it is recommended that both the northbound left-turn lane and the eastbound left-turn lane be constructed concurrently.

**TABLE 9**  
**2026 INTERSECTION CAPACITY ANALYSIS RESULTS -**  
**N. CAMPBELL STATION ROAD AT FRETZ ROAD**  
**OPENING YEAR (WITH PROJECT AND EB LEFT-TURN LANE)**

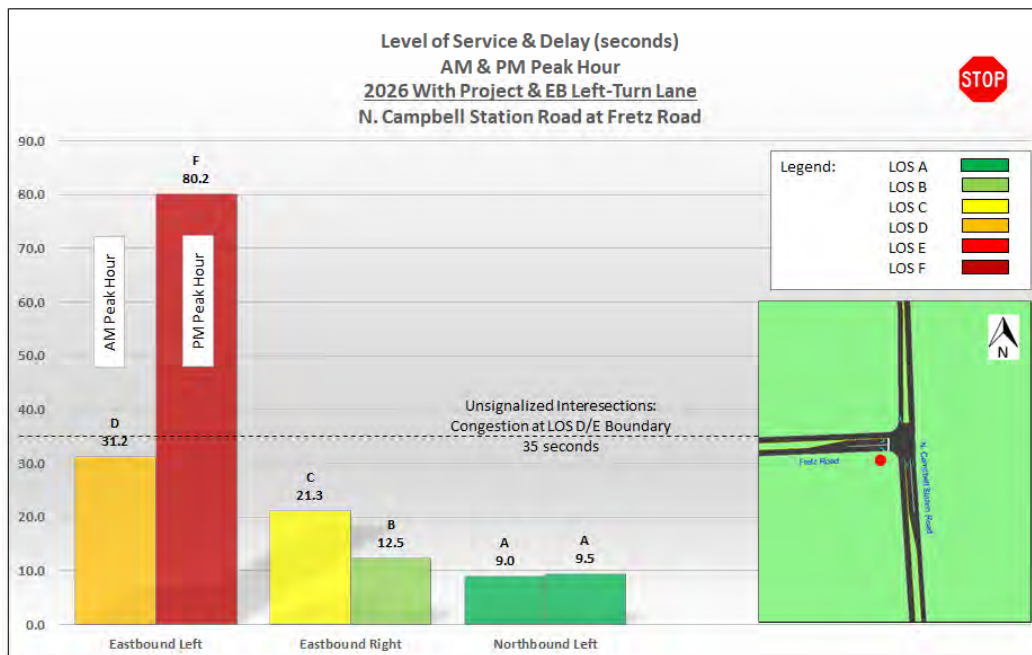
INTERSECTION	TRAFFIC CONTROL	APPROACH/MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
N. Campbell Station Road at Fretz Road	 Unsignalized	Eastbound Left	D	31.2	0.330	F	80.2	0.500
		Eastbound Right	C	21.3	0.610	B	12.5	0.290
		Northbound Left	A	9.0	0.130	A	9.5	0.310

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2000 intersection methodology

<sup>a</sup> Level of Service

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

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





While a LOS F for the eastbound left-turn lane will be less-than-optimal, overall, most vehicles at this approach will be turning right. Despite the poor LOS results for this turn lane, mitigation for this turn lane based on low volumes would not be justified. For this situation, where there are much fewer left-turn movements, the more appropriate metric would be to investigate the projected queue lengths for the proposed left-turn lane operating at LOS F.

The proposed left-turn lane projected queue lengths on Fretz Road in the year 2026 were calculated to determine if the proposed storage length of 75 feet is adequate while operating at LOS F. To estimate the left-turn lane queue lengths, SimTraffic (Version 8) software was employed to perform micro-simulation and animation of vehicular traffic. This software calculates various vehicle parameters such as intersection vehicle queue lengths. Based on the projected volumes, the 95th percentile queue distance was calculated. The 95th percentile queue is the recognized measurement in the traffic engineering profession as the design standard used when considering vehicle queue lengths. A 95th percentile queue means that there is a 95% certainty the queue will not extend beyond that point. The calculated queue results were based on averaging the outcome obtained during 10 traffic simulations. The queue results from the SimTraffic software are shown in Appendix J and summarized in Table 10. Based on these results, the proposed 75-foot left-turn storage length on Fretz Road to accommodate the projected 2026 traffic volumes is adequate. The 95<sup>th</sup> percentile queue length is projected to be longest in the AM peak hour at 52 feet. This would correlate to two standard-sized passenger vehicles at most.

**TABLE 10**  
**TURN LANE STORAGE & VEHICLE QUEUE SUMMARY -**  
**2026 PROJECTED PEAK HOUR TRAFFIC VOLUMES**

INTERSECTION	APPROACH/ MOVEMENT	PROPOSED STORAGE (ft)	95% QUEUE (ft)		ADEQUATE STORAGE
			AM	PM	
N. Campbell Station Road at Fretz Road	Eastbound Left	75	52	43	YES
	Eastbound Right	-	98	72	N/A
	Northbound Left	75 *	53	76	NO
	Southbound Thru/Right	-	2	8	N/A

\* 75-foot northbound left-turn lane on North Campbell Station Road recommended in previous studies

Note: 95% queues were calculated in SimTraffic 8 software

With general traffic growth and the imminent residential developments occurring along Fretz Road and Hatmaker Lane, this report agrees with the previous traffic impact studies for Windsor Forest and Towering Oaks that recommended a northbound left-turn lane be constructed on North Campbell Station Road at the intersection of Fretz Road. The threshold for triggering the construction of the northbound left-turn lane was determined to be 47 houses in the Windsor Forest Subdivision. The threshold for the Towering Oaks Subdivision was determined to be 46 houses. These thresholds were independent of each other since the studies did not take into account the other developments. Based on the current status of these developments, it appears that the Windsor Forest Subdivision will reach its threshold first. This development, at the time of this study, has about 2 dozen homes under construction and is much further along than the Towering Oaks Subdivision. The Towering Oaks Subdivision has yet to begin any construction.

The previous studies recommended a northbound left-turn lane with 75 feet of storage on North Campbell Station Road. However, as shown in Table 10, the calculated 95<sup>th</sup> percentile queue length for the northbound left-turn lane is 76 feet in the year 2026. While this is just over 75 feet, to ensure enough storage capacity on this heavily traveled roadway, it is recommended that an additional 25 feet (approximately one standard-sized passenger vehicle length) be added to this left-turn lane for a total storage length of 100 feet. There are spacing constraints on North Campbell Station in between Fretz Road and the next road to the south, Campbell Park Lane. With this constraint, the taper length is recommended to be a minimum of 120 feet.





**Fretz Road / Hatmaker Lane:** Fretz Road / Hatmaker Lane will be the only access roads in between the proposed residential development and outside destinations. The previous traffic impact studies recommended that Fretz Road and Hatmaker Lane be widened. For Windsor Forest, the study recommended that Fretz Road be widened to 20 feet from Woodhollow Lane (Brandywine at Turkey Creek Subdivision) to the proposed entrance for Windsor Forest (Lillibridge Crossing Lane). This widening was recently completed.

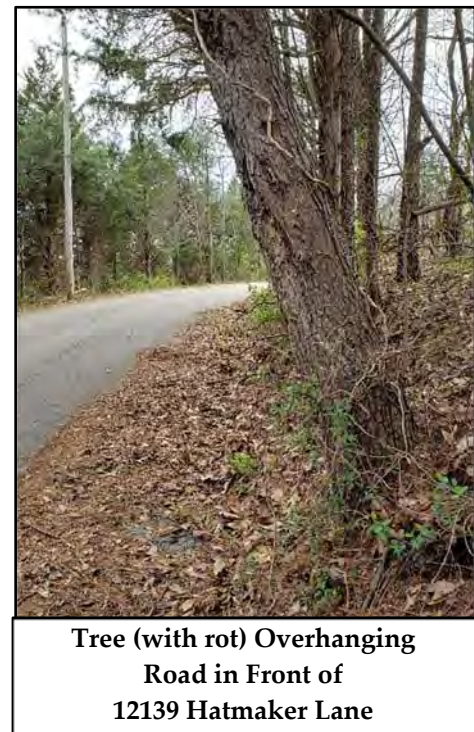
The traffic study for Towering Oaks (formerly October Park) recommended that the pavement width along Fretz Road and Hatmaker Lane in between Woodhollow Lane (Brandywine at Turkey Creek Subdivision) to the proposed entrance for Towering Oaks be widened to 18 feet. However, the subdivision was just approved by the Planning Commission (3/12/2020) subject to 12 conditions with one of them being that Fretz Road and Hatmaker Lane be widened to 20 feet in between Lillibridge Crossing Lane to the subdivision entrance on Hatmaker Lane. Based on the concept plan for Towering Oaks, the entrance for this subdivision is approximately 3,000 feet from the intersection of Fretz Road at Lillibridge Crossing Lane. As shown in Figure 10, there are several road sections less than 20 feet (corresponds closely to Station 0+00 to Station 30+00) in between Lillibridge Crossing Lane and the proposed entrance for Towering Oaks.

- 2a) To provide continuity of the road width, it is recommended that this minimum width of 20 feet be continued along Hatmaker Lane past the Towering Oaks Subdivision entrance to the new Hatmaker Lane Subdivision. Based on the road width measurements during the field review past the proposed Towering Oaks Subdivision entrance, Hatmaker Lane already has a road width of 20 feet or greater except around Station 50+00 – Station 52+50 which corresponds to +/-250 feet. These reduced pavement widths exist to the west of the intersection of Hatmaker Lane at Hopper Lane. There may be other locations not measured on Hatmaker Lane where the pavement is less than 20 feet, but the vast majority is already above this minimum.



**Road Pavement and Edge Obscured  
due to Organic Debris**

It should be noted that Hatmaker Lane has more pavement width than at first glance due to organic material build-up (leaves, pine needles, etc.) on the edge of the road due to low traffic volumes and probably due to motorists tendency to travel more towards the center of the road due to the lack of conflicting opposite traffic on Hatmaker Lane. General maintenance of the sides of Hatmaker Lane and the road surface needs attention. The organic debris needs to be removed from the road surface and there is also gravel spillage from some of the residential driveways that need to be addressed. Also, two trees on Hatmaker Lane were noted as being hazardous due to leaning and/or encroaching within the roadway. One of these trees is just to the west of 12101 Hatmaker Lane and one is in front of 12139 Hatmaker Lane.



