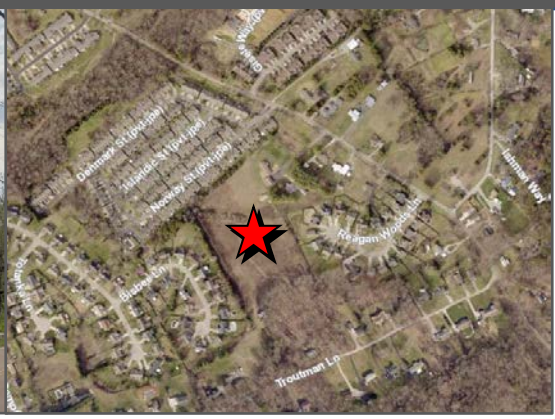
Transportation Impact Study
Andes Hill Subdivision
Knox County, Tennessee



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Prepared for:
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EXECUTIVE SUMMARY

Preface:

Turner Homes, LLC is proposing a residential development off Andes Road in West Knox County, TN. This proposed development is named "Andes Hill Subdivision". The development will include 95 multi-family attached townhouses on 10.6 +/- acres. It is anticipated to be fully built out and occupied by 2025 and proposes a single entrance on Andes Road. This study's primary purpose is to determine and evaluate the potential impacts of the development on the adjacent transportation system. The study includes a review of the primary access roads and intersections and is a Level 1 study established by Knoxville/Knox County Planning. (The developer also proposes three single-family detached houses on the south side of the 10.6-acre development property with separate individual driveways on Troutman Lane. These three houses are not included in the analysis since their transportation impact will be minimal and will not be connected to the development's proposed internal road system or entrance at Andes Road.) Recommendations and mitigation measures are offered if transportation operations are projected to be below recognized engineering standards.

Study Results:

The findings of this study include the following:

- The Andes Hill Subdivision with 95 multi-family attached townhouses is estimated to generate 911 trips on an average weekday at full build-out and occupancy. Of these daily trips, 51 are estimated to occur during the AM peak hour and 74 in the PM peak hour in 2025.
- The Proposed Entrance on Andes Road has been calculated in the projected 2025 conditions to operate with low vehicle delays in the AM and PM peak hours. Construction of separate entering left and right-turn lanes are not warranted on Andes Road at the Proposed Entrance. A single exiting lane for the development entrance at Andes Road will be sufficient.

Recommendations:

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

- It is recommended that a Stop Sign (R1-1) be installed, and a 24" white stop bar be applied to the Proposed Entrance approach at Andes Road. The stop bar should be applied a minimum of 4 feet away from the edge of the intersecting roadway and placed at the desired stopping point that maximizes the sight distance.
- Sight distances at the Proposed Entrance approach must not be impacted by future landscaping, signage, or vegetation. Based on a posted speed limit of 30-mph on Andes Road, the desirable intersection sight distance is 300 feet looking in each direction at each entrance. The required stopping sight distance is 195 feet looking to the north and 205 feet to the south at the Proposed Entrance. A visual inspection determined that the intersection and stopping sight distances are available. However, views to the north are reduced by existing roadway features. The site designer must ensure that these sight distances are accounted for and provided in the design plans. It is recommended that a registered land surveyor confirm that the sight distances are available at the Proposed Entrance location on Andes Road.
- The developer should request a variance to allow an intersection spacing of less than 300 feet on Andes Road. The Proposed Entrance on Andes Road will be 150 feet to the southeast of the existing intersection of Andes Road at Norway Street. It is not expected that traffic operations between the two intersections will be detrimental if this variance is approved.
- A 15-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the development entrance off Andes Road. It is recommended that a "No Outlet" Sign (W14-2a) be installed at the front of the subdivision at Andes Road. This sign can be installed below the street name sign.
- As shown in the report, a Stop Sign (R1-1) and a 24" white stop bar are recommended on the new internal roadway.
- Sight distance at the new internal road intersection must not be impacted by new signage, parked cars, or future landscaping. With a proposed speed limit of 15-mph in the development, the internal intersection sight distance is 170 feet. The required stopping sight distance is 80 feet for a level road grade. The site designer should ensure that internal sight distance lengths are met.

- Traffic calming measures may be needed to decrease internal vehicle speeds. The internal roadway has long and straight segments. It is recommended that the site designer consider installing speed humps or speed tables within the development to reduce internal speeds.
- All drainage grates and covers for the residential development must be pedestrian and bicycle safe.
- Sidewalks are proposed on one side of the internal roadway. Sidewalks should have appropriate ADA-compliant ramps at intersection corners, and the internal sidewalks are recommended to be 5 feet minimum in width to meet Knox County regulations. White crosswalks should be marked on the road pavement internally where pedestrians are expected to cross.
- If directed by the local post office, the site designer should include a parking area within the development for a centralized mail delivery center.
- All road grade and intersection elements should be designed to AASHTO, TDOT, and Knox County specifications and guidelines to ensure proper operation.

DESCRIPTION OF EXISTING CONDITIONS

- **STUDY AREA:**

The proposed location of this new residential development is shown on a map in Figure 1. This proposed development will be located off Andes Road between Cureton Road and Ball Camp Pike in West Knox County, TN, and will have a single entrance on Andes Road. This development will be located approximately 1,000 feet to the south of the Schaad Road Extension currently being constructed by Knox County. Transportation impacts associated with the proposed development were analyzed at the Proposed Entrance on Andes Road, as Knoxville/Knox County Planning requested.

View of Proposed Development Site
(Looking Southeast from North Side of Development Property)

The proposed development property is in a more rural area of West Knox County, TN, gradually being transformed into an area more suburbanized and residential in character. The development property is flag-shaped, bound by Andes Road to the northeast and Troutman Lane to the south.

The growing number of residential units in the surrounding area include standalone single-family residences and subdivisions of Chip's Crossing, Tippit Village, Cureton Park, Arbor Creek, Reagan Woods, and Trails End. The proposed development site is currently undeveloped, with forested areas on the south side and a field used for farm activities on the north side. The very southern portion of the development property at Troutman Lane has an existing abandoned single-family home and shed/barn that will be removed for construction.

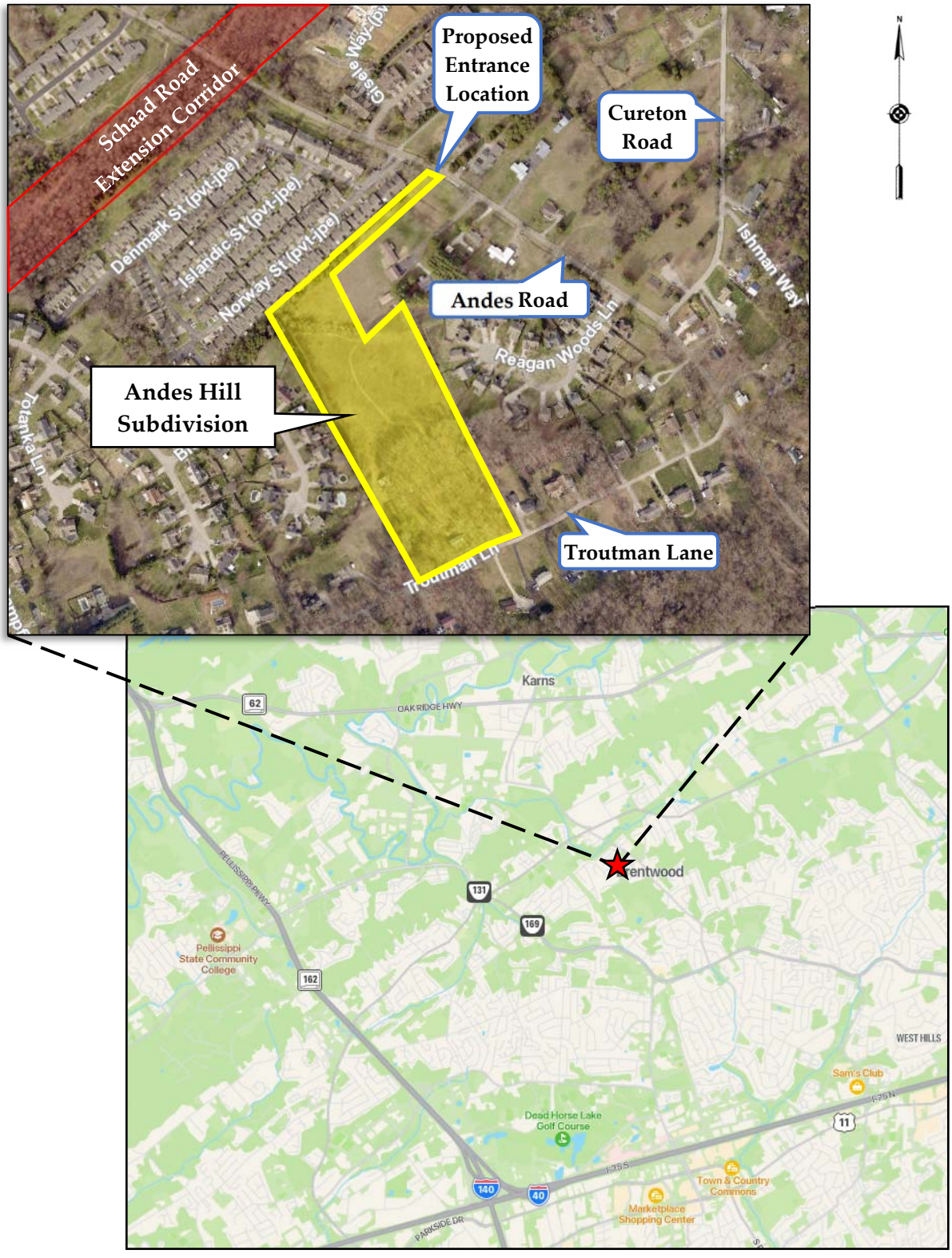


Figure 1
Location Map

- **EXISTING ROADWAYS:**

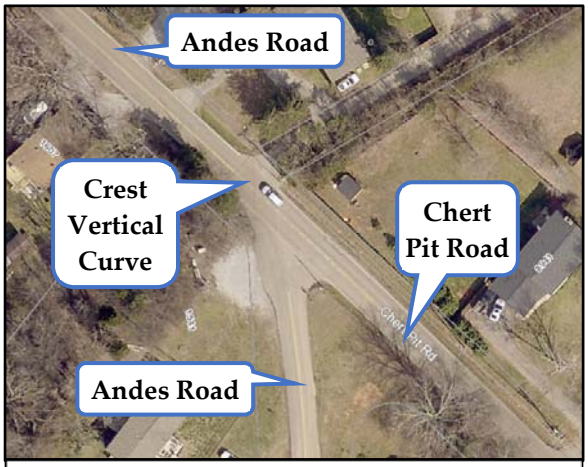
Table 1 lists the characteristics of the existing primary access roadway adjacent to the development property and included in the study:

TABLE 1
STUDY CORRIDOR CHARACTERISTICS

NAME	CLASSIFICATION [1]	SPEED LIMIT	LANES	ROAD WIDTH [2]	TRANSIT [3]	PEDESTRIAN FACILITIES	BICYCLE FACILITIES
Andes Road	Major Collector	30 mph	2 undivided	20 feet	None	None	None

[1] 2018 Major Road Plan by Knoxville/Knox County Planning
[2] From edges of pavement
[3] According to Knoxville Area Transit System Map

Andes Road is classified as a Major Collector and generally traverses north to south with several turns along its length. Andes Road has a total length of 1.7 miles. Andes Road begins at an unsignalized t-intersection at Middlebrook Pike (SR 169). From Middlebrook Pike, Andes Road traverses to the north for approximately 3,700 feet and intersects Chert Pit Road at a y-intersection. Andes Road continues to the north at this intersection while Chert Pit Road officially ends. This y-intersection occurs at a location where Andes Road has a significant crest vertical curve with very disadvantageous views looking to the north. A mirror installed on a utility pole is provided to help motorists with the limited sight distance. On its northern side near the development site, Andes Road is wider than its southern section between Chert Pit Road and Middlebrook Pike. From the y-intersection at Chert Pit Road, Andes Road continues to the north to a t-intersection at Ball Camp Pike. At this intersection, Andes Road operates under stop conditions at Ball Camp Pike, with a CSX railroad crossing just to the east.



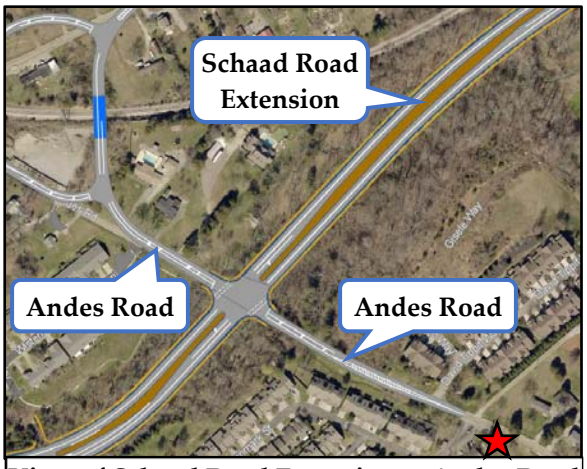
Intersection of Andes Road at Chert Pit Road

According to US DOT Crossing Inventory Form data, an average of five railroad crossings occur per day on this CSX line. This railroad crossing includes flashing railroad crossbuck signals and is controlled by crossing gates. With this railroad crossing close to the t-intersection of Ball Camp

Pike at Andes Road and another t-intersection on the other side of the railroad (Ball Camp Pike at Byington Solway Road), this location experiences a great deal of vehicle congestion and poor safety conditions.

To the north of the proposed development site, Andes Road will see significant changes in the near future to combat vehicle congestion and safety issues. Knox County has pursued a multi-decade road project to provide a northwest connector link from Interstate 75 at Callahan Road to Lovell Road at Kingston Pike. This 13-mile project has included many phases, will provide a minimum of four lanes over its entire length, and several phases have been constructed. The current phase under construction is the Schaad Road Extension which will include a re-alignment of Andes Road on its north end with a 100-foot bridge to remove the existing at-grade railroad crossing. According to the Knox County Engineer, this construction is expected to be completed by December 2023.