- 2b) Another recommendation that was presented in the previous traffic study for Towering Oaks included a reference to an existing need for improving road safety on Hatmaker Lane. The study pointed out that there are sizable drop-offs on the side of Hatmaker Lane and that they should be addressed by further evaluation and installing “signs, markings or guardrail along the north side of Hatmaker Lane”. In addition to the drop-offs on the north side in the vicinity of the proposed Towering Oaks Subdivision, there are also considerable drop-offs on the south side of Hatmaker Lane



in between the road and the Interstate. Of particular concern is the north side of Hatmaker Lane adjacent to the stormwater detention pond that has been constructed for the Windsor Forest Subdivision. The pond is located adjacent to Hatmaker Lane and there are no barriers or shoulder areas for an errant motorist to self-correct or avoid falling down the drop-off and potentially end up in the



**North Side of Hatmaker Lane Adjacent to Stormwater Detention Pond for Windsor Forest**

pond water impoundment. There are also a few drop-offs on both sides of Hatmaker Lane further west of the proposed Towering Oaks Subdivision. These drop-off locations are shown in the photographs and information on pages 55-66.

As recommended in the previous study for the Towering Oaks Subdivision, further evaluation should be made by the County to determine the appropriate means and locations to install traffic signage, guardrails, and/or pavement markings along Hatmaker Lane. There should be identification and removal or relocation of roadside hazards (ditches, drop-offs, utility poles, and trees).

- 2c) As discussed earlier in the report, the intersection sight distance at Hatmaker Lane and Hopper Lane needs to be improved. Vegetation needs to be removed and maintained in the future. Additionally, vegetation is obscuring the Stop Sign (R1-1) for the Hopper Lane approach and needs to be removed and maintained.



**Stop Sign (R1-1) Obscured at Hopper Lane Approach at Hatmaker Lane**

- 2d) It is recommended that the Turn Sign (W1-1R) to the north of the 90° horizontal curve at the transition between Fretz Road and Hatmaker Lane be replaced and the vegetation be removed and maintained. This sign is damaged and obscured by vegetation.



**Turn Sign (W1-1R) Obscured and Damaged –  
Located Prior to 90° Horizontal Curve  
(Looking South)**

- 2e) It is recommended that a Turn Sign (W1-1L) be installed for motorists traveling east on Hatmaker Lane prior to the 90° horizontal curve at the transition between Fretz Road and Hatmaker Lane.



**W1-1L**

- 2f) Once all areas of Fretz Road and Hatmaker Lane are widened to 20 feet, it is recommended that the County consider striping the centerline with double yellow lines and applying white edge lines.

- 2g) It is recommended that the large expanse of pavement at the 90° horizontal curve be delineated if the County decides not to apply white edge lines on Fretz Road and Hatmaker Lane. The roadway delineation is recommended to be a white edge line or other pavement marking that is appropriate as directed by Knox County Engineering.



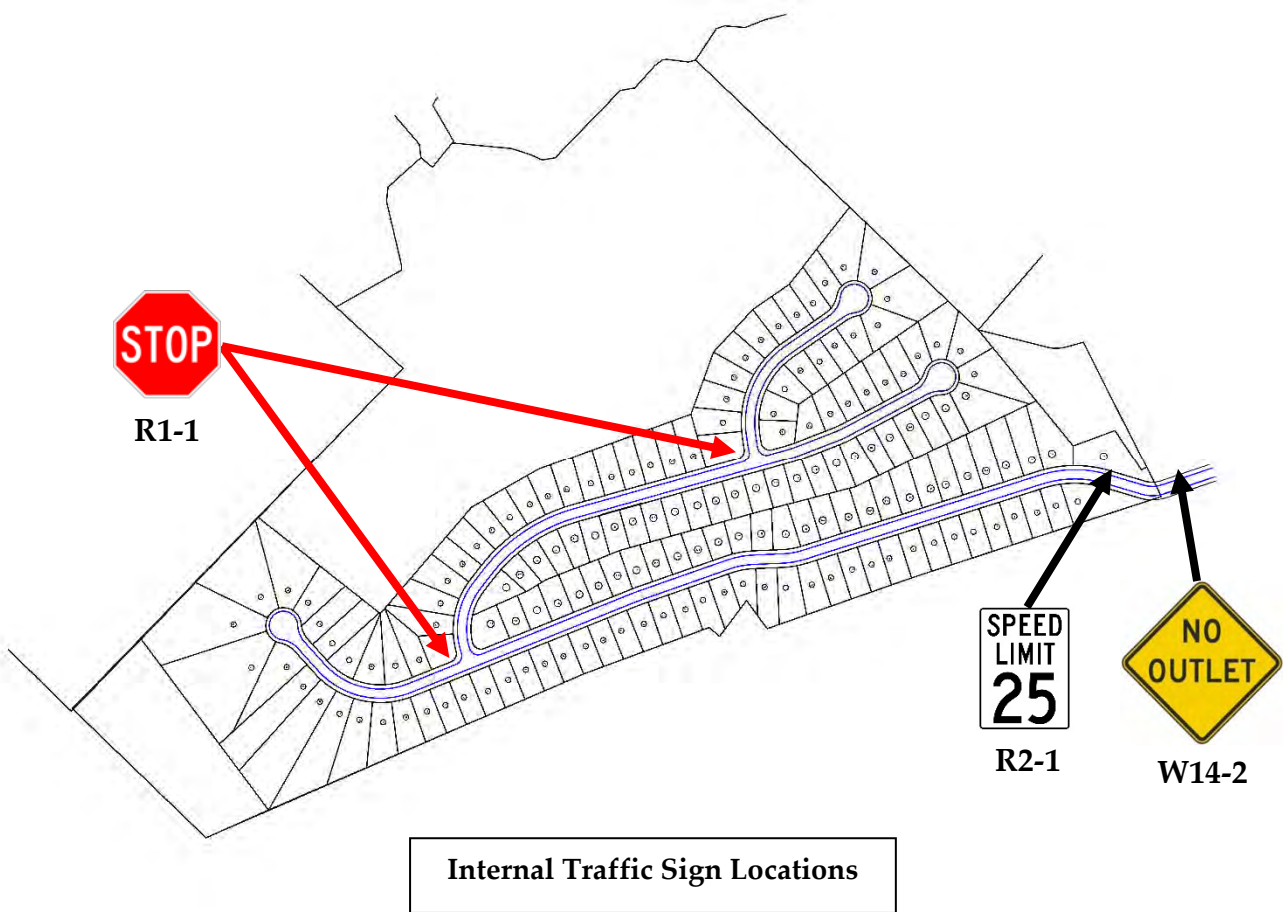
**Large Expanse of Asphalt Pavement at  
90° Horizontal Curve  
(Looking South)**





**Hatmaker Lane Subdivision Internal Roads:** The current concept plan shows three new streets being constructed within the development as shown in Figure 4.

- 3a) It is recommended that a 25-mph speed limit sign and a No Outlet Sign (W14-2) be posted on Road "A" for vehicles traveling into the new residential subdivision.
- 3b) Stop Signs (R1-1) and white stop bars should be installed at the locations as shown below:



- 3c) Sight distance at the new intersections in the Hatmaker Lane Subdivision must not be impacted by new signage or future landscaping. For a posted speed limit of 25-mph in the subdivision, the intersection sight distance requirement is 250 feet. The stopping sight distance required is 155 feet for a level road grade. The road layout designer should ensure that these sight distance lengths are met, and they should be labeled on the plans.

- 3d) All drainage grates and covers for the residential development need to be pedestrian and bicycle safe.
- 3e) Sidewalks are not shown on the concept plan. If the development does install internal sidewalks, they should have appropriate ADA compliant curbed ramps at intersection corners and the sidewalks are recommended to be 5 feet minimum in width.

3f) The United States Postal Service (USPS) has recently implemented changes to its guidelines for delivery in new residential subdivisions. If directed by the local post office, the designer should include an area within the development with a parking area for a centralized mail delivery center.



**Centralized USPS Delivery Center**

3g) All road grade and intersection elements internally and externally should be designed to AASHTO, TDOT, and Knox County specifications and guidelines to ensure proper operation.



**APPENDIX A**

**HISTORICAL TRAFFIC COUNT DATA**

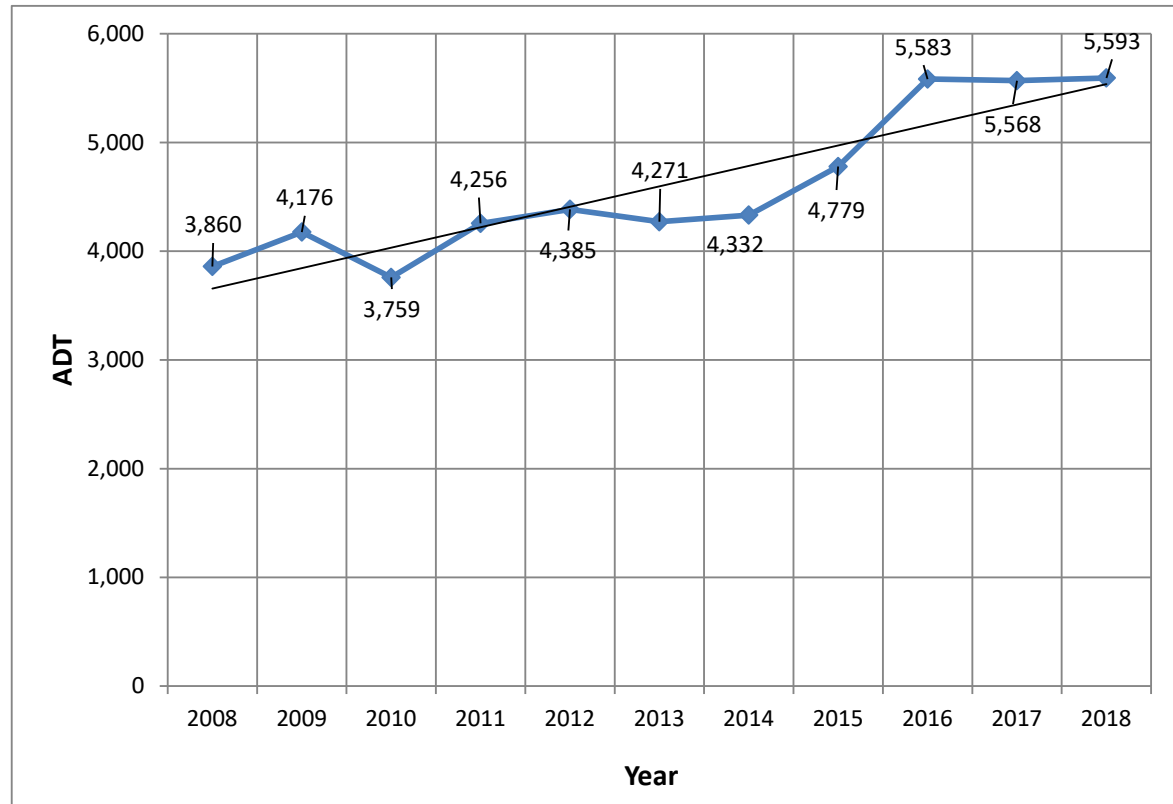
## Historical Traffic Counts

Organization: TDOT

Station ID #: 000303

Location: N. Campbell Station Road (south of Yarnell Road)

YEAR	ADT	Trendline
2008	3,860	
2009	4,176	
2010	3,759	
2011	4,256	
2012	4,385	
2013	4,271	
2014	4,332	
2015	4,779	
2016	5,583	
2017	5,568	
2018	5,593	



2008 - 2018 Growth Rate = 44.9%

Average Annual Growth Rate = 3.8%



TN TDOT Department of Transportation Traffic History Help

Find address or place

(1 of 2)

Station Number: 000303  
Knox County, NEAR LOUDON CO LINE  
Route: 01277

AADT by year:

2018	= 5,593
2017	= 5,568
2016	= 5,583
2015	= 4,779
2014	= 4,332
2013	= 4,271
2012	= 4,385
2011	= 4,256
2010	= 3,759
2009	= 4,176
2008	= 3,860

Zoom to

0.2mi  
-84.20035, 919 Degrees

Esri, HERE, Garmin, FAO, USGS, NGA, EPA, NPS

All rights reserved


## **APPENDIX B**

### **WALK SCORE**



# WALKSCORE

(from walkscore.com)


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




[Go](#)

---


**12205 Hatmaker Lane** [Add scores to your site](#)

Knoxville, Tennessee, 37932

Commute to **Downtown Farragut** 

 9 min  26 min  60+ min [View Routes](#)

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


[More about 12205 Hatmaker Lane](#) 

**Walk Score**  
**1**  
**Car-Dependent**  
Almost all errands require a car.

**Transit Score**  
**0**  
**Minimal Transit**  
It is possible to get on a bus.

**Bike Score**  
**6**  
**Somewhat Bikeable**  
Minimal bike infrastructure.

[About your score](#)



## Scores for 12205 Hatmaker Lane



## Scores for 12205 Hatmaker Lane



Walk Score	Transit Score	Bike Score
------------	---------------	------------

Transit Score measures how well a location is served by public transit based on the distance and type of nearby transit lines.

90-100	<b>Rider's Paradise</b> World-class public transportation
70-89	<b>Excellent Transit</b> Transit is convenient for most trips
50-69	<b>Good Transit</b> Many nearby public transportation options
25-49	<b>Some Transit</b> A few nearby public transportation options
0-24	<b>Minimal Transit</b> It is possible to get on a bus



## Scores for 12205 Hatmaker Lane



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

## Travel Time Map

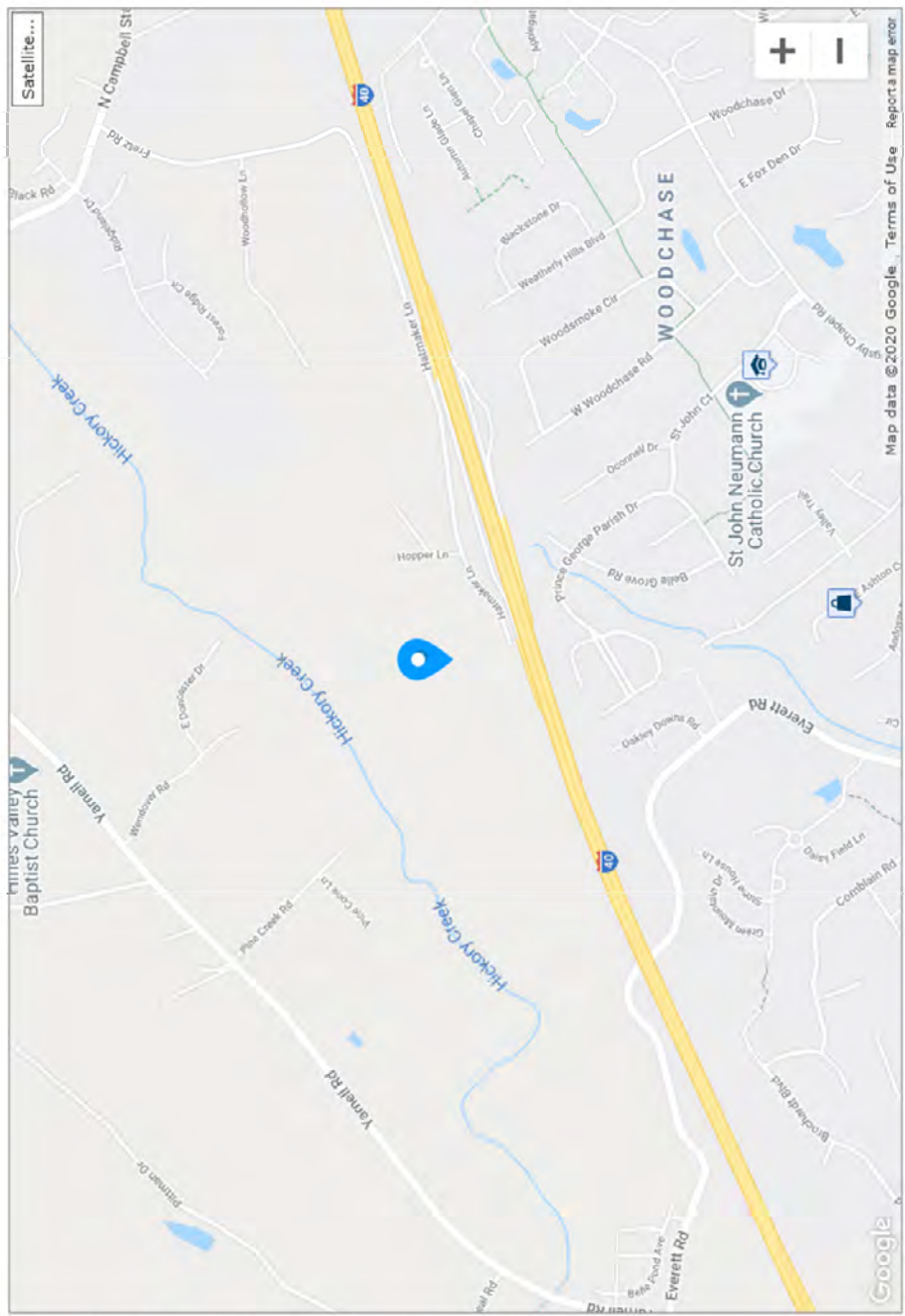
[Add to your site](#)

Explore how far you can travel by car, bus, bike and foot from 12205 Hatmaker Lane.



## What's Nearby

- Restaurants:**
  - LongHorn Steakhouse 1.3mi
- Coffee:**
  - Starbucks 1.9mi
- Bars:**
  - Big Kahuna Wings 2mi
- Groceries:**
  - Campbell Station Wine & Spiri... 1.5mi
- Parks:**
  - Hickory Creek Park 2.9mi
- Schools:**
  - Saint John Neumann Catholic ... .7mi
- Shopping:**
  - Knoxville Landscaping Compa... .7mi
- Entertainment:**
  - Redbox 1.9mi
- Errands:**
  - Walgreens 1.6mi
- Search Nearby:**