Screen Capture from Knox County Engineering Video Highlighting Schaad Road Extension Improvements (Video by CDM Smith)

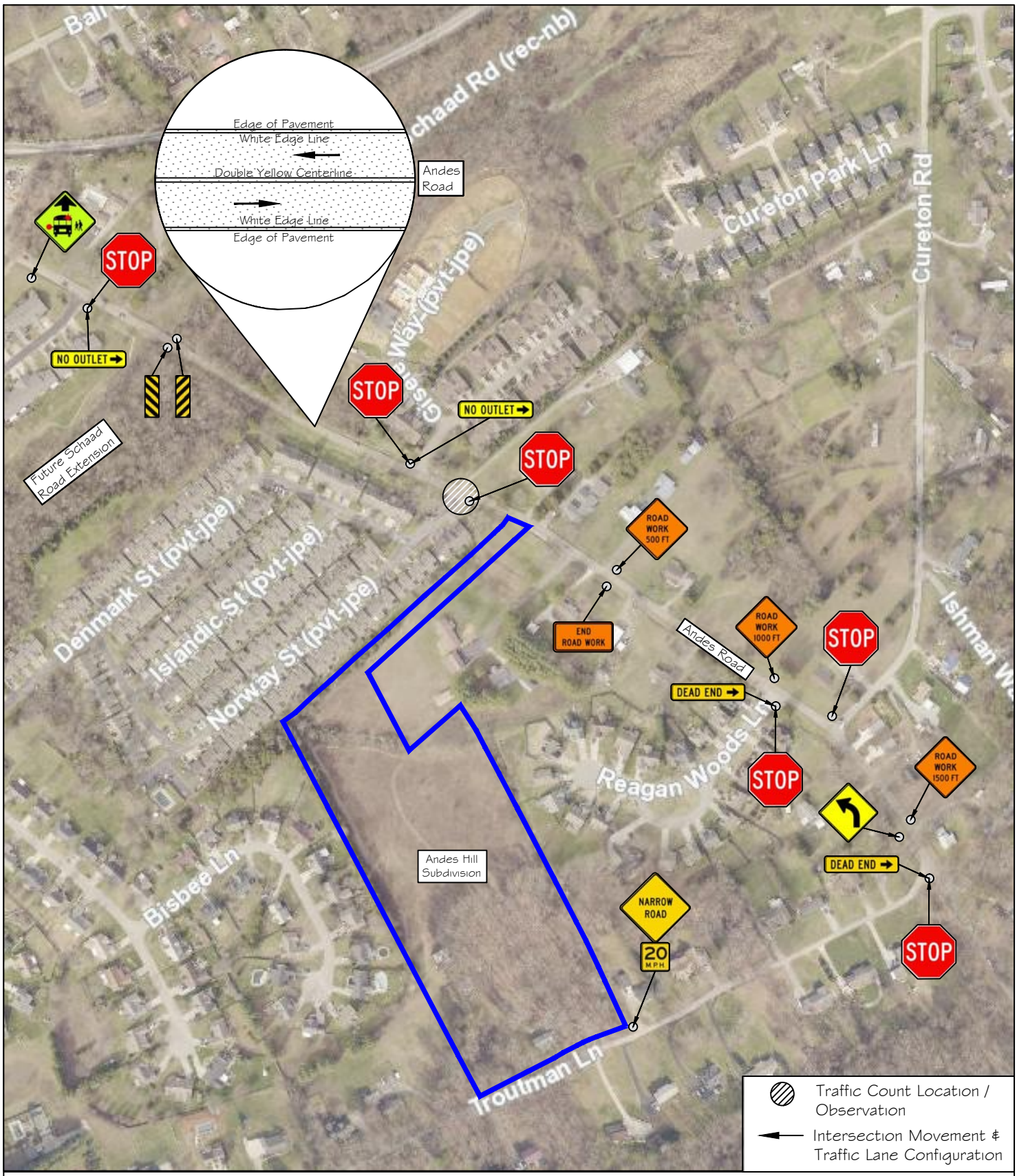


View of Schaad Road Extension at Andes Road (from Knox County Engineering)

For the proposed development, Andes Road will provide convenient access to the north and south between Middlebrook Pike and the new Schaad Road Extension for travel destinations to the east and west. Andes Road currently provides access to only residential subdivisions and properties except for two parcels. The only non-residential properties on Andes Road are located on its southern section. One parcel is occupied by the West Knoxville Kingdom Hall Of Jehovah's Witnesses. The other is a Carson Newman University building at the corner of Andes Road at Middlebrook Pike.

The posted speed limit on Andes Road is 30-mph near the project site. Adjacent to the proposed development site, Andes Road is a 2-lane undivided roadway with a total width of 20 feet, which includes 9.5-foot travel lanes in each direction. The pavement on Andes Road is marked with white edge lines and a double yellow centerline. Andes Road is characterized by mailboxes, private driveways, trees, and drainage features outside the roadway pavement. An unnamed tributary of Meadow Creek runs adjacent to Andes Road on its western side at the development site. Andes Road has a fairly steep slope outside the roadway down to this tributary near the proposed entrance location for the development. Utility lights are not provided for roadway illumination on Andes Road but are installed in the nearby Chip's Crossing Subdivision.

Figure 2 shows the existing lane configurations of the roadway examined in the study, the traffic count location for the study, and the current traffic signage in the study area. The traffic signage shown in Figure 2 only includes warning and regulatory signage near the development site. However, the figure does show the temporary construction signage installed for the Schaad Road Extension project. The pages following Figure 2 give a further overview of the site study area with photographs.



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NOT TO SCALE

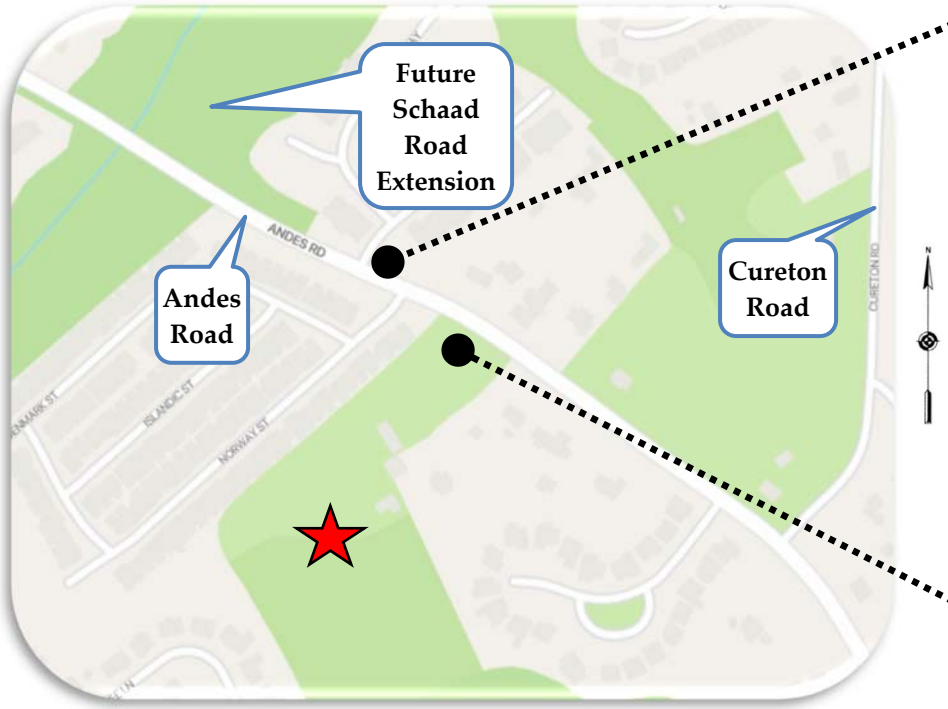
NORTH

FIGURE 2

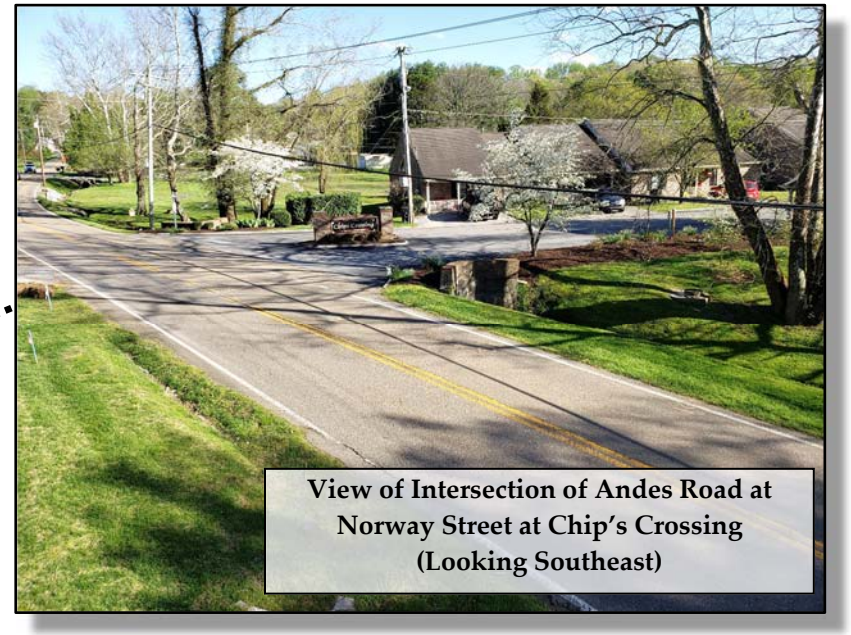
Andes Hill Subdivision

Traffic Count Location, Traffic Signage & Existing Lane Configurations

PHOTO EXHIBITS

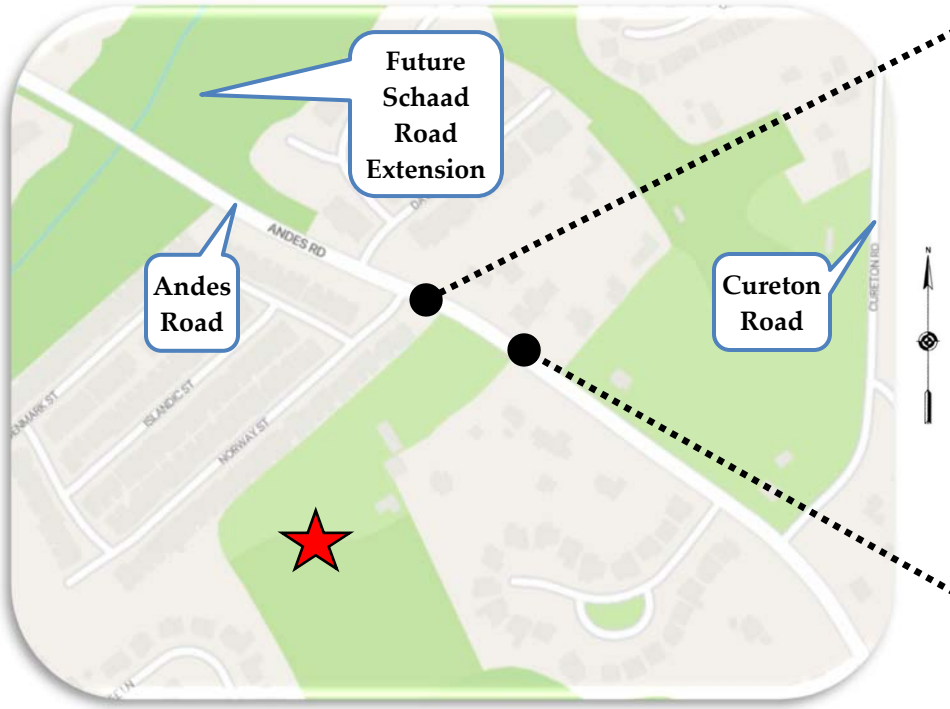


Andes Road

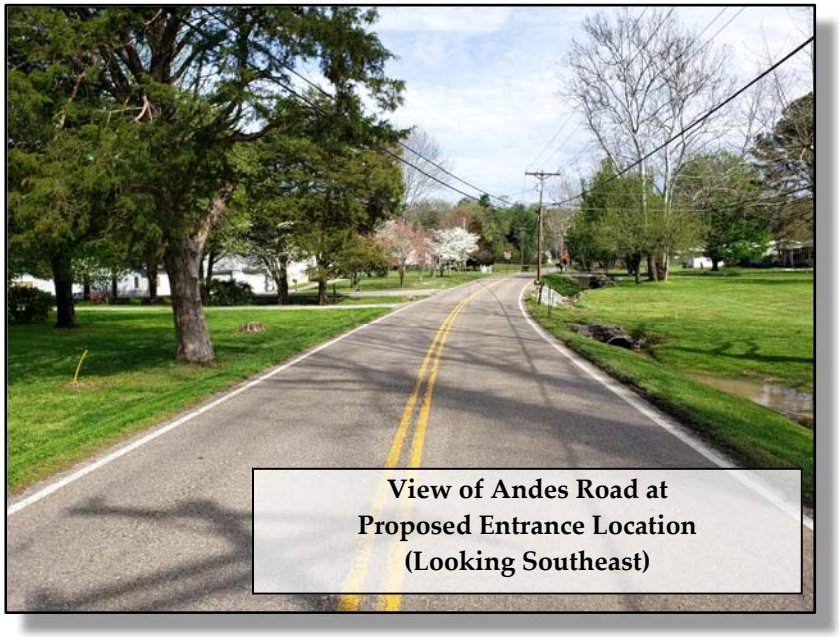


View of Intersection of Andes Road at Norway Street at Chip's Crossing (Looking Southeast)