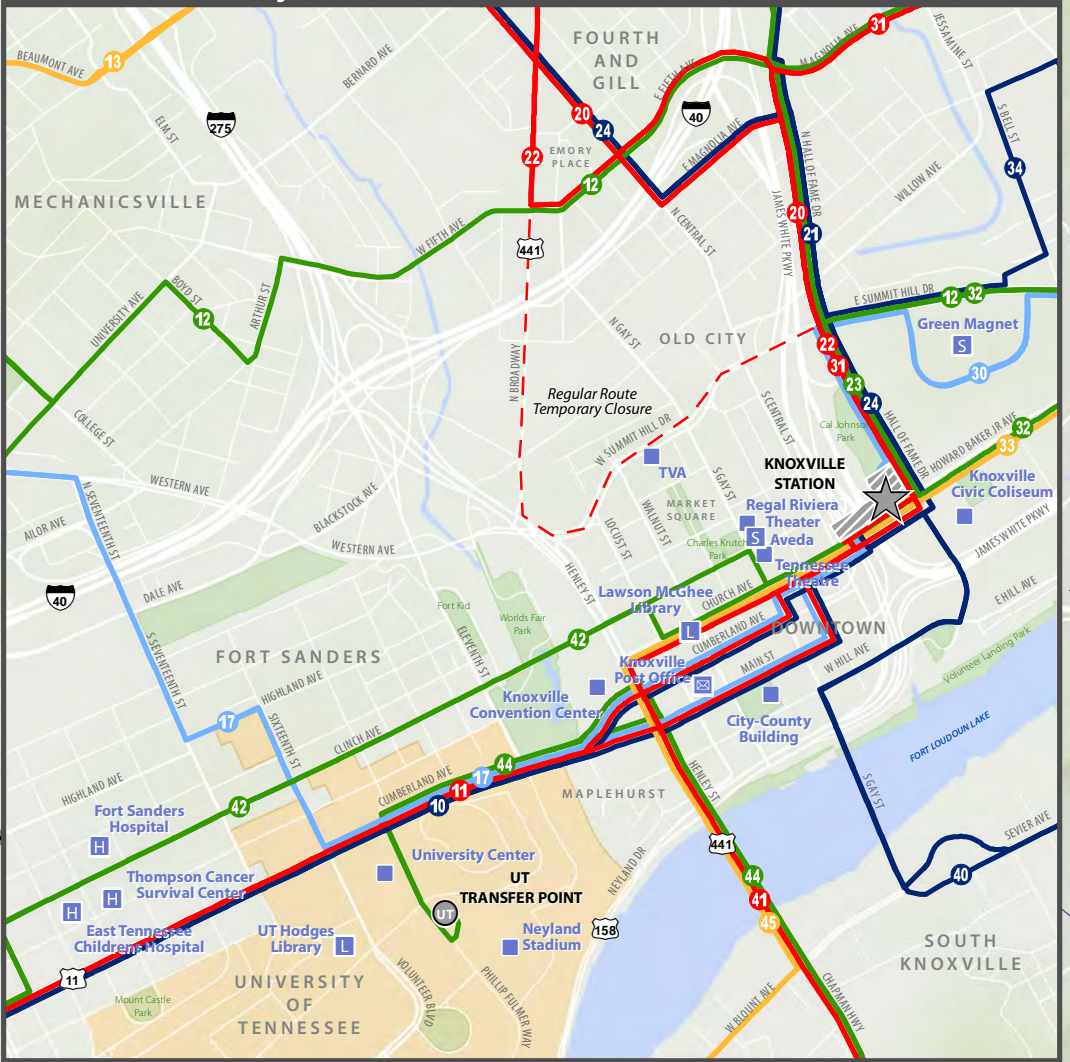


**APPENDIX C**

**KNOXVILLE AREA TRANSIT MAP AND INFORMATION**



# Knoxville City Center



**Legend**

- Transfer Point
- Lift Service Area Boundary

**Points of Interest**

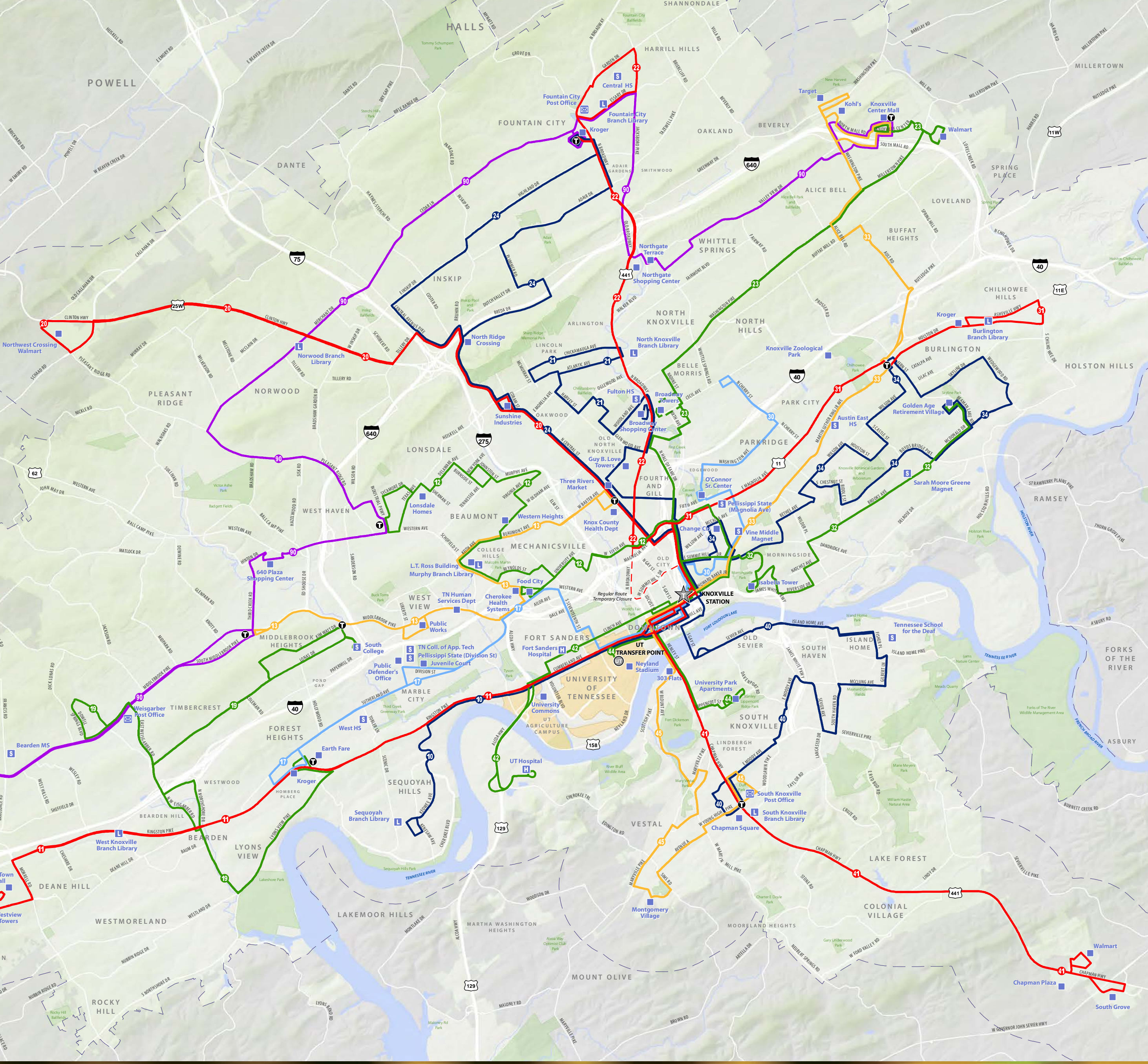
- Hospital
- Library
- Post Office
- School
- Point of Interest

**Distances**

0 5 10 Minutes Walking

0 5 10 Minutes Biking

0 0.5 1 Map Scale in Miles



## FARE INFORMATION

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

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

### REDUCED FARE INFORMATION

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

### BUS STOPS ONLY!

KAT buses stop ONLY at locations designated by bus stop signs. Generally, bus stops are located at least every 1/4 mile along the route.

### KAT HOLIDAYS

KAT buses do not run on the following holidays:

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

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

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

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

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



# 16 CEDAR BLUFF CONNECTOR

(Weekdays and Saturdays)



### Legend

- Route Timepoint
- Transfer Point
- Bus Stop

### Points of Interest

- Hospital
- Library
- Point of Interest
- Post Office
- School
- Park & Ride

0      0.25      0.5

Miles



# CEDAR BLUFF CONNECTOR

(Weekdays and Saturdays)

## SERVES:

- ★ Cedar Bluff
- ★ Knoxville Catholic High School
- ★ Kroger at The Landing
- ★ Parkwest Hospital
- ★ Social Security Administration
- ★ Walmart
- ★ Windsor Square



Information Updated: January 6, 2020

Going from Wal Mart to Windsor Square				Going from Windsor Square to Wal Mart			
<b>T</b> Transfer to:							Rts. 11 & 90
Walmart	Park Village at Woodpark	Parkwest Hospital	Windsor Square	Parkwest Hospital	Cedar Bluff at Fox Lonas	Walmart	
①	②	③	④	⑤	⑥	⑦	
WEEKDAY SCHEDULE							
A.M.	6:15	6:27	6:32	6:42	6:50	6:54	7:10
	7:15	7:27	7:32	7:42	7:50	7:54	8:10
	8:15	8:27	8:32	8:42	8:50	8:54	9:10
	9:15	9:27	9:32	9:42	9:50	9:54	10:10
	10:15	10:27	10:32	10:42	10:50	10:54	11:10
	11:15	11:27	11:32	11:42	11:50	11:54	<b>12:10</b>
P.M.	<b>12:15</b>	<b>12:27</b>	<b>12:32</b>	<b>12:42</b>	<b>12:50</b>	<b>12:54</b>	<b>1:10</b>
	1:15	1:27	1:32	1:42	1:50	1:54	2:10
	2:15	2:27	2:32	2:42	2:50	2:54	3:10
	3:15	3:27	3:32	3:42	3:50	3:54	4:10
	4:15	4:27	4:32	4:42	4:50	4:54	5:10
	5:15	5:27	5:32	5:42	5:50	5:54	6:10
	6:15	6:27	6:32	6:42	6:50	6:54	7:10
	7:15	7:27	7:32	7:42	7:50	7:54	8:10
	8:15	8:27	8:32	8:42	8:50	8:54	9:10
	9:15	9:27	9:32	9:42	9:50	9:54	10:10
SATURDAY SCHEDULE							
A.M.	7:15	7:27	7:32	7:42	7:50	7:54	8:10
	8:15	8:27	8:32	8:42	8:50	8:54	9:10
	9:15	9:27	9:32	9:42	9:50	9:54	10:10
	10:15	10:27	10:32	10:42	10:50	10:54	11:10
	11:15	11:27	11:32	11:42	11:50	11:54	<b>12:10</b>
P.M.	<b>12:15</b>	<b>12:27</b>	<b>12:32</b>	<b>12:42</b>	<b>12:50</b>	<b>12:54</b>	<b>1:10</b>
	1:15	1:27	1:32	1:42	1:50	1:54	2:10
	2:15	2:27	2:32	2:42	2:50	2:54	3:10
	3:15	3:27	3:32	3:42	3:50	3:54	4:10
	4:15	4:27	4:32	4:42	4:50	4:54	5:10
	5:15	5:27	5:32	5:42	5:50	5:54	6:10
	6:15	6:27	6:32	6:42	6:50	6:54	7:10
	7:15	7:27	7:32	7:42	7:50	7:54	8:10
	8:15	8:27	8:32	8:42	8:50	8:54	9:10
	9:15	9:27	9:32	9:42	9:50	9:54	10:10

Need help reading this schedule?