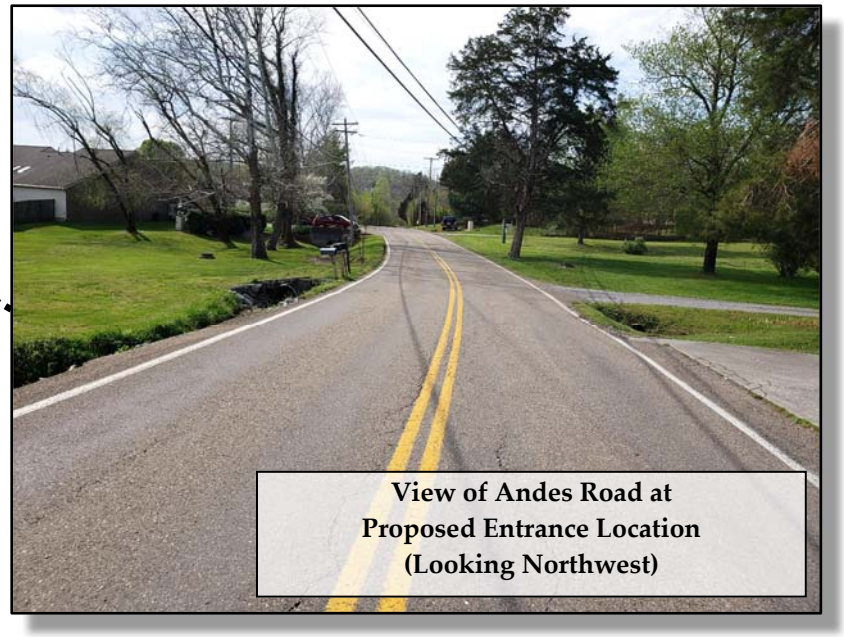
View of Proposed Entrance Location at Andes Road (Looking Northeast)



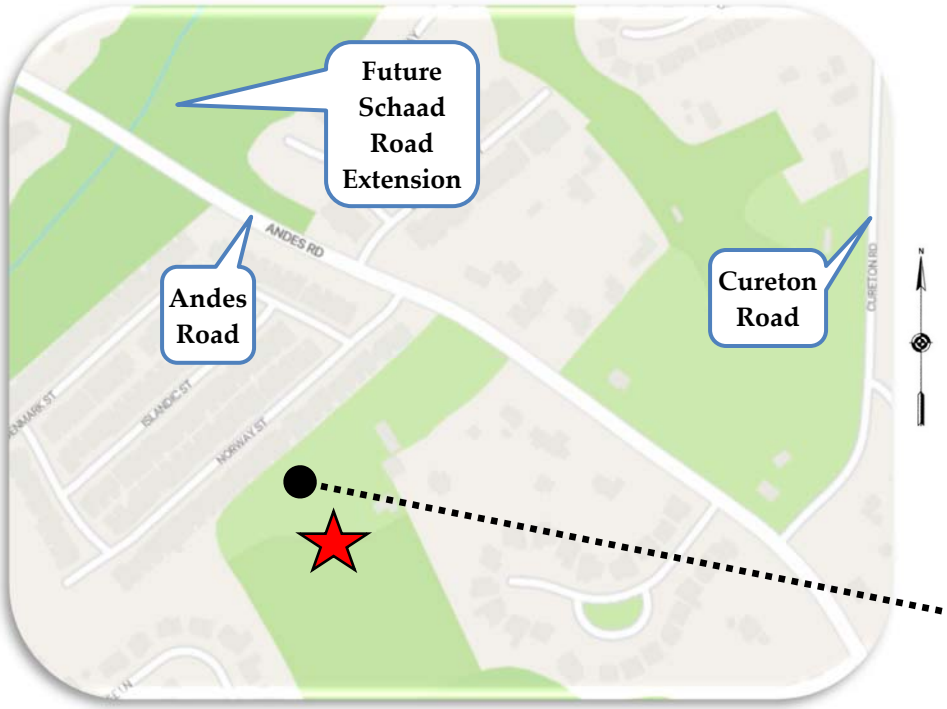
Andes Road



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



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


Future
Schaad
Road
Extension
Andes
Road
Cureton
Road
ANDES RD
CURETON RD
ICELANDIC ST
NORWAY ST

Andes Road


View of Project Site on North Side
(Looking Southeast)

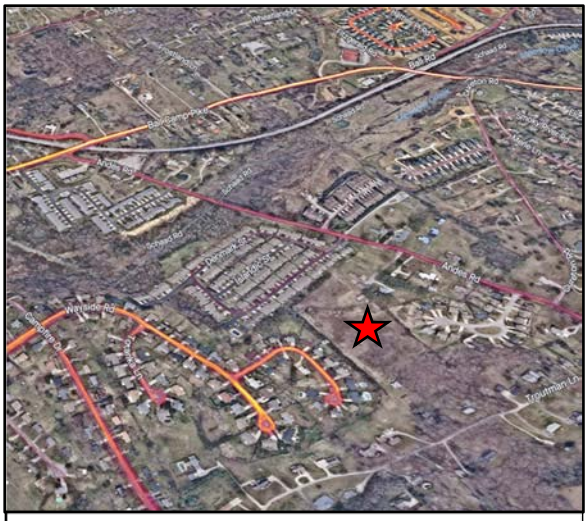
- **EXISTING TRANSPORTATION VOLUMES PER MODE**:

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

- Existing vehicular roadway traffic:
  The TDOT reported an Average Daily Traffic (ADT) on Andes Road at Norway Street at 4,128 vehicles per day in 2020. From 2010 to 2020, this count station has indicated a 0.3% average annual traffic growth rate.

- Existing bicycle and pedestrian volumes:
  The average daily pedestrian and bicycle traffic is unknown along Andes Road. Due to the lack of facilities, it is assumed that there is a minimal number of pedestrians and bicyclists on Andes Road. During the traffic counts for this project at the intersection of Andes Road at Norway Street, only four pedestrians were observed over 6 hours. This pedestrian activity appeared to be exercise-related.

  An online website, strava.com, provides "heat" maps detailing exercise routes taken by pedestrians, joggers, and bicyclists. The provided heat maps show the last two years of data, are updated monthly, and are gathered from individuals allowing their smart devices to track and compile their routes (millions of users). The activities in the maps are shown on the roads with color intensities with lighter colors signifying higher activity. Based on the Strava heat map data, some bicycle traffic occurs on Andes Road, but fewer amounts of pedestrians and joggers have been recorded. Most of the non-vehicle travel in the area is recorded in the nearby subdivisions located off and around Andes Road.



Strava Heat Map for Bicyclists

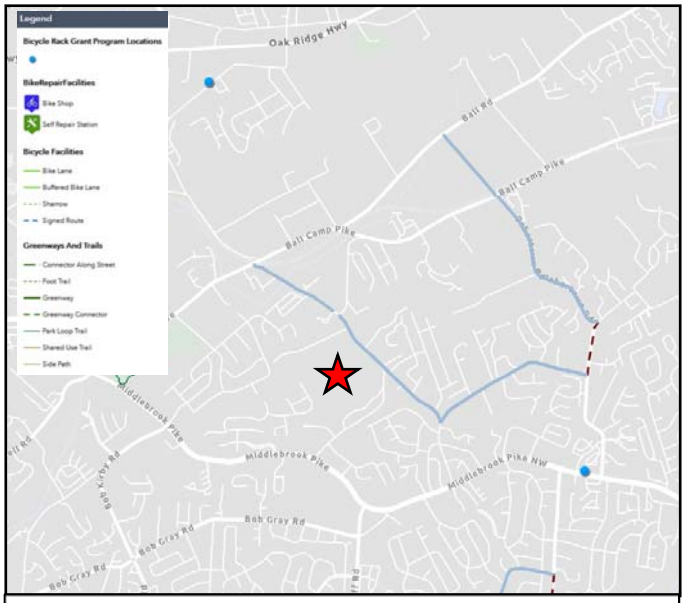
Strava Heat Map for Pedestrian and Joggers

- **ON-STREET PARKING:**

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

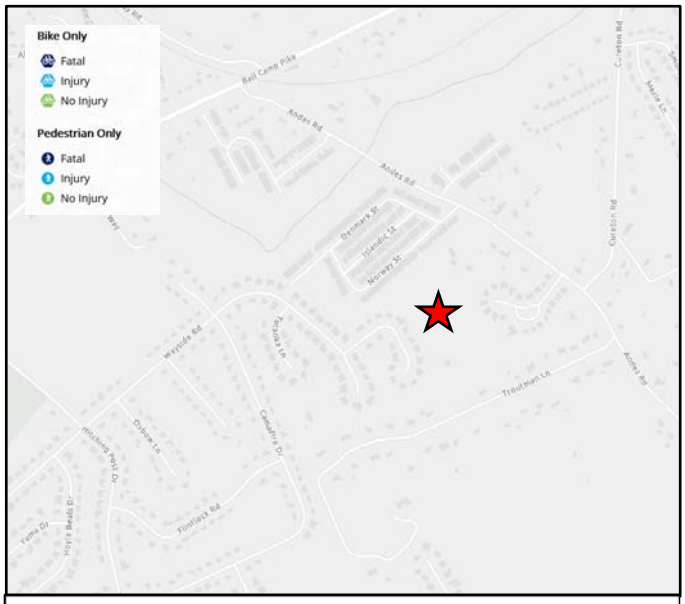
- **PEDESTRIAN AND BICYCLE FACILITIES:**

Bicycle lanes are not available within the project study area. However, the City of Knoxville has listed Andes Road adjacent to the development site as a "Comfortable Route". A "Comfortable Route" is defined as a route "based on low to medium traffic speeds and volumes along with other criteria." This "Comfortable Route" shown on the mapping begins on Andes Road at Ball Camp Pike and traverses to the south to Chert Pit Road, eastward on to Jenkins Road and then to Joe Hinton Road. Joe Hinton Road is marked on the mapping with a dashed line indicating that bicyclists should "use caution". After a short section on Joe Hinton Road, the "Comfortable Route" designation begins again on Bakertown Road up to Ball Road.



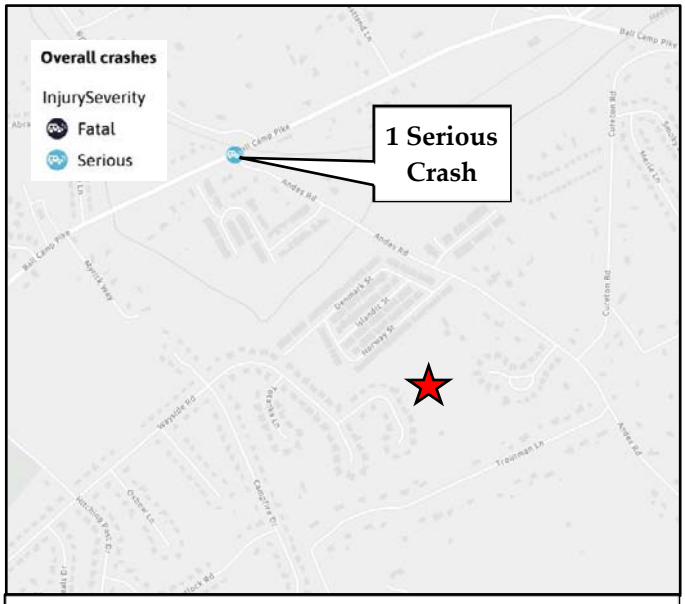
Bicycle Routes in Study Area

The entire "Comfortable Route", including the caution area on Joe Hinton Road, is just over four miles.



Pedestrian/Bicycle Crash Data in Study Area

The Knoxville TPO provided a 2020 update to bicycle and pedestrian crash data for Knox County, Blount County, and other surrounding counties. According to the data, none of these incidents occurred near the study area in the past couple of years.

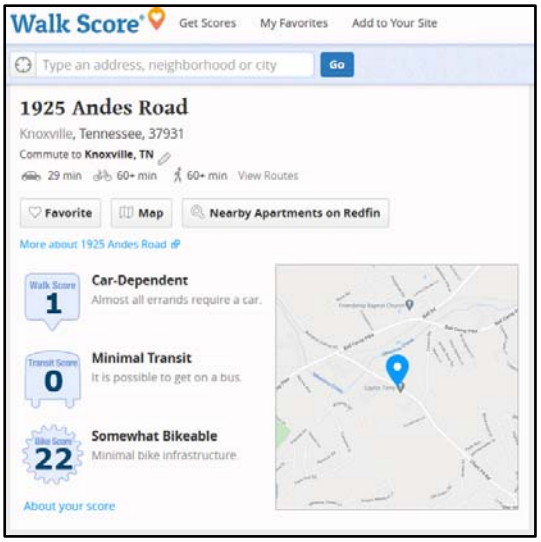


Vehicular Crash Data in Study Area

The Knoxville TPO also provides data related to "Life-Altering Traffic Crashes". This data lists "the location of 2,326 traffic crashes in the Knoxville region that resulted in a fatality or serious injury between January 2016 and June 2019." One "Serious" crash is shown on this TPO mapping in the vicinity of the proposed development site on Andes Road. This crash occurred near the intersection of Andes Road at Ball Camp Pike and is listed as a DUI-related crash.

- **WALK SCORE**:

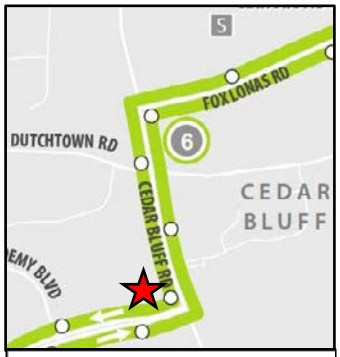
A private company offers an online website at walkscore.com that grades and gives scores to locations within the United States based on "walkability", "bikeability", and transit availability based on a patented system. According to the website, the numerical values assigned for the Walk Score and the Bike Score are based on the distance to the closest amenity in various relevant categories (businesses, schools, parks, etc.) and are graded from 0 to 100.



Appendix B shows maps and other information for the Walk Score, Bike Score, and Transit Score at the approximate development property address (1925 Andes Road). The project site location is graded with a Walk Score of 1. This Walk Score indicates that all errands require a vehicle for travel at the property site due to the lack of sidewalks and the travel lengths required to amenity locations. The site is graded with a Bike Score of 22, which means there is minimal bike infrastructure, but it is somewhat bikeable. The site is given a Transit Score of zero.