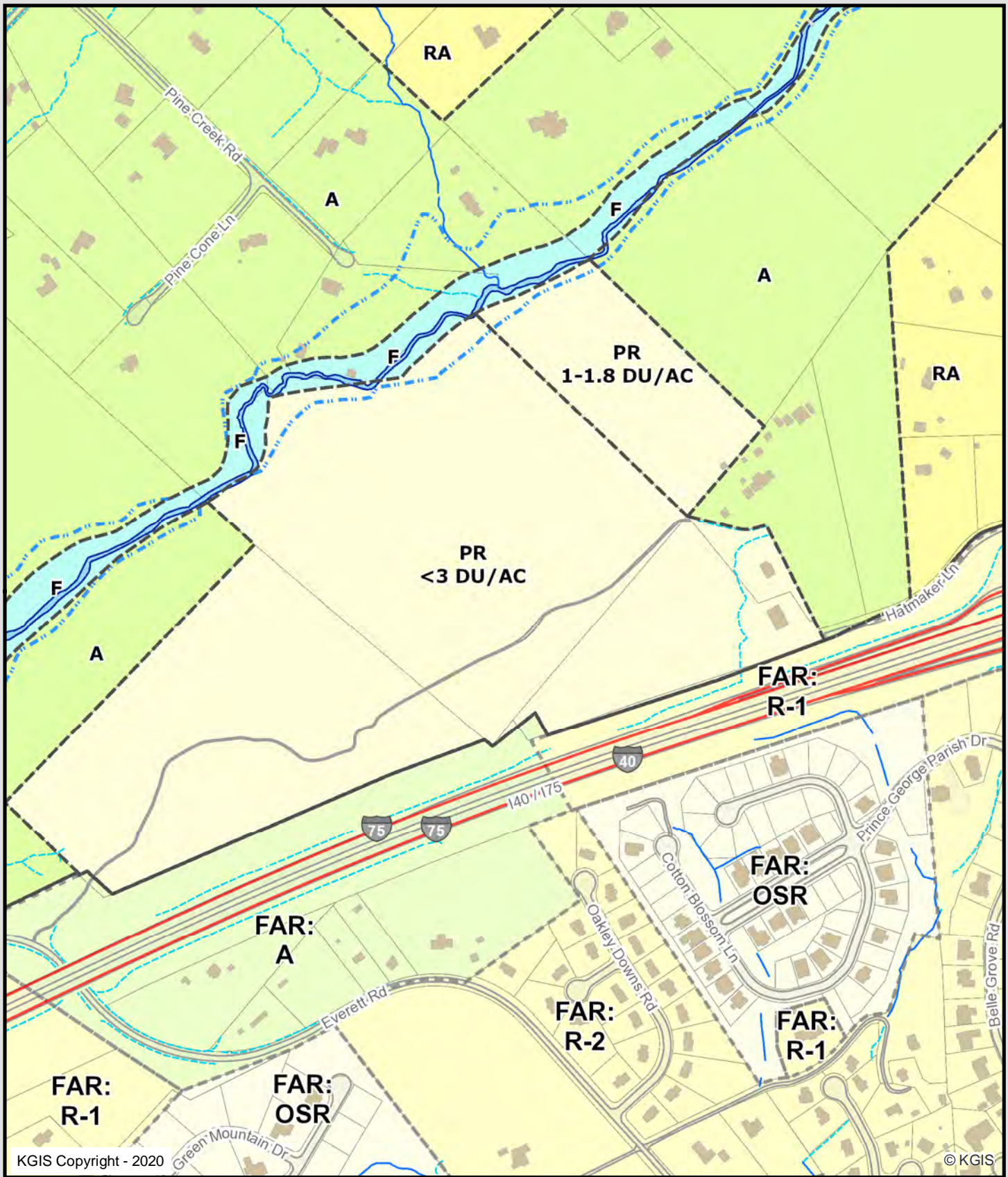
Need other general information on how to ride?

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



**APPENDIX D**

**ZONING MAP**



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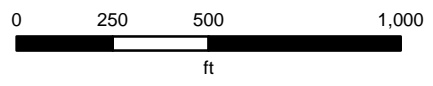
## Hatmaker Lane Subdivision

Zoning Map

Knoxville - Knox County - KUB Geographic Information System



Printed: 3/17/2020 at 12:56:57 PM



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**APPENDIX E**

**MANUAL TRAFFIC COUNT DATA**

**TRAFFIC COUNT DATA**

Major Street: North Campbell Station Road (NB-SB)  
 Minor Street: Fretz Road (EB)  
 Traffic Control: Stop Control on Minor Street

3/4/2020 (Wednesday)  
 Partly Cloudy/Mild  
 Conducted by: Ajax Engineering

TIME BEGIN	N. Campbell Station Road		N. Campbell Station Road		Fretz Road		VEHICLE TOTAL	PEAK HOUR
	SOUTHBOUND		NORTHBOUND		EASTBOUND			
	THRU	RT	LT	THRU	LT	RT		
7:00 AM	46	0	2	37	0	1	86	
7:15 AM	74	2	4	35	2	14	131	7:15 AM - 8:15 AM
7:30 AM	83	0	11	49	1	7	151	
7:45 AM	107	1	9	50	3	7	177	
8:00 AM	83	4	6	65	1	9	168	
8:15 AM	65	4	3	41	1	8	122	
8:30 AM	49	1	7	37	2	8	104	
8:45 AM	43	1	1	33	1	7	86	
TOTAL	550	13	43	347	11	61	1025	
3:00 PM	45	1	15	53	2	4	120	
3:15 PM	49	0	8	73	1	8	139	
3:30 PM	67	1	2	83	0	7	160	
3:45 PM	75	4	10	59	0	6	154	
4:00 PM	81	1	6	65	2	10	165	
4:15 PM	58	1	11	77	0	9	156	
4:30 PM	70	2	4	69	1	5	151	
4:45 PM	51	1	12	68	4	10	146	
5:00 PM	60	2	8	70	0	5	145	5:00 PM - 6:00 PM
5:15 PM	68	2	11	92	1	7	181	
5:30 PM	74	0	2	75	2	7	160	
5:45 PM	71	0	10	84	0	3	168	
TOTAL	769	15	99	868	13	81	1845	

**2020 AM Peak Hour** **7:15 AM - 8:15 AM**

TIME BEGIN	N. Campbell Station Road		N. Campbell Station Road		Fretz Road	
	SOUTHBOUND		NORTHBOUND		EASTBOUND	
	THRU	RT	LT	THRU	LT	RT
7:15 AM	74	2	4	35	2	14
7:30 AM	83	0	11	49	1	7
7:45 AM	107	1	9	50	3	7
8:00 AM	83	4	6	65	1	9
TOTAL	347	7	30	199	7	37
PHF	0.81	0.44	0.68	0.77	0.58	0.66

**2020 PM Peak Hour** **5:00 PM - 6:00 PM**

TIME BEGIN	N. Campbell Station Road		N. Campbell Station Road		Fretz Road	
	SOUTHBOUND		NORTHBOUND		EASTBOUND	
	THRU	RT	LT	THRU	LT	RT
3:30 PM	60	2	8	70	0	5
3:45 PM	68	2	11	92	1	7
4:00 PM	74	0	2	75	2	7
4:15 PM	71	0	10	84	0	3
TOTAL	273	4	31	321	3	22
PHF	0.92	0.50	0.70	0.87	0.38	0.79



## **APPENDIX F**

### **CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 8)**

## EXISTING TRAFFIC CONDITIONS



# HCM Unsignalized Intersection Capacity Analysis

## 4: N. Campbell Station Road & Fretz Road

3/12/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	7	37	30	199	347	7
Sign Control	Stop			Free	Free	
Grade	4%			0%	0%	
Peak Hour Factor	0.58	0.66	0.68	0.77	0.81	0.44
Hourly flow rate (vph)	12	56	44	258	428	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	783	436	444			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	783	436	444			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	91	96			
cM capacity (veh/h)	347	620	1116			
<b>Direction, Lane #</b>						
	EB 1	NB 1	SB 1			
Volume Total	68	303	444			
Volume Left	12	44	0			
Volume Right	56	0	16			
cSH	544	1116	1700			
Volume to Capacity	0.13	0.04	0.26			
Queue Length 95th (ft)	11	3	0			
Control Delay (s)	12.6	1.6	0.0			
Lane LOS	B	A				
Approach Delay (s)	12.6	1.6	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			1.6			
Intersection Capacity Utilization		44.2%		ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: N. Campbell Station Road & Fretz Road

3/12/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	3	22	31	321	273	4
Sign Control	Stop			Free	Free	
Grade	4%			0%	0%	
Peak Hour Factor	0.38	0.79	0.70	0.87	0.92	0.50
Hourly flow rate (vph)	8	28	44	369	297	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	758	301	305			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	758	301	305			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	96	96			
cM capacity (veh/h)	361	739	1256			
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	36	413	305			
Volume Left	8	44	0			
Volume Right	28	0	8			
cSH	600	1256	1700			
Volume to Capacity	0.06	0.04	0.18			
Queue Length 95th (ft)	5	3	0			
Control Delay (s)	11.4	1.2	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.4	1.2	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			1.2			
Intersection Capacity Utilization		46.6%		ICU Level of Service		A
Analysis Period (min)			15			

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



# HCM Unsignalized Intersection Capacity Analysis

## 4: N. Campbell Station Road & Fretz Road

3/12/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	26	151	68	235	409	13
Sign Control	Stop			Free	Free	
Grade	4%			0%	0%	
Peak Hour Factor	0.58	0.66	0.68	0.77	0.81	0.44
Hourly flow rate (vph)	45	229	100	305	505	30
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1025	520	534			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1025	520	534			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	81	59	90			
cM capacity (veh/h)	235	556	1033			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	274	100	305	534
Volume Left	45	100	0	0
Volume Right	229	0	0	30
cSH	454	1033	1700	1700
Volume to Capacity	0.60	0.10	0.18	0.31
Queue Length 95th (ft)	97	8	0	0
Control Delay (s)	24.2	8.9	0.0	0.0
Lane LOS	C	A		
Approach Delay (s)	24.2	2.2		0.0
Approach LOS	C			

Intersection Summary			
Average Delay		6.2	
Intersection Capacity Utilization		46.8%	ICU Level of Service A
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 4: N. Campbell Station Road & Fretz Road

3/12/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	11	100	163	379	322	18
Sign Control	Stop			Free	Free	
Grade	4%			0%	0%	
Peak Hour Factor	0.38	0.79	0.70	0.87	0.92	0.50
Hourly flow rate (vph)	29	127	233	436	350	36
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1269	368	386			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1269	368	386			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	80	81	80			
cM capacity (veh/h)	148	677	1172			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	156	233	436	386
Volume Left	29	233	0	0
Volume Right	127	0	0	36
cSH	407	1172	1700	1700
Volume to Capacity	0.38	0.20	0.26	0.23
Queue Length 95th (ft)	44	18	0	0
Control Delay (s)	19.2	8.8	0.0	0.0
Lane LOS	C	A		
Approach Delay (s)	19.2	3.1		0.0
Approach LOS	C			

Intersection Summary			
Average Delay		4.2	
Intersection Capacity Utilization		43.9%	ICU Level of Service A
Analysis Period (min)		15	

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



# HCM Unsignalized Intersection Capacity Analysis

## 4: N. Campbell Station Road & Fretz Road

3/27/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	39	224	92	235	409	17
Sign Control	Stop			Free	Free	
Grade	4%			0%	0%	
Peak Hour Factor	0.58	0.66	0.68	0.77	0.81	0.44
Hourly flow rate (vph)	67	339	135	305	505	39
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1100	524	544			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1100	524	544			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	67	39	87			
cM capacity (veh/h)	203	553	1025			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	407	135	305	544		
Volume Left	67	135	0	0		
Volume Right	339	0	0	39		
cSH	430	1025	1700	1700		
Volume to Capacity	0.94	0.13	0.18	0.32		
Queue Length 95th (ft)	274	11	0	0		
Control Delay (s)	61.8	9.0	0.0	0.0		
Lane LOS	F	A				
Approach Delay (s)	61.8	2.8		0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			19.0			
Intersection Capacity Utilization			53.6%	ICU Level of Service	A	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: N. Campbell Station Road & Fretz Road

3/27/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	17	151	249	379	322	28
Sign Control	Stop			Free	Free	
Grade	4%			0%	0%	
Peak Hour Factor	0.38	0.79	0.70	0.87	0.92	0.50
Hourly flow rate (vph)	45	191	356	436	350	56
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1525	378	406			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1525	378	406			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	50	71	69			
cM capacity (veh/h)	89	668	1153			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	236	356	436	406
Volume Left	45	356	0	0
Volume Right	191	0	0	56
cSH	300	1153	1700	1700
Volume to Capacity	0.79	0.31	0.26	0.24
Queue Length 95th (ft)	155	33	0	0
Control Delay (s)	49.9	9.5	0.0	0.0
Lane LOS	E	A		
Approach Delay (s)	49.9	4.3		0.0
Approach LOS	E			

Intersection Summary			
Average Delay		10.6	
Intersection Capacity Utilization		52.7%	ICU Level of Service A
Analysis Period (min)		15	

**OPENING YEAR TRAFFIC CONDITIONS (WITH PROJECT AND EB LEFT-TURN LANE)**



# HCM Unsignalized Intersection Capacity Analysis

## 4: N. Campbell Station Road & Fretz Road

3/27/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	39	224	92	235	409	17
Sign Control	Stop			Free	Free	
Grade	4%			0%	0%	
Peak Hour Factor	0.58	0.66	0.68	0.77	0.81	0.44
Hourly flow rate (vph)	67	339	135	305	505	39
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1100	524	544			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1100	524	544			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	67	39	87			
cM capacity (veh/h)	203	553	1025			
Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	
Volume Total	67	339	135	305	544	
Volume Left	67	0	135	0	0	
Volume Right	0	339	0	0	39	
cSH	203	553	1025	1700	1700	
Volume to Capacity	0.33	0.61	0.13	0.18	0.32	
Queue Length 95th (ft)	34	103	11	0	0	
Control Delay (s)	31.2	21.3	9.0	0.0	0.0	
Lane LOS	D	C	A			
Approach Delay (s)	23.0		2.8		0.0	
Approach LOS	C					
Intersection Summary						
Average Delay			7.6			
Intersection Capacity Utilization			43.1%		ICU Level of Service	A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: N. Campbell Station Road & Fretz Road

3/27/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	17	151	249	379	322	28
Sign Control	Stop			Free	Free	
Grade	4%			0%	0%	
Peak Hour Factor	0.38	0.79	0.70	0.87	0.92	0.50
Hourly flow rate (vph)	45	191	356	436	350	56
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1525	378	406			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1525	378	406			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	50	71	69			
cM capacity (veh/h)	89	668	1153			
Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	
Volume Total	45	191	356	436	406	
Volume Left	45	0	356	0	0	
Volume Right	0	191	0	0	56	
cSH	89	668	1153	1700	1700	
Volume to Capacity	0.50	0.29	0.31	0.26	0.24	
Queue Length 95th (ft)	54	29	33	0	0	
Control Delay (s)	80.2	12.5	9.5	0.0	0.0	
Lane LOS	F	B	A			
Approach Delay (s)	25.4		4.3	0.0		
Approach LOS	D					
Intersection Summary						
Average Delay			6.5			
Intersection Capacity Utilization			45.8%	ICU Level of Service	A	
Analysis Period (min)			15			

**APPENDIX G**

**ITE TRIP GENERATION RATES**



# Land Use: 210

## Single-Family Detached Housing

### Description

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

### Additional Data

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

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

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

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

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

### Source Numbers

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

# Single-Family Detached Housing (210)

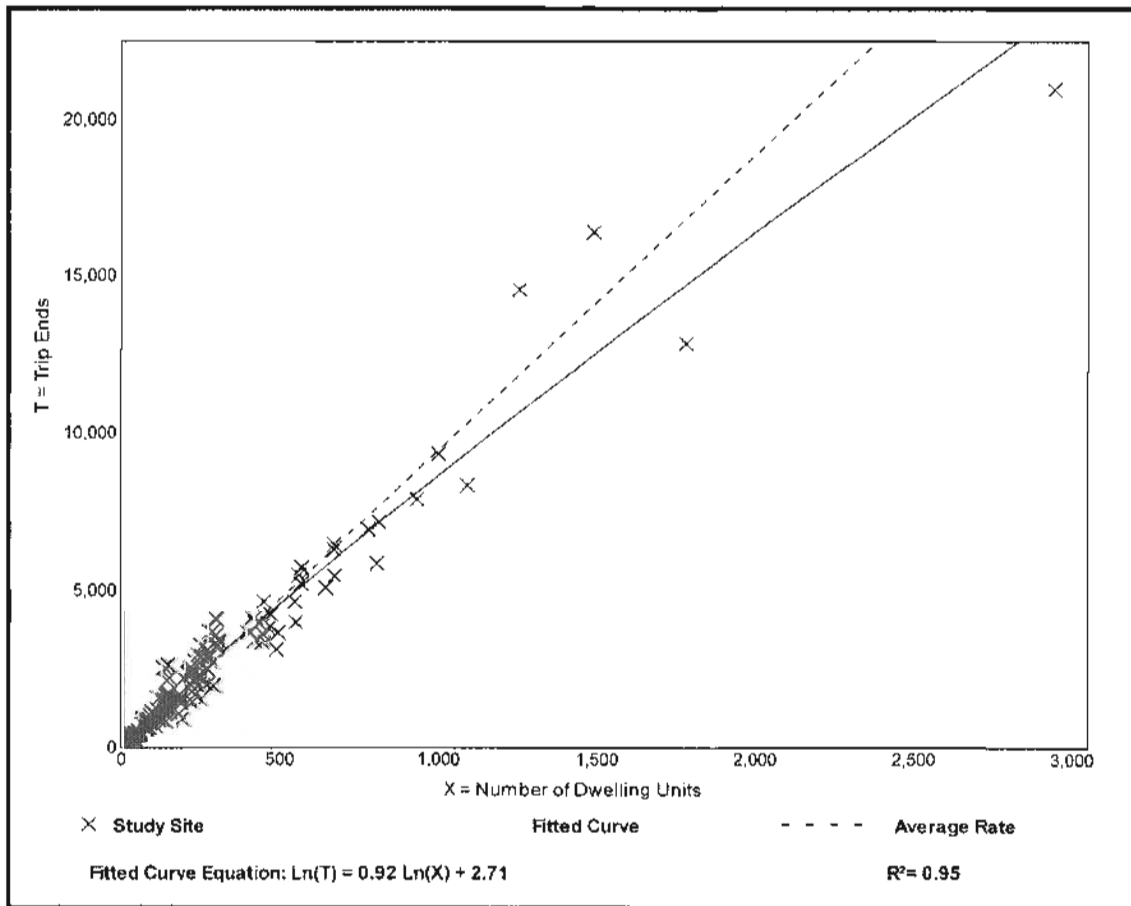
Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday

Setting/Location: General Urban/Suburban  
Number of Studies: 159  
Avg. Num. of Dwelling Units: 264  
Directional Distribution: 50% entering, 50% exiting

### Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.44	4.81 - 19.39	2.10

### Data Plot and Equation



# Single-Family Detached Housing (210)

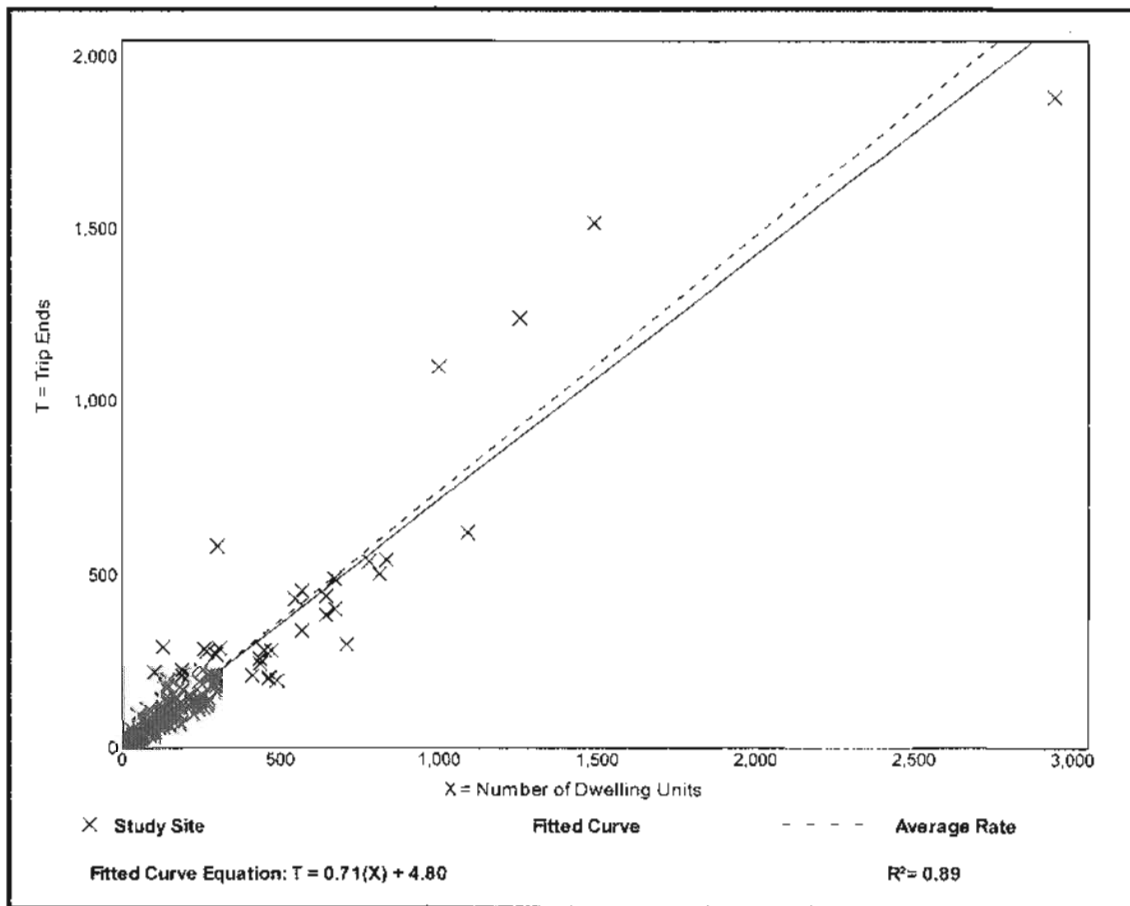
**Vehicle Trip Ends vs: Dwelling Units**  
**On a: Weekday,**  
**Peak Hour of Adjacent Street Traffic,**  
**One Hour Between 7 and 9 a.m.**