- **TRANSIT SERVICES:**

The City of Knoxville has a network of public transit opportunities offered by Knoxville Area Transit (KAT). Bus service is not available in this area, and the overall KAT bus system map is in Appendix C. The closest public transit bus stop is 2.7 miles away by roadway on Cedar Bluff Road at Fox Lonas Road and is on Route 16, "Cedar Bluff Connector". It operates on weekdays and weekends, and this route map is also included in Appendix C. Other transit services in the area include the East Tennessee Human Resource Agency (ETHRA) and the Community Action Committee (CAC), which provides transportation services when requested.



KAT Route 16

PROJECT DESCRIPTION

- **LOCATION AND SITE PLAN:**

The proposed plan layout with 95 multi-family attached townhouses and three single-family detached houses is designed by Welroc Enterprises, LLC and is shown in Figure 3. As shown in the figure, one new entrance will be constructed for the townhouses (Lots #2 - 96) and will tie onto Andes Road. One new private street will be constructed internally with a total length of 2,410 feet (0.46 miles). The three single-family detached residences (Lots #97 - 99) will have individual driveways with access to Troutman Lane. Lot #1 acreage is included in the calculation of the allowable density permitted for the development.

The driveway entrance at Andes Road and the internal roadway will have a width of 26 feet. The Proposed Entrance on Andes Road is approximately 150 feet to the southeast of the existing Norway Street unsignalized t-intersection.

View of Existing Northern Portion of Site (Looking Southwest)

The townhouse residents will own the individual lots and units, and the minimum lot size will be 2,400 square feet. The townhouse units will range from 1,456 ft^2 to 1,760 ft^2 in size. Each townhouse will have an individual driveway with a garage. Sidewalks will be provided on one side of the internal road in the development. The subdivision design shows four common areas in the development that will incorporate stormwater controls. A mail center/kiosk area is labeled in the site plan at the front of the development. A white solid PVC privacy fence will be installed to screen the subdivision on the east and west side.

The schedule for completing the Andes Hill Subdivision depends on economic factors and construction timelines. This project is contingent on permitting, design, and other regulatory approvals. Currently, the area's real estate and housing market is experiencing tremendous activity and growth. This study assumed that the total construction build-out of the development and full occupancy would occur within the next three years (2025).

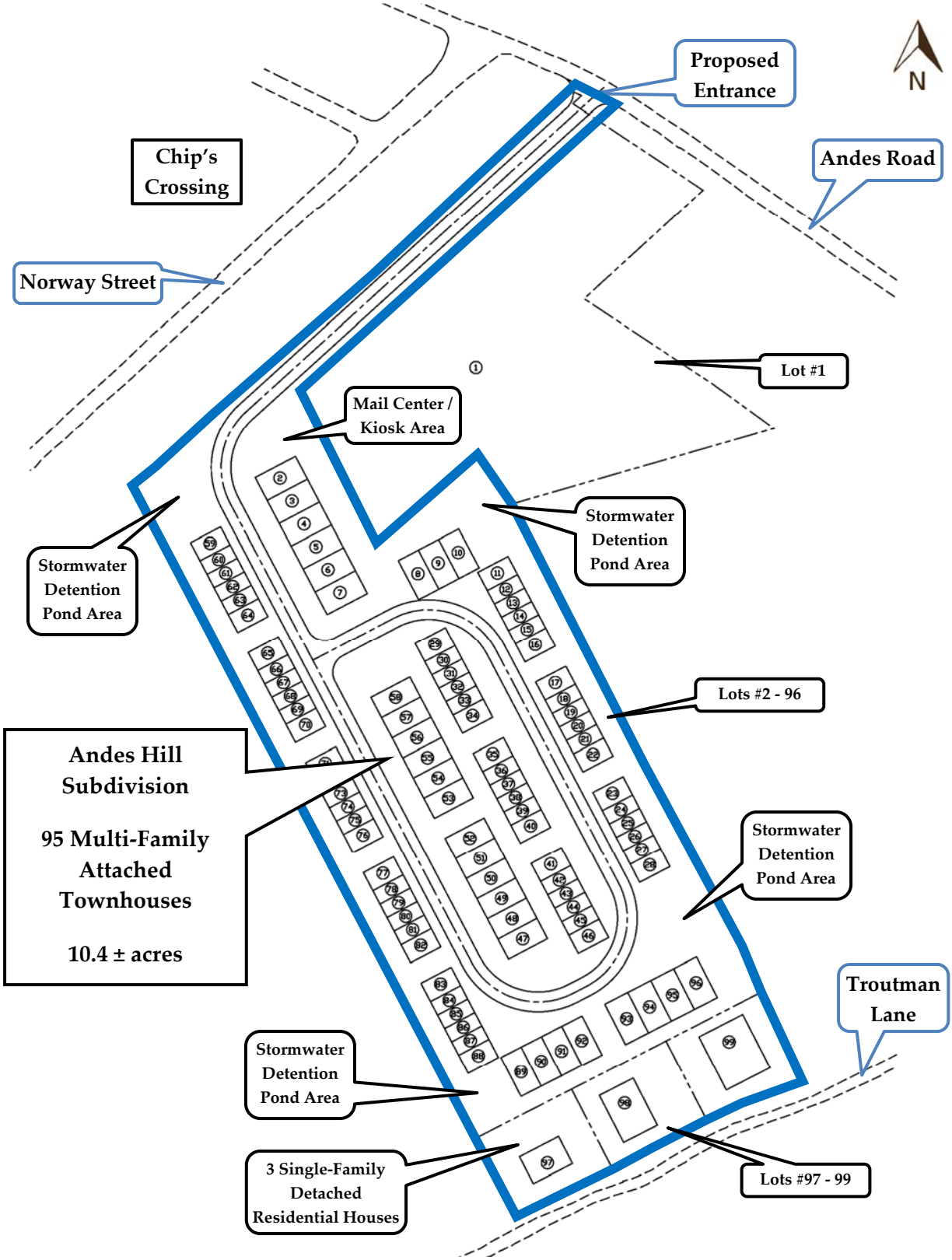


Figure 3
Proposed Plan Layout
Andes Hill Subdivision

Not to Scale

- **PROPOSED USES AND ZONING REQUIREMENTS:**

The Andes Hill Subdivision development property was zoned as Agricultural (A) within Knox County, TN. The development property was recently requested and approved to be rezoned to the Planned Residential (PR) zone with up to 7 units per acre. The Planned Residential (PR) zone allows for various land uses primarily within the residential realm. Uses permitted in this zone include single-family dwellings, duplexes, and multi-dwelling structures and developments. The most recent published online KGIS zoning map is provided in Appendix D. This requested rezoning was for all the lots in the subdivision, including Lot #1, which contains an existing single-family detached house that will remain. Lot #1 is 4.01 acres in size, and the total size of all the other development lots (Lot #2 – 99) is 10.6 acres.

The existing adjacent surrounding zoning and land uses are the following:

- Residential properties, including single-family detached houses and attached townhouses, exist to the west, southwest, and north of the development property. These residences are in the Chip's Crossing and Trails End Subdivisions, and all are zoned in the Planned Residential (PR) zone.
- One property exists to the northeast of the development property and contains a single-family residence on a large lot of 4.01 acres. This property is designated as Lot #1 in the development and was included in the rezoning request.
- The properties to the east are in the Reagan Woods Subdivision, in the Planned Residential (PR) zone, and consist of single-family detached houses.
- One property is located to the southeast of the development site outside the Reagan Woods Subdivision. It consists of a single-family detached house located in the Agricultural (A) zone and has access to Troutman Lane. This property will be adjacent to and east of the proposed single-family detached houses on Troutman Lane for the Andes Hill Subdivision.
- Troutman Lane binds the development property to the south. Across Troutman Lane, several single-family detached houses are in the Agricultural (A) zone.

KGIS Existing Zoning Map

KGIS Existing Land Use Map

- **<u>DEVELOPMENT DENSITY</u>:**

The Andes Hill Subdivision development's proposed density is based on a maximum of 95 townhouses and three single-family houses on 10.6 acres and Lot #1's size of 4.01 acres. The density calculation includes a total of 14.61 acres. Ninety-nine (95+3+1=99) housing units over 14.61 acres compute to 6.8 dwelling units per acre, less than the approved rezoning of 7 units per acre.

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

The entrance and internal road will be designed and constructed to Knox County, TN specifications. The internal road will be asphalt paved and include 6" concrete curbs. The lane widths will be 13 feet each for a total 26-foot pavement entrance and internal road. Concrete sidewalks are being proposed internally on one side of the internal road system. The driveway entrance and internal road will be private and will be maintained in the future by the development.

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

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

development.

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

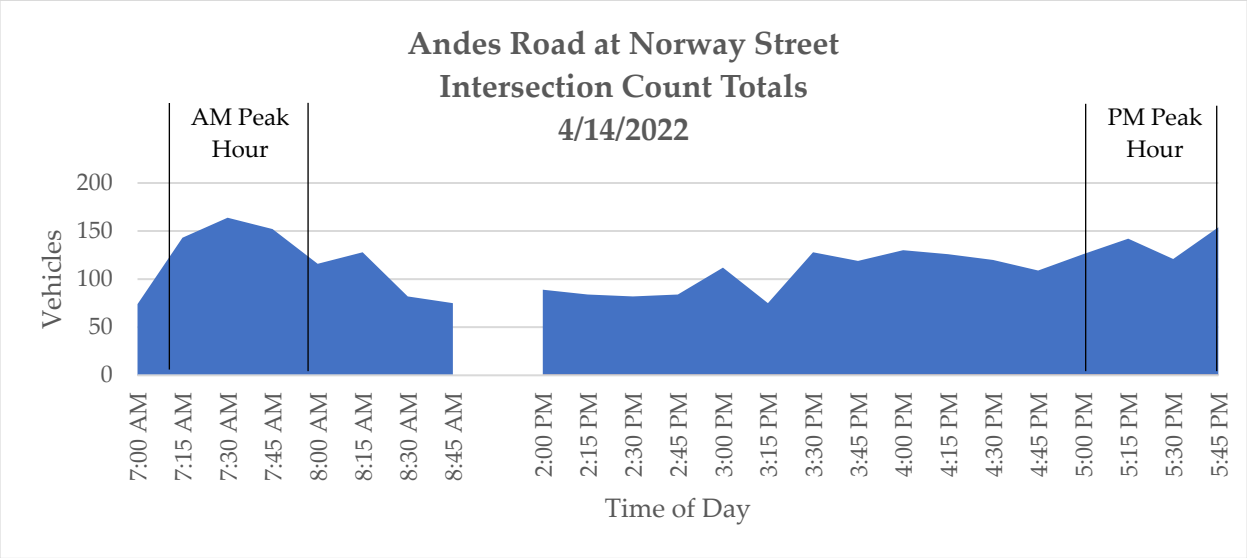
ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

- **EXISTING TRAFFIC CONDITIONS:**

For this study, a traffic count was conducted at the adjacent intersection of Andes Road at Norway Street (Chip's Crossing Subdivision) on Thursday, April 14, 2022. The manual traffic counts were conducted to tabulate the morning and afternoon peak period volumes and travel directions near the proposed development site. Based on the traffic volumes collected, the AM and PM peak hours were observed at 7:15 – 8:15 am and 5:00 – 6:00 pm at the intersection. Local county public schools were in session when the traffic counts were conducted.

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

- Most of the observed traffic was passenger vehicles, but the traffic stream on Andes Road also included public school buses and trash collection trucks.
- During the 6-hour traffic count, public school buses stopped to pick up and let out school children on Andes Road at Norway Street at 8:00 am, 3:20 pm, 3:30 pm, and 4:35 pm.
- No bicyclists were observed during the traffic counts. A total of four pedestrians were observed crossing Andes Road to the north of Norway Street. These four included the same two pedestrians first crossing Andes Road from the east side up to Norway Street, entering Chip's Crossing Subdivision, and returning a few minutes later. These individuals were walking a dog which was assumed to be an exercise-related activity.



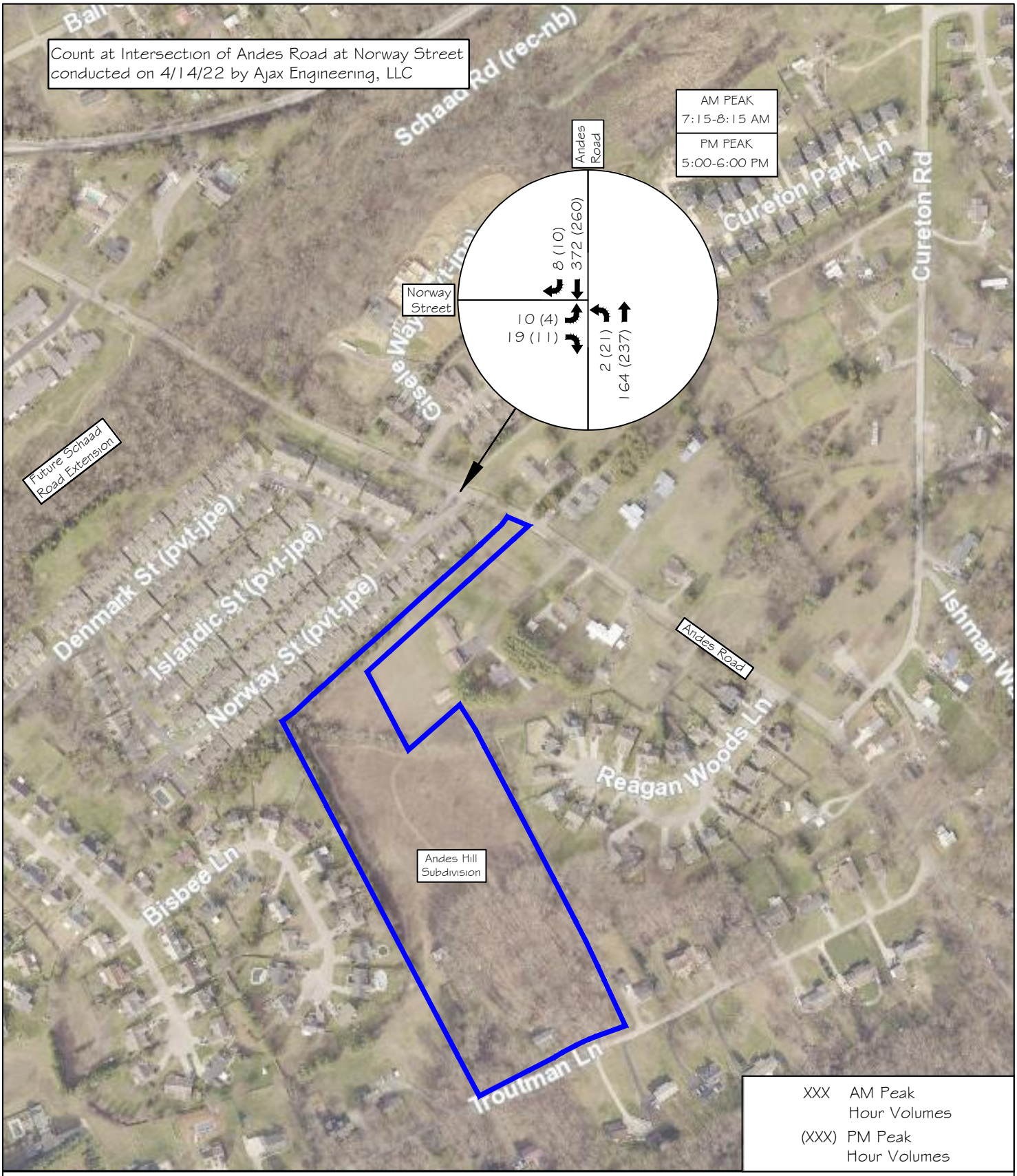


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FIGURE 4

Andes Hill Subdivision

2022 Peak Hour Traffic Volumes - EXISTING CONDITIONS

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

Methodology:

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

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

For unsignalized intersections, LOS is measured in terms of delay (in seconds). This measure is an attempt to quantify delay that includes travel time, driver discomfort, and fuel consumption. For unsignalized intersections, the analysis assumes that the mainline thru and right-turn traffic does not stop and is not affected by the traffic on the minor side streets. Thus, the LOS for a two-way stop (or yield) controlled intersection is defined by

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

Intersection capacity results from the existing 2022 peak hour traffic are shown in Table 3. The intersection in the table is shown with a LOS designation, delay (in seconds), and v/c ratio (volume/capacity) for the AM and PM peak hours. Appendix F includes the worksheets for the existing 2022 peak hour capacity analyses.

As shown in Table 3, all the approaches at the intersection are calculated to operate with good LOS and low vehicle delays in the existing 2022 conditions. These calculations and results are presented in this report as a courtesy and point of reference. This existing intersection was not included in the Knoxville/Knox County Planning requested scope of work.

TABLE 2
LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS

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

Source: Highway Capacity Manual, 6th Edition

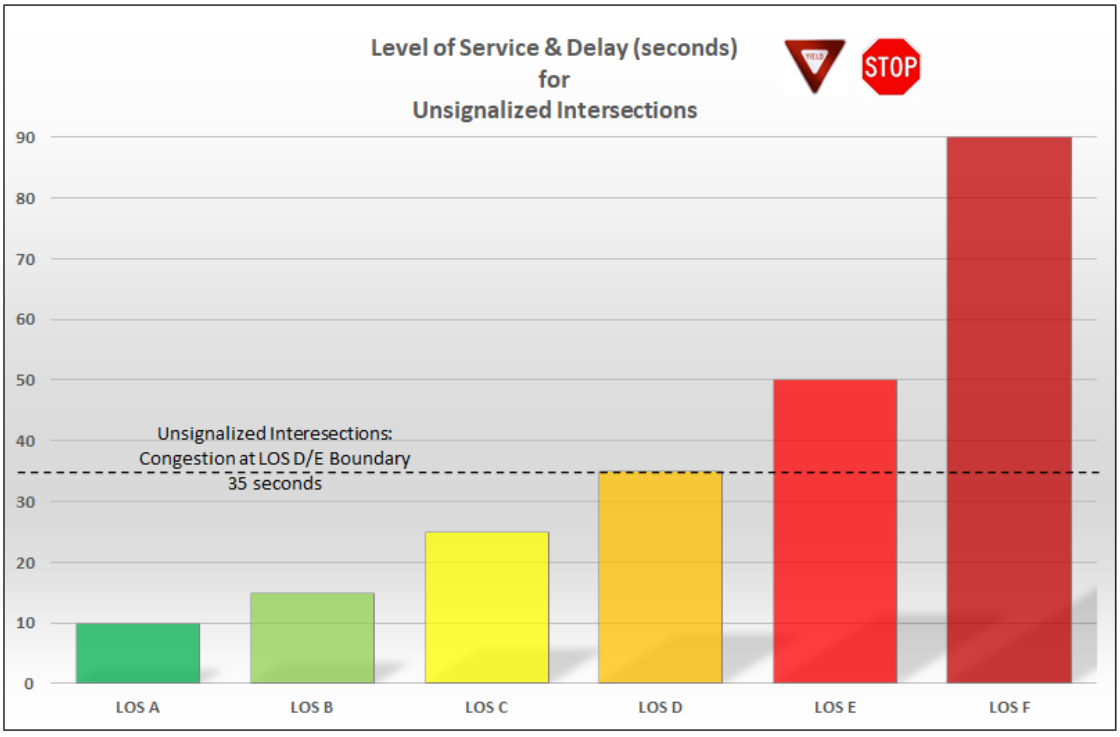


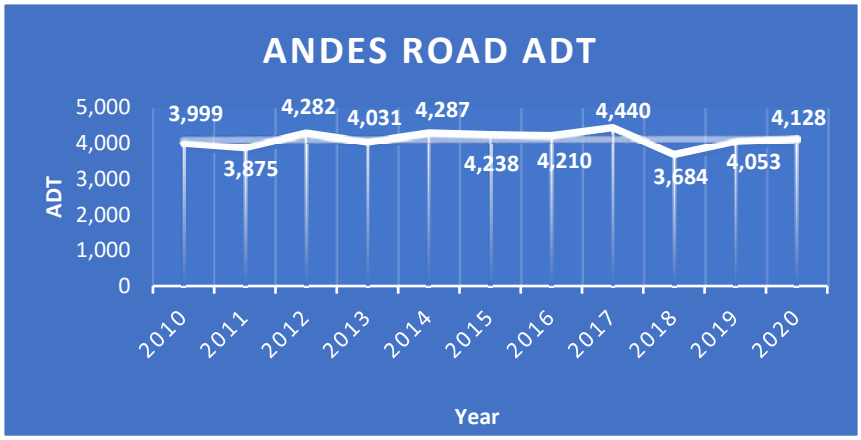
TABLE 3
2022 INTERSECTION CAPACITY ANALYSIS RESULTS - EXISTING CONDITIONS

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
Andes Road at Norway Street	 Unsignalized	Eastbound Left/Right	B	12.8	0.101	B	10.8	0.037
		Northbound Left	A	8.3	0.007	A	8.0	0.026

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology
In Synchro calculations, NE approach = Norway Street and EB and WB are Andes Road approaches
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

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

Horizon year traffic conditions represent the projected traffic volumes in the study area without the proposed project being developed (no-build option). The build-out and full occupancy for this proposed development is assumed to occur by 2025. This horizon year corresponds to three years for this development to reach full capacity and occupancy.



Vehicular traffic on Andes Road in the study area has shown flat annual growth over the past ten years (0.3%), according to the TDOT traffic count station and as shown in Appendix A. A higher annual growth rate of 1.0% was used to calculate future growth on Andes Road up to 2025 to account for potential traffic growth in the study area and provide a conservative analysis. Future higher growth rates on this roadway are not expected since this is in a fairly established area with nearby developments and subdivisions completely built out. However, a higher rate is used to consider the possibility of increased growth due to the construction of the Schaad Road Extension and further residential construction occurring on the remaining undeveloped properties in the surrounding area.

Capacity analyses were not undertaken to determine the projected LOS in 2025 without the project. These analyses were not conducted since the Proposed Entrance at Andes Road intersection only exists in the projected conditions with the project. Figure 5 shows the projected 2025 horizon year traffic volumes on Andes Road without the project during the AM and PM peak hours at the location of the Proposed Entrance. The volumes shown in Figure 5 include vehicles tabulated in the traffic count entering and exiting the Chip's Crossing Subdivision at Norway Street and traveling through the Proposed Entrance location on Andes Road.

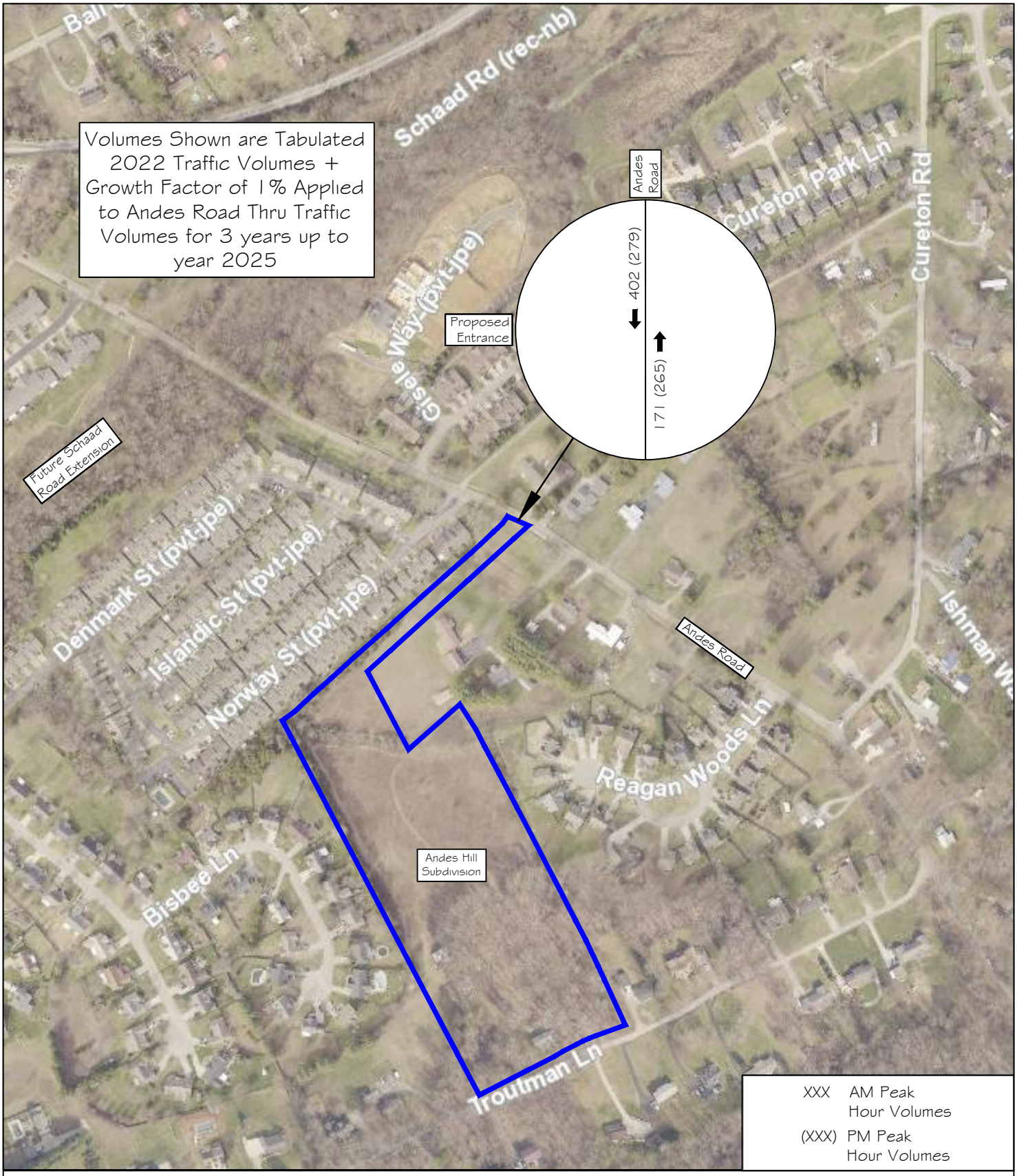


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FIGURE 5

Andes Hill Subdivision

2025 Peak Hour Traffic Volumes - PROJECTED CONDITIONS (WITHOUT THE PROJECT)

- **TRIP GENERATION:**

A generated trip is a single or one-direction vehicle movement entering or exiting the study site. The estimated number of trips that the 95 multi-family townhouses will generate was calculated based on Knoxville/Knox County Planning equations. These equations were developed from local studies to estimate apartment (and townhouse) trip generation in the surrounding area and were published in December 1999. For Knox County, these are the preferred trip generation rates to use for apartments and townhouses. The data and calculations for the proposed land use are shown in Appendix G. A summary of this information is presented in the following table:

TABLE 4
TRIP GENERATION FOR ANDES HILL SUBDIVISION
95 Multi-Family Townhouse Units

ITE LAND USE CODE	LAND USE DESCRIPTION	# OF UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Local Trip Rate	Multi-Family Townhouses	95	911	22%	78%		55%	45%	
				11	40	51	41	33	74
Total New Volume Site Trips			**911**	**11**	**40**	**51**	**41**	**33**	**74**

Calculated from Local Trip Rates
Trips calculated by using Fitted Curve Equations

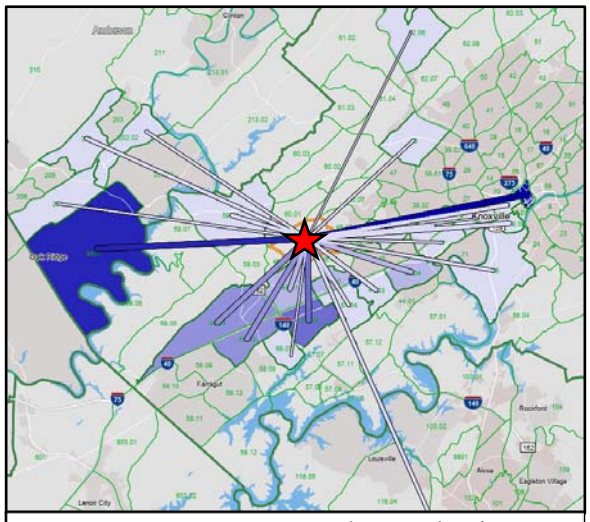
For the proposed residential development, with 95 multi-family townhouses, it is estimated that 11 vehicles will enter and 40 will exit, for a total of 51 generated trips during the AM peak hour in the year 2025. Similarly, it is estimated that 41 vehicles will enter and 33 will exit, for a total of 74 generated trips during the PM peak hour in the year 2025. The calculated trips generated for an average weekday are estimated to be 911 vehicles for the proposed development.