**Setting/Location: General Urban/Suburban**  
 Number of Studies: 173  
 Avg. Num. of Dwelling Units: 219  
 Directional Distribution: 25% entering, 75% exiting

### Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.74	0.33 - 2.27	0.27

### Data Plot and Equation





# Single-Family Detached Housing (210)

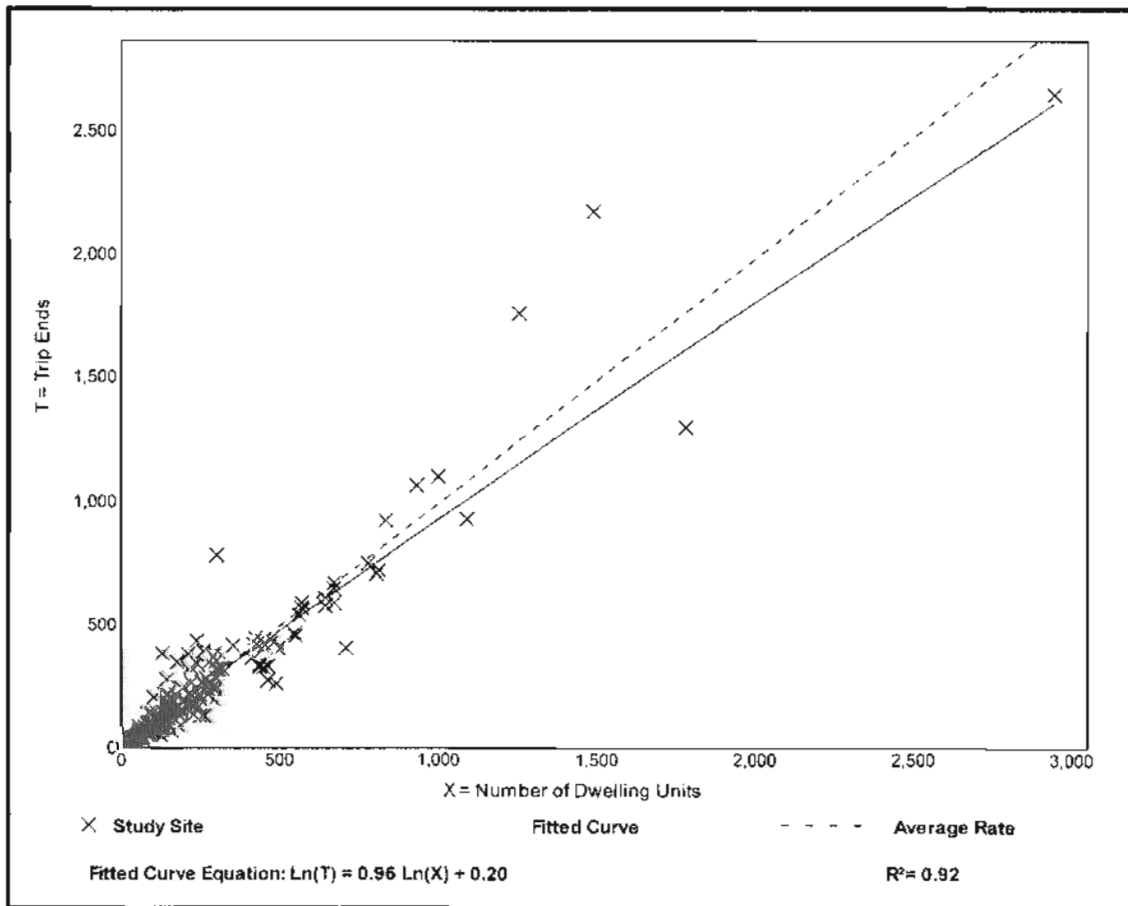
Vehicle Trip Ends vs: Dwelling Units  
 On a: Weekday,  
 Peak Hour of Adjacent Street Traffic,  
 One Hour Between 4 and 6 p.m.

Setting/Location: General Urban/Suburban  
 Number of Studies: 190  
 Avg. Num. of Dwelling Units: 242  
 Directional Distribution: 63% entering, 37% exiting

## Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.99	0.44 - 2.98	0.31

## Data Plot and Equation



**TRIP GENERATION FOR HATMAKER LANE SUBDIVISION**

**153 Single-Family Detached Houses**

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	153 Houses	1,538	25%	75%		63%	37%	
				28	86	114	96	57	153
Total New Volume Site Trips			<b>1,538</b>	<b>28</b>	<b>86</b>	<b>114</b>	<b>96</b>	<b>57</b>	<b>153</b>

ITE Trip Generation Manual, 10th Edition

Trips calculated by using Fitted Curve Equation

## TRIP GENERATION FOR HATMAKER LANE SUBDIVISION

### 153 Single-Family Detached Houses

153 Residential Houses = X

---

#### Weekday:

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

$$\ln(T) = 0.92 * 5.03 + 2.71$$

$$\ln(T) = 7.34$$

$$\underline{\underline{T = 1,538 \text{ trips}}}$$

---

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

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

$$T = 0.71 * 153 + 4.80$$

$$\underline{\underline{T = 114 \text{ trips}}}$$

---

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

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

$$\ln(T) = 0.96 * 5.03 + 0.20$$

$$\ln(T) = 5.03$$

$$\underline{\underline{T = 153 \text{ trips}}}$$



**TRIP GENERATION FOR OTHER RESIDENTIAL SUBDIVISIONS ON FRETZ ROAD AND HATMAKER LANE**

**21 Single-Family Detached Houses in Campbell Crossing Subdivision**

**121 Single-Family Detached Houses in Windsor Forest Subdivision**

**85 Single-Family Detached Houses in Towering Oaks Subdivision**

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	Campbell Crossing - 21 Houses	248	25%	75%		63%	37%	
				5	15	20	14	9	23
#210	Single-Family Detached Housing	Windsor Forest - 121 Houses	1,240	25%	75%		63%	37%	
				23	68	91	77	45	122
#210	Single-Family Detached Housing	Towering Oaks - 85 Houses	896	25%	75%		63%	37%	
				16	50	66	55	32	87
Total New Volume Site Trips			<b>2,384</b>	<b>44</b>	<b>133</b>	<b>177</b>	<b>146</b>	<b>86</b>	<b>232</b>

ITE Trip Generation Manual, 10th Edition

Trips calculated by using Fitted Curve Equation

## TRIP GENERATION FOR CAMPBELL CROSSING SUBDIVISION

### 21 Single-Family Detached Houses

21 Residential Houses = X

---

#### Weekday:

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

$$\ln(T) = 0.92 * 3.04 + 2.71$$

$$\ln(T) = 5.51$$

$$\underline{\underline{T = 248 \text{ trips}}}$$

---

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

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

$$T = 0.71 * 21 + 4.80$$

$$\underline{\underline{T = 20 \text{ trips}}}$$

---

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

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

$$\ln(T) = 0.96 * 3.04 + 0.20$$

$$\ln(T) = 3.12$$

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

## TRIP GENERATION FOR WINDSOR FOREST

### 121 Single-Family Detached Houses

121 Residential Houses = X

---

#### Weekday:

Fitted Curve Equation:  $\text{Ln}(T) = 0.92 \text{Ln}(X) + 2.71$

$$\text{Ln}(T) = 0.92 * 4.80 + 2.71$$

$$\text{Ln}(T) = 7.12$$

$$\underline{\underline{T = 1,240 \text{ trips}}}$$

---

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

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

$$T = 0.71 * 121 + 4.80$$

$$\underline{\underline{T = 91 \text{ trips}}}$$

---

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

Fitted Curve Equation:  $\text{Ln}(T) = 0.96 \text{Ln}(X) + 0.2$

$$\text{Ln}(T) = 0.96 * 4.80 + 0.20$$

$$\text{Ln}(T) = 4.80$$

$$\underline{\underline{T = 122 \text{ trips}}}$$



## TRIP GENERATION FOR TOWERING OAKS

### 85 Single-Family Detached Houses

85 Residential Houses = X

---

#### Weekday:

Fitted Curve Equation:  $\text{Ln}(T) = 0.92 \text{Ln}(X) + 2.71$

$$\text{Ln}(T) = 0.92 * 4.44 + 2.71$$

$$\text{Ln}(T) = 6.80$$

$$\underline{\underline{T = 896 \text{ trips}}}$$

---

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

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

$$T = 0.71 * 85 + 4.80$$

$$\underline{\underline{T = 66 \text{ trips}}}$$

---

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

Fitted Curve Equation:  $\text{Ln}(T) = 0.96 \text{Ln}(X) + 0.2$

$$\text{Ln}(T) = 0.96 * 4.44 + 0.20$$

$$\text{Ln}(T) = 4.46$$

$$\underline{\underline{T = 87 \text{ trips}}}$$

**APPENDIX H**

**KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS**

TABLE 5A

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

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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	65	55	45	40	30
500 - 549	70	60	45	40	35	25
550 - 599	65	55	40	35	30	25
600 - 649	60	45	35	30	25	20
650 - 699	55	35	30	25	20	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25	25	20	20

North Campbell  
Station Road at Fretz  
Road  
  
2026 Projected AM  
NB Left Turns = 92  
  
Turn Lane  
Warranted

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149	70	60	50	45	40	35
150 - 199	60	55	45	40	35	30
200 - 249	55	50	40	35	30	30
250 - 299	50	45	35	30	30	30
300 - 349	45	40	35	30	25	25
350 - 399	40	35	30	25	25	20
400 - 449	35	30	30	25	20	20
450 - 499	30	25	25	20	20	20
500 - 549	25	25	20	20	20	15
550 - 599	25	20	20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	15	15	15

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



TABLE 5B

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

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

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

409

17

North Campbell  
Station Road at Fretz  
Road  
  
2026 Projected AM  
SB Right Turns = 17  
  
Turn Lane NOT  
Warranted

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

TABLE 5A

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

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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	65	55	45	40	30
500 - 549	70	60	45	35	30	25
550 - 599	65	55	40	30	25	20
600 - 649	60	45	35	25	20	15
650 - 699	55	35	30	20	15	10
700 - 749	50	35	30	20	15	10
750 or More	45	35	25	20	15	10

North Campbell  
Station Road at Fretz  
Road  
  
2026 Projected AM  
NB Left Turns = 249  
  
Turn Lane  
Warranted

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149	70	60	50	45	40	35
150 - 199	60	55	45	40	35	30
200 - 249	55	50	40	35	30	30
250 - 299	50	45	35	30	30	30
300 - 349	45	40	35	30	25	25
350 - 399	40	35	30	25	25	20
400 - 449	35	30	30	25	20	20
450 - 499	30	25	25	20	20	20
500 - 549	25	25	20	20	20	15
550 - 599	25	20	20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	15	15	15

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

TABLE 5B

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

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *							
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399		
Fewer Than 25 25 - 49 50 - 99					322			
100 - 149 150 - 199		North Campbell Station Road at Fretz Road  2026 Projected AM SB Right Turns = 28  Turn Lane NOT Warranted						
200 - 249 250 - 299						Yes	Yes	Yes
300 - 349 350 - 399						Yes	Yes	Yes
400 - 449 450 - 499						Yes	Yes	Yes
500 - 549 550 - 599	Yes	Yes	Yes	Yes	Yes	Yes		
600 or More	Yes	Yes	Yes	Yes	Yes	Yes		

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

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



## **APPENDIX I**

### **TRIP GENERATION ITERATIONS**

**TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT TO DETERMINE TRIGGER POINT FOR EB LEFT-TURN LANE**

70 HOUSES ADDS THE FOLLOWING TO THE INTERSECTION OF NORTH CAMPBELL STATION ROAD AT FRETZ ROAD:

55 TRIPS IN AM PEAK	25% ENTER =	14	75% EXIT =	41	FRETZ ROAD EB SHARED LT/RT LANE: LOS D - 34.7 SEC
	85% NB LT	12	15% EB LT	6	
	15% SB RT	2	85% EB RT	35	
73 TRIPS IN PM PEAK	63% ENTER =	46	37% EXIT =	27	
	90% NB LT	41	10% EB LT	3	
	10% SB RT	5	90% EB RT	24	

**72 HOUSES ADDS THE FOLLOWING TO THE INTERSECTION OF NORTH CAMPBELL STATION ROAD AT FRETZ ROAD:**

56 TRIPS IN AM PEAK	25% ENTER =	14	75% EXIT =	42	FRETZ ROAD EB SHARED LT/RT LANE: <b>LOS D - 34.9 SEC</b>
	85% NB LT	12	15% EB LT	6	
	15% SB RT	2	85% EB RT	36	
75 TRIPS IN PM PEAK	63% ENTER =	47	37% EXIT =	28	
	90% NB LT	43	10% EB LT	3	
	10% SB RT	4	90% EB RT	25	

**75 HOUSES ADDS THE FOLLOWING TO THE INTERSECTION OF NORTH CAMPBELL STATION ROAD AT FRETZ ROAD:**

59 TRIPS IN AM PEAK	25% ENTER =	15	75% EXIT =	44	FRETZ ROAD EB SHARED LT/RT LANE: LOS E - 36.4 SEC
	85% NB LT	13	15% EB LT	6	
	15% SB RT	2	85% EB RT	38	
78 TRIPS IN PM PEAK	63% ENTER =	49	37% EXIT =	29	
	90% NB LT	44	10% EB LT	3	
	10% SB RT	5	90% EB RT	26	

## **APPENDIX J**

### **SIMTRAFFIC QUEUING AND BLOCKING REPORTS**



Intersection: 4: N. Campbell Station Road & Fretz Road

Movement	EB	EB	NB	SB
Directions Served	L	R	L	TR
Maximum Queue (ft)	61	120	63	2
Average Queue (ft)	26	58	26	0
95th Queue (ft)	52	98	53	2
Link Distance (ft)		417		283
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	75		100	
Storage Blk Time (%)	0	3	0	
Queuing Penalty (veh)	0	1	0	

Network Summary

Network wide Queuing Penalty: 2

Intersection: 4: N. Campbell Station Road & Fretz Road

Movement	EB	EB	NB	SB
Directions Served	L	R	L	TR
Maximum Queue (ft)	47	92	94	13
Average Queue (ft)	16	43	44	1
95th Queue (ft)	43	72	76	8
Link Distance (ft)		417		283
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	75		100	
Storage Blk Time (%)	0	1	0	
Queuing Penalty (veh)	0	0	0	

Network Summary

Network wide Queuing Penalty: 1

**APPENDIX K**

RESPONSE LETTER TO ADDRESS REVIEW COMMENTS





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

April 23, 2020

**PROJECT NAME:** Hatmaker Lane Subdivision TIS

**TO:** Knoxville-Knox County Planning

**SUBJECT:** TIS Comment Response Document for Hatmaker Lane Subdivision  
(5-SB-20-C & 5-F-20-UR – S & E Properties, LLC) –  
Review Comments dated April 17, 2020

Dear Knoxville-Knox County Planning Staff:

The following comment response document is submitted to address comments dated April 17, 2020.

1. **Reviewer Comment 18a:** Page i- The title of the major heading on page 24 is **TRAFFIC ANALYSIS OF EXISTING AND PROPOSED CONDITIONS** instead of **“PROJECTED CONDITIONS”**

**Response:** The heading on Page 24 was changed from “Proposed” to “Projected” to match Page i.

2. **Reviewer Comment 18b:** Page ii- APPENDIX E is labeled **MANUAL TRAFFIC COUNTS**

**Response:** On Page ii, Appendix E was changed to “Manual Traffic Count Data”.

3. **Reviewer Comment 18c:** Page 1- First bullet under **“Study Results”**- number of units is **153** instead of **164**.

**Response:** On Page 1, first bullet point, the number of units was corrected to 153.

4. **Reviewer Comment 18d:** Page 2- First bullet under “Recommendations”- identify the current approach of Fretz Road at N. Campbell Station Road.

Response: On Page 2, the first bullet point under “Recommendations”, the wording “at North Campbell Station Road” was added on the 4<sup>th</sup> line. This wording was also added to Page 67, 3<sup>rd</sup> paragraph, 2<sup>nd</sup> line.

5. **Reviewer Comment 18e:** Page 7- In the second to last sentence, the study mentions “One roadway light”. What type of roadway light? Is this a flashing roadway light or a utility roadway light? Please provide description on what it is.

Response: On Page 7 in the second to last sentence, the “One roadway light” was changed to “One utility pole streetlight”.

6. **Reviewer Comment 18f:** Pages 35-37- The volumes do not indicate the trip generation for the other sites. Are Figures 6b-6d supposed to show the consecutive traffic generated from each subdivision or just each individually?

Response: A sentence at the end of Page 34 was added to state “Figures 6b thru 6d show the projected traffic volumes generated by each individual subdivision separately.”

7. **Reviewer Comment 18g:** Page 38-

- i. Edit second line of first paragraph to “... Figure 6a plus the existing traffic entering and exiting Fretz Road at N. Campbell Station Road plus....”

Response: On Page 38, the second line of the 1<sup>st</sup> paragraph was changed to include “plus the existing traffic entering and exiting Fretz Road at North Campbell Station Road”.

- ii. Edit line 6 of second paragraph to specify Fretz Road at N. Campbell Station Road.

Response: On Page 38, the 5<sup>th</sup>-6<sup>th</sup> line and the last line of the 2<sup>nd</sup> paragraph was changed to include “on North Campbell Station Road at Fretz Road”.

8. **Reviewer Comment 18h:** Page 49- Second line under EVALUATION OF TURN LANE THRESHOLDS, specify that turn lane is on N. Campbell Station Road at Fretz Road.

Response: On Page 49, the second line under EVALUATION OF TURN LANE THRESHOLDS was changed to state that the turn lane is at “North Campbell Station Road at Fretz Road.”

9. **Reviewer Comment 18i:** Knox County will not pursue the 100 ft storage for the left-turn lane on N Campbell Station Rd since the analysis showed 76 ft, which is 1 ft from the next storage depth of 75 ft. Knox County will also not require separate left-and right-turn lanes on Fretz Road at N. Campbell Station Road since it leads to driver competition for sight distance.

Response: As Tarren Barrett, PE stated in a follow-up email (4/22/2020), the report recommendations for the extension of the 75-foot left-turn lane to 100 feet on North Campbell Station Road at Fretz Road and the 75-foot left-turn lane on Fretz Road at North Campbell Station Road are recommended by her to remain in the report. As stated by Ms. Barrett in this follow-up email, this intersection is within the Town of Farragut and will be up to their decision of when and how these modifications are made. As recommended, a statement noting this fact was added to the report on Page 2 in the 2<sup>nd</sup> bullet point and Page 67 at the end of the third paragraph.

10. **Reviewer Comment 18j:** There is potential that improvements (like widening, signage, guardrail on Hatmaker Lane, sight distance improvements for Hopper Lane, etc.) could have to be made to Hatmaker Lane from Towering Oaks Subdivision entrance to the proposed Hatmaker Lane Subdivision. Knox County will clean the edge of pavement to better ascertain the pavement width and conduct a field inventory of widths, drop-offs, sign/pavement marking needs and the like.

Response: No changes were made to the report based on this comment.

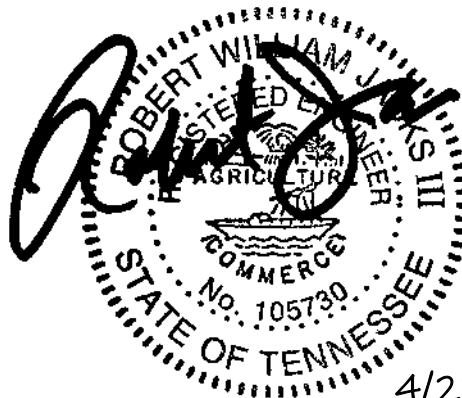
In addition to the requested revisions, other changes in the report include the following:

- Updated Title Page
- Updated Table of Contents
- Updated Page Footers
- Added Appendix K to include this response letter

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

Sincerely,

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



4/23/2020



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