The trips generated by the three proposed single-family detached houses on Troutman Lane will be minimal and are not included in the study analyses. The residents in these houses will have road access to Troutman Lane exclusively.

- **TRIP DISTRIBUTION AND ASSIGNMENT:**

Figure 6 shows the projected distribution of traffic entering and exiting the proposed development. The percentages shown in the figure only pertain to the trips generated by the proposed dwellings in the development calculated from the local trip rates.

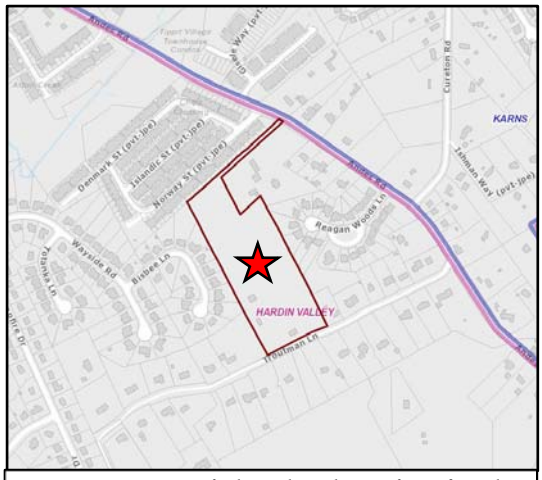
The percentages assumed and shown in Figure 6 are based on several sources and engineering judgment. The first source is based on the traffic count volumes and the observed directions of travel collected at the existing intersection adjacent to the proposed development site.



2019 Census Bureau Work-Based Trips to & from Census Tract 46.06

The second source for projected trip distribution is based on work-related trips in the local area. Work-based trips will be a significant impetus for generated trips by the development, and these trips are more likely to travel to and from the north, south, and east. This assertion is based on data from the United States Bureau website for Census Tract 46.06, where the development property is located. Based on 2019 (latest available) census data and as shown in Appendix H, most work-based trips in the surrounding area correspond to Oak Ridge, downtown Knoxville (including the University of Tennessee), and other areas of West Knoxville.

In addition to employment centers, some generated traffic will travel to and from public and private schools. Schools will be another impetus for external trip-making. The development property is currently zoned for Ball Camp Elementary, Karns Middle, and Hardin Valley High School (Academy). The middle school boundary zone between Hardin Valley and Karns is along the development site's rear (western) property line. The high school boundary zone between Hardin Valley and Karns is along Andes Road. Ball Camp Elementary is located 1.5 miles



Knox County High School Zoning for the Development Property

away to the southwest via Andes Road and Ball Camp Pike. Karns Middle School is located 1.9 miles away to the north by roadway via Andes Road, Byington Solway Road, and Gray Hendrix Road. Hardin Valley High School is located 5.7 miles away by roadway to the southwest via Andes Road, Ball Camp Pike, and Hardin Valley Road.

The Knox County Schools Transportation Department has developed Parental Responsibility Zones (PRZ) to determine whether students are offered transportation services to and from school. The PRZ is defined as being 1.5 miles for grades 6 – 12 and 1.0 miles for grades K – 5 from the point where the students' parcel is accessed to the point where the buses unload at the school. This development will be outside the PRZ for all the zoned schools, and all school-age children attending public schools in the development will be able to utilize this service if desired.

Ultimately, a different distribution rate was assumed for entering and exiting trips. The study used a 35%/65% split in the AM and PM peak hours for exiting trips, with 65% of trips assumed to and from the south on Andes Road and 35% of trips to and from the north on Andes Road. For entering trips, the study assumed the similar splits observed at the adjacent Chip's Crossing Subdivision. For the AM peak hour, it was assumed that 65% of trips would enter from the north and 35% from the south. The opposite 35%/65% split was assumed for the PM peak hour. It is speculated that the observed higher rates of entering trips coming from the north on Andes Road at Chip's Crossing Subdivision in the AM peak hour are from parents returning home from taking their children to school at Ball Camp Elementary, Karns Middle, and Hardin Valley High School. During the PM peak, it is assumed most residents in Andes Hill Subdivision will travel home from the south, as observed at the Chip's Crossing Subdivision.

It is estimated that the Schaad Road Extension, which will be completed in December 2023, will not significantly affect future travel patterns. The construction of this new roadway will improve travel times and reduce congestion for residents in the study area but is not expected to noticeably change the trip-making decisions occurring in the area.

Figure 7 shows the traffic assignment of the computed trips generated by the development (Table 4) based on the assumed distribution of trips shown in Figure 6.

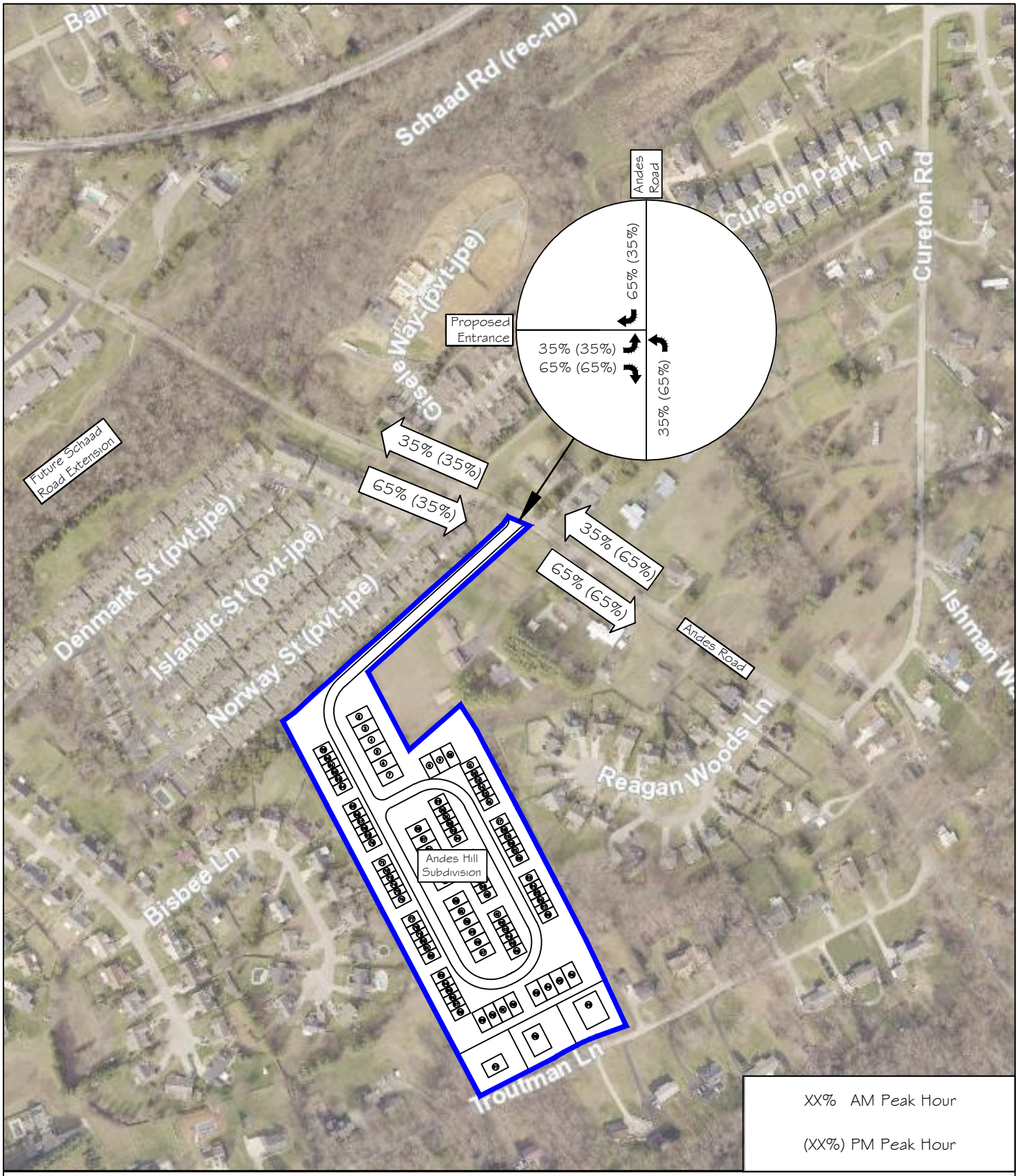


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FIGURE 6

Andes Hill Subdivision

Directional Distribution of Generated Traffic during AM and PM Peak Hour

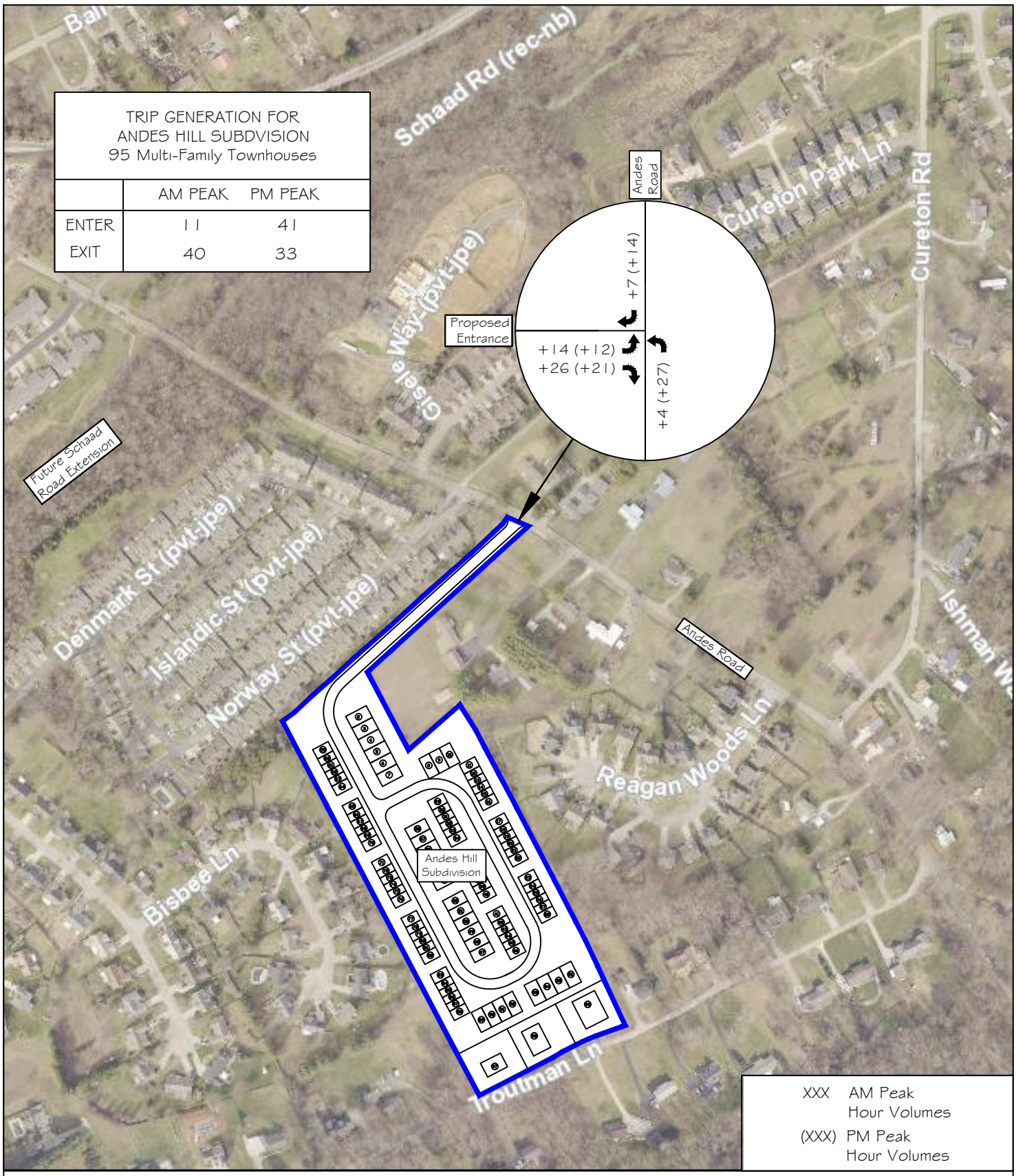

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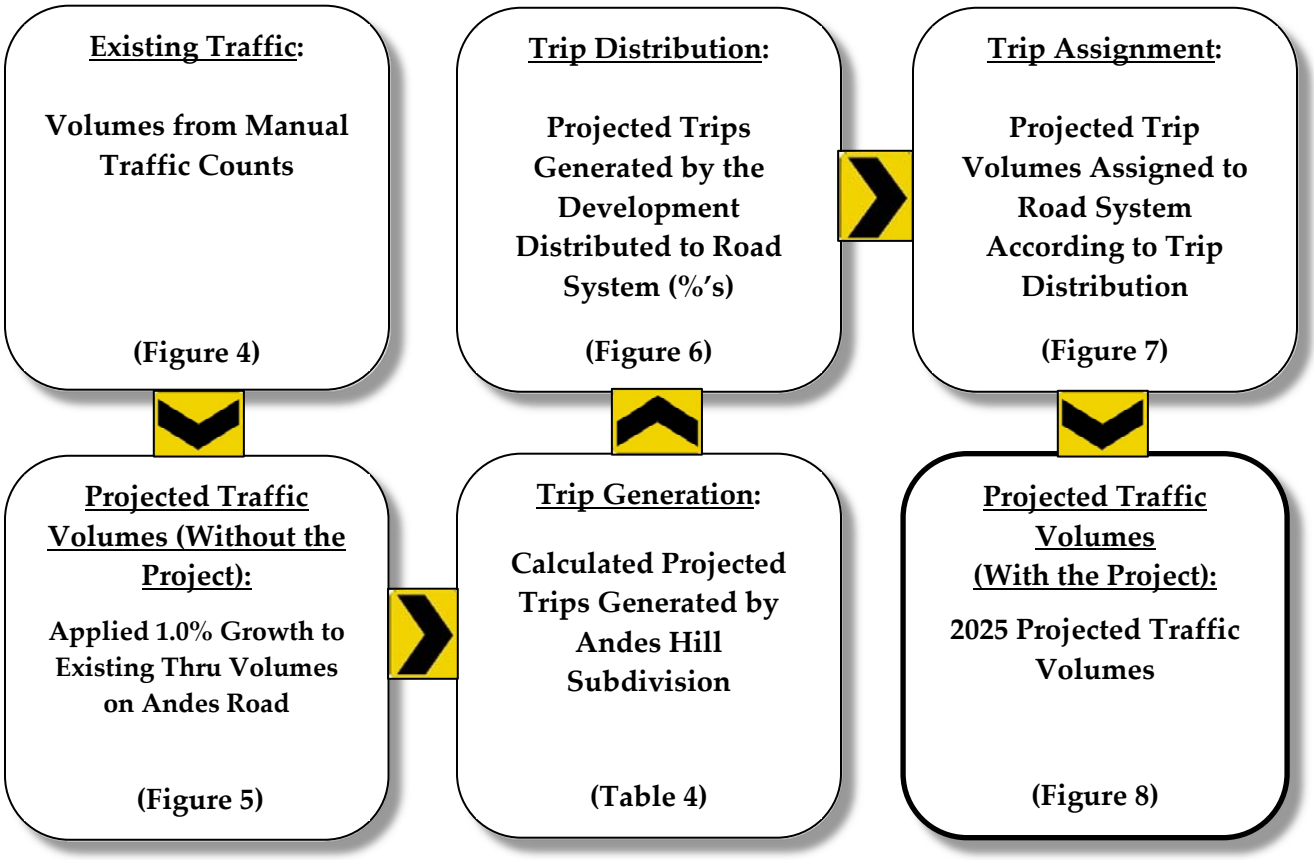
FIGURE 7

Andes Hill Subdivision

Traffic Assignment of Generated Traffic during AM and PM Peak Hour

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

Overall, several additive steps were taken to estimate the total projected traffic volumes at the studied intersection when the Andes Hill Subdivision is entirely constructed and occupied by 2025. The steps are illustrated below for clarity and review:



The calculated peak hour traffic (Table 4) generated by the Andes Hill Subdivision was added to the 2025 horizon year traffic (Figure 5) by following the predicted trip distributions and assignments (Figures 6 and 7). This procedure was completed to obtain the total projected traffic volumes when the proposed development is fully built out and occupied in 2025. Figure 8 shows the projected 2025 AM and PM peak hour volumes with the generated development traffic at the studied intersection.

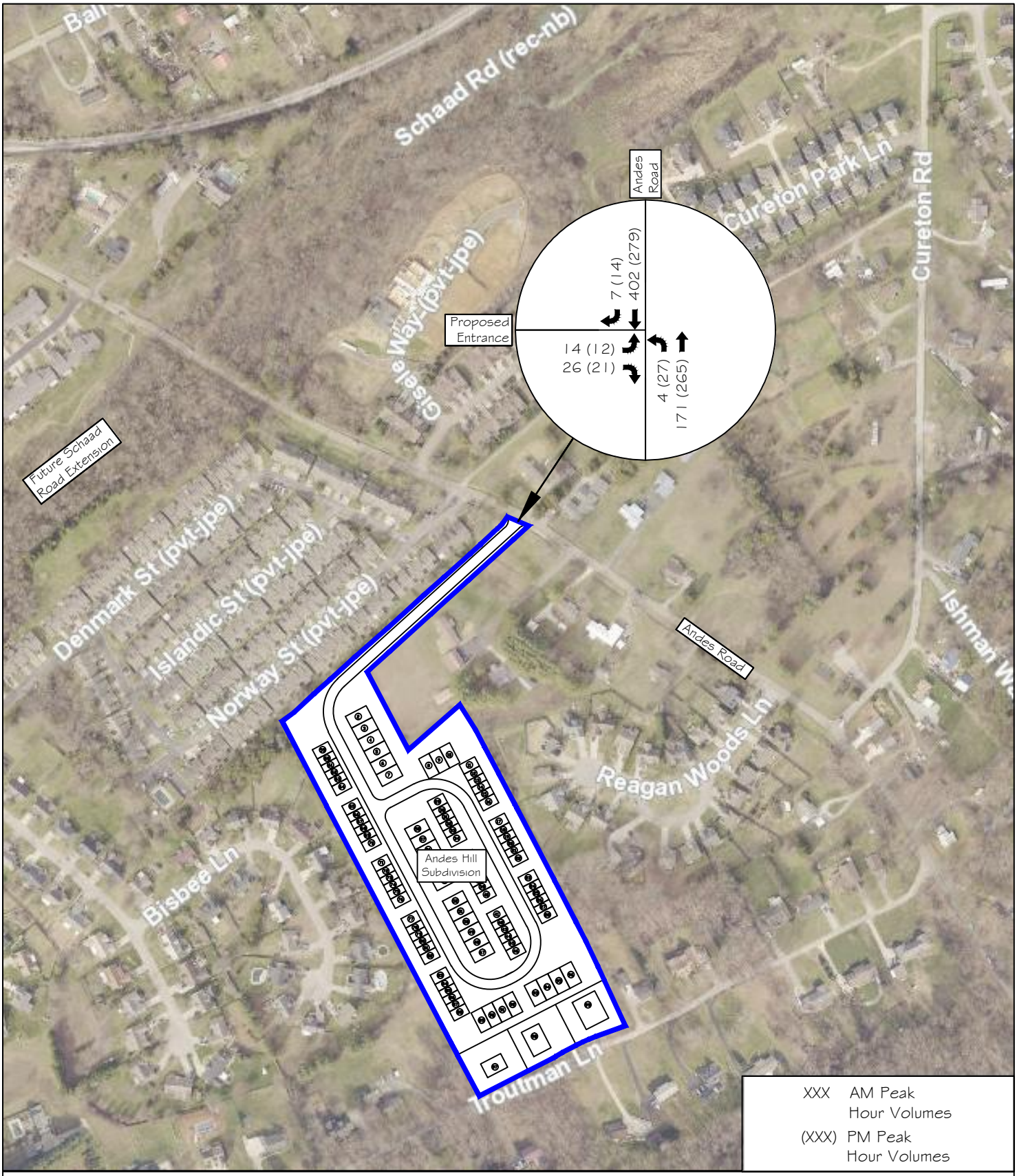


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FIGURE 8

Andes Hill Subdivision

2025 Peak Hour Traffic Volumes - PROJECTED CONDITIONS (WITH THE PROJECT)

Capacity analyses were conducted to determine the projected LOS at the studied intersection with the development traffic in 2025. The projected 2025 peak hour capacity results for the intersection with the project resulted in good LOS with low vehicle delays and can be seen in Table 5. Appendix F includes the worksheets for these capacity analyses.

TABLE 5
2025 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED CONDITIONS (WITH THE PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
Andes Road at Proposed Entrance	Unsignalized	Eastbound Left/Right	B	13.8	0.150	B	11.8	0.087
		Northbound Left	A	8.4	0.015	A	8.1	0.034

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology
In Synchro calculations, NE approach = Proposed Entrance and EB and WB are Andes Road approaches
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

- **POTENTIAL TRANSPORTATION SAFETY ISSUES:**

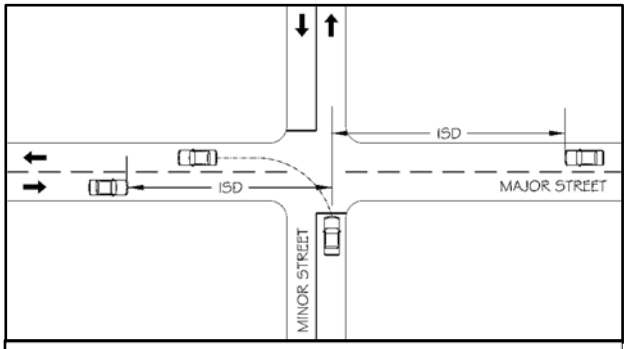
The study area was investigated for potential existing and future safety issues when the development is completed. A couple of features of the adjacent transportation system are discussed in the following pages.

EVALUATION OF SIGHT DISTANCE

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

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

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



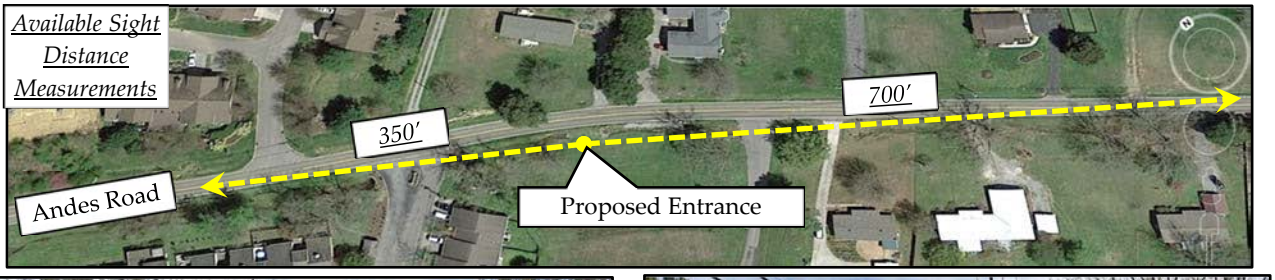
Intersection Sight Distance Diagram

With a posted speed limit of 30-mph on Andes Road, the ISD is 300 feet based on Knox County's requirement of 10 feet per 1-mph of the posted speed.

Andes Road has a 3% road grade downhill to the north at the Proposed Entrance location on the southern side and 0.7% on the northern side (separated by a vertical curve). Based on the posted speed limit of 30-mph on Andes Road and the existing road grades, the SSD is calculated to be 195 feet looking to the north and 205 feet to the south.

Visual observations of the sight distances at the Proposed Entrance location on Andes Road were undertaken. Using a Nikon Laser Rangefinder at the Proposed Entrance location, the ISD was visually estimated to be 350 feet to the north and 700 feet to the south. The intersection sight and stopping sight distances from the Proposed Entrance will be adequate based on visual observation. However, the view to the north is reduced by the vertical curvature of Andes Road, a utility pole, and road signage.

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



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

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

EVALUATION OF TURN LANE THRESHOLDS

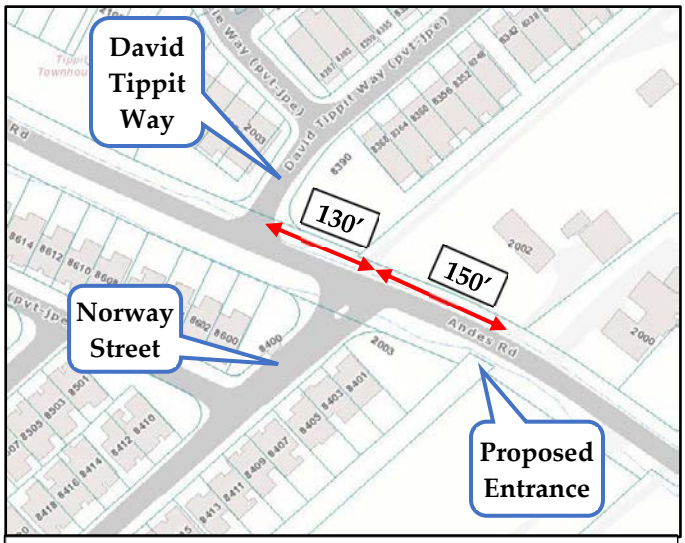
An evaluation of the need for separate entering turn lanes into the development in the projected 2025 conditions was conducted for the Proposed Entrance at Andes Road.

The criteria used for this turn lane evaluation were based on Knox County's "Access Control and Driveway Design Policy". This design policy relates vehicle volume thresholds based on prevailing speeds for two-lane and four-lane roadways. This Knox County policy follows TDOT and nationally accepted guidelines for unsignalized intersections.

With a posted speed limit of 30-mph on Andes Road, separate left and right-turn entering lanes are not warranted at the Proposed Entrance based on the projected 2025 AM and PM peak hour traffic volumes. The projected volumes at the intersection were not particularly close to meeting the thresholds required to warrant turn lanes on Andes Road. The worksheets for these evaluations are provided in Appendix I.

EVALUATION OF INTERSECTION SPACING

Knox County has established intersection standards for public and private streets. One of these standards is related to the spacing of intersections. Since Andes Road is designated as a Major Collector, the minimum intersection spacing is 300 feet.



Andes Road Intersection Spacing

The proposed spacing between Norway Street in the Chip's Crossing Subdivision and the Proposed Entrance for Andes Hill Subdivision is 150 feet from centerline to centerline, less than the Knox County minimum. The existing intersection spacing between Norway Street and David Tippit Way is 130 feet. David Tippit Way provides access to Tippit Village Subdivision.

CONCLUSIONS & RECOMMENDATIONS

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

Andes Road at Proposed Entrance: The 2025 projected level of service calculations for the Proposed Entrance intersection at Andes Road resulted in low vehicle delays. The construction of left and right-turn lanes on Andes Road for entering traffic is not warranted at the Proposed Entrance. A single exiting lane for the development entrance will be sufficient.

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

1b) Sight distances at the Proposed Entrance approach must not be impacted by future landscaping, signage, or vegetation. Based on a posted speed limit of 30-mph on Andes Road, the desirable intersection sight distance is 300 feet looking in each direction at each entrance. The required stopping sight distance is 195 feet looking to the north and 205 feet to the south at the Proposed Entrance. A visual inspection determined that the intersection and stopping sight distances are available. However, the view to the north is reduced by the vertical curvature of Andes Road, a utility pole, and road signage. The site designer must ensure that these sight distances are accounted for and provided in the design plans. It is recommended that a registered land surveyor confirm that the sight distances are available at the Proposed Entrance location on Andes Road.

1c) Knox County requires a 300-foot minimum intersection spacing distance on Collector roads. The intersection of Andes Road at the Proposed Entrance will be 150 feet away to the southeast from Norway Street.

The site designer should request a variance to allow the proposed intersection spacing to be less than the minimum. This variance should be requested since the development property only has a narrow and limited access point to provide an entrance on Andes Road. Shifting the Proposed Entrance further away from Norway Street is not an option

due to the property frontage limitations.

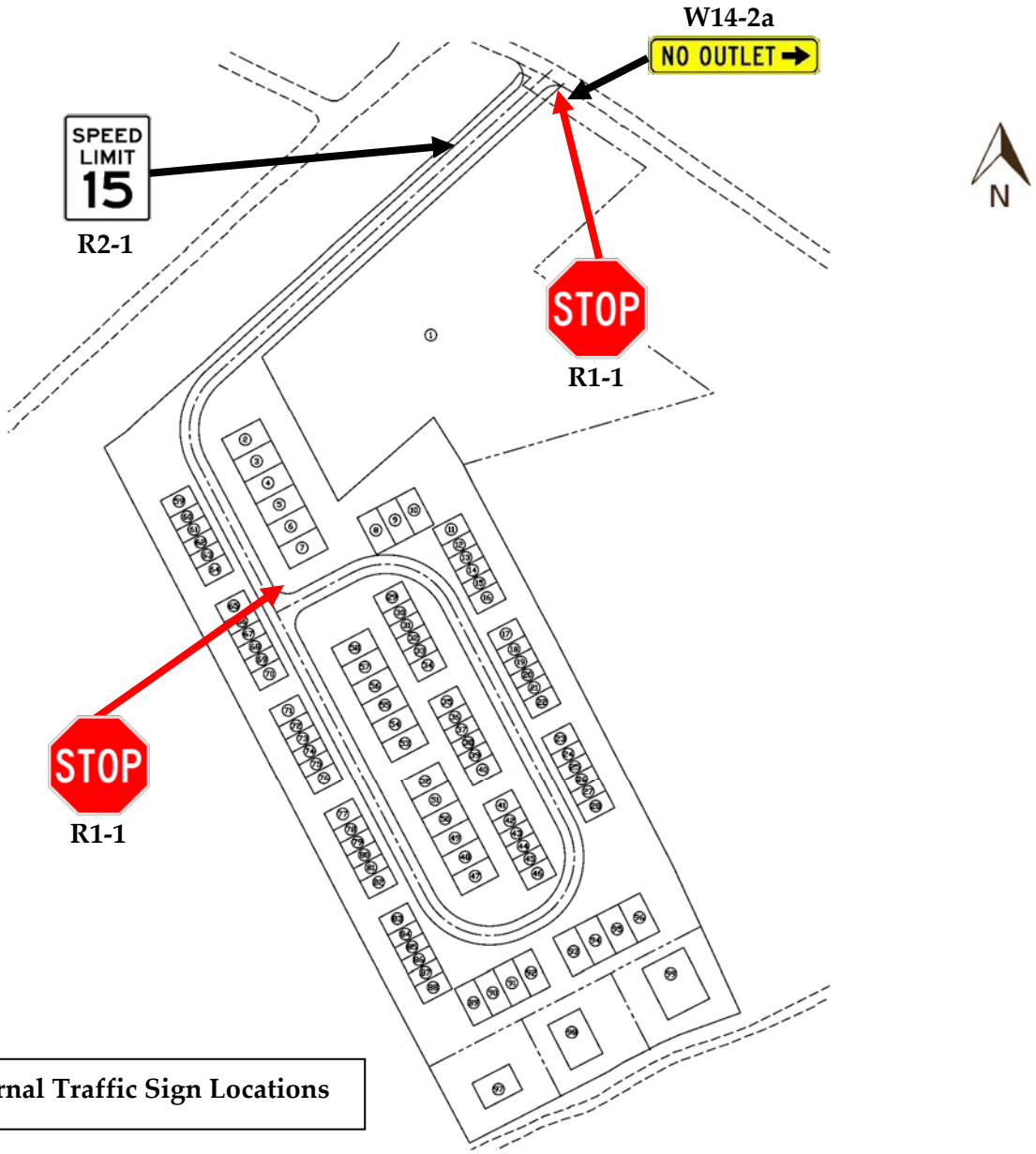
The longest calculated 95th percentile vehicle queue length for the existing northbound left-turn movement at Norway Street on Andes Road in the PM peak hour is only 2.5 feet. This queue length result is shown in the Synchro software results in Appendix F. This calculated queue suggests that vehicles turning left from Andes Road onto Norway Street at Chip's Crossing Subdivision will not back up to the Proposed Entrance for Andes Hill Subdivision. Andes Hill Subdivision entering vehicles from the north, turning right at the Proposed Entrance, will not experience vehicle queues since this is a free movement without conflicts. Traffic operations from the entering right-turning movement at the Proposed Entrance will not back up to the Andes Road at Norway Street intersection. It is not expected that the traffic operations on Andes Road at the intersection of Norway Street will be detrimental to traffic operations at the Proposed Entrance for Andes Hill Subdivision and vice versa.

Furthermore, while the proposed intersection spacing does not meet the requirement on a collector road, it will meet the local road intersection spacing requirement of 150 feet. The proposed spacing of 150 feet will provide greater spacing than what currently exists on Andes Road between Norway Street and David Tippit Way, which is only 130 feet.

2 **Andes Hill Subdivision Internal Roads:** The layout plan shows one entrance on Andes Road constructed for the development, as shown in Figure 3.

2a) A 15-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the development entrance off Andes Road. Since the entrance driveway will not be a public road, a posted speed limit of less than 25-mph is acceptable. It is recommended that a "No Outlet" Sign (W14-2a) be installed at the front of the subdivision at Andes Road. This sign can be installed below the street name sign.

2b) Stop Signs (R1-1) with 24" white stop bars and other traffic signage are recommended to be installed at the internal locations, as shown below:



Internal Traffic Sign Locations

2c) Sight distance at the new internal road intersection must not be impacted by signage, parked cars, or future landscaping. With a proposed speed limit of 15-mph in the development, the internal intersection sight distance is 170 feet. The required stopping sight distance is 80 feet for a level road grade. The site designer should ensure that internal sight distance lengths are met.

2d) Traffic calming measures may be needed to decrease internal vehicle speeds. The internal roadway has long and straight segments. It is recommended that the site designer consider installing speed humps or speed tables within the development to reduce internal speeds.

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

2f) Sidewalks are proposed on one side of the internal roadway. Sidewalks should have appropriate ADA-compliant ramps at intersection corners, and the internal sidewalks are recommended to be 5 feet minimum in width to meet Knox County regulations. White crosswalks should be marked on the road pavement internally where pedestrians are expected to cross.

2g) If directed by the local post office, the site designer should include a parking area within the development for a centralized mail delivery center. The site plan shows a general location at the front of the development, but a specific plan with a parking area should be designed and provided.

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

APPENDIX A

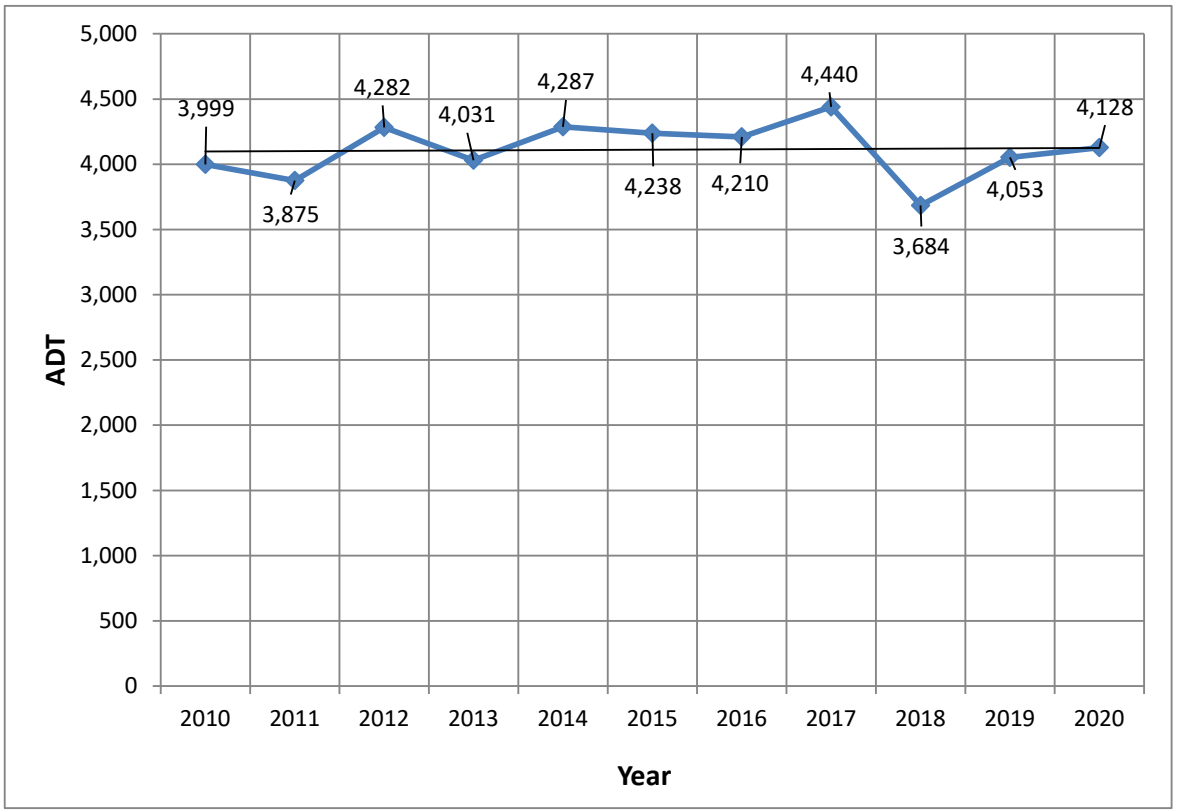
HISTORICAL TRAFFIC COUNT DATA

Historical Traffic Counts

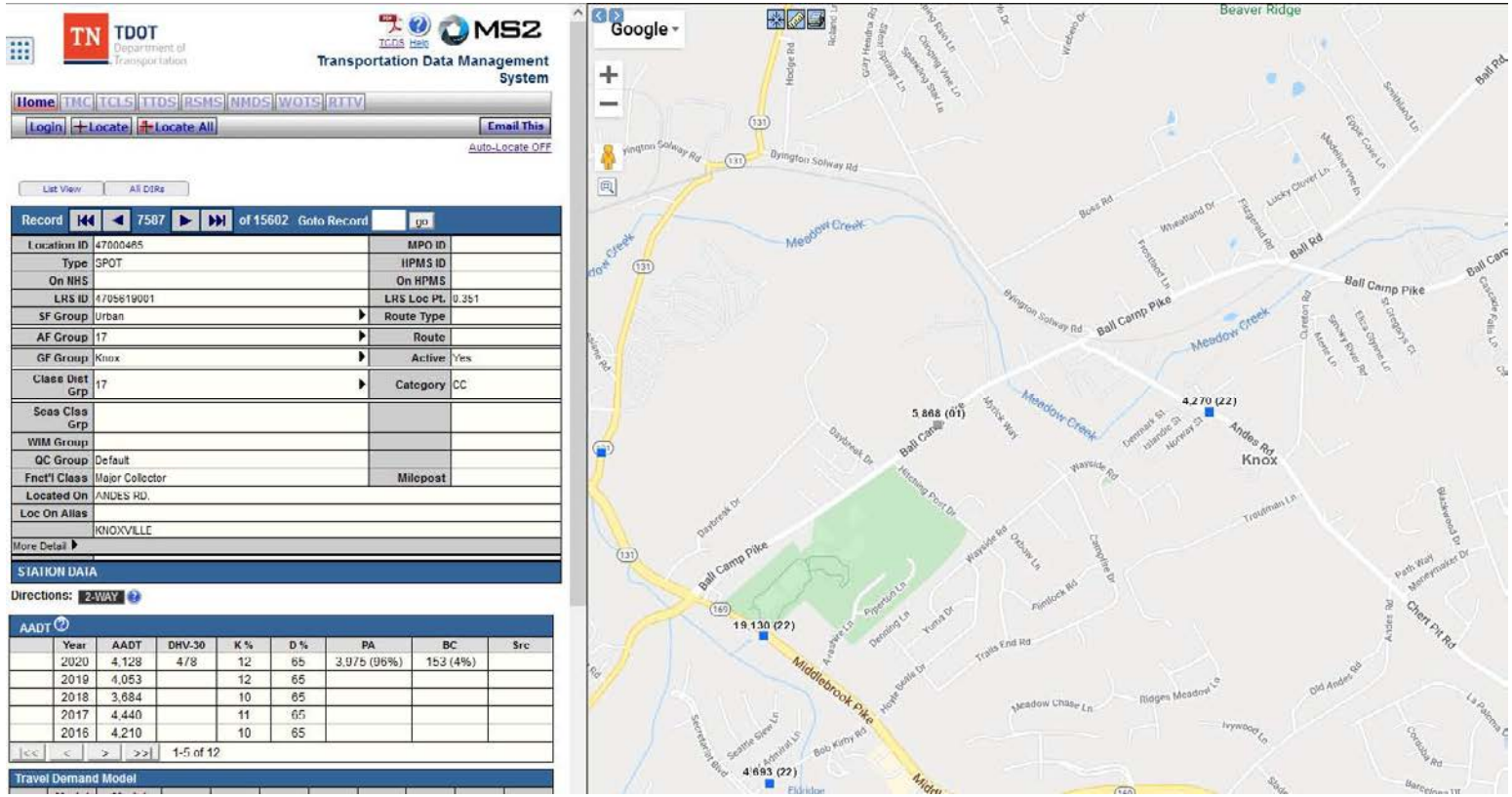
Organization: TDOT
Station ID #: 47000465
Location: Andes Road at Norway Street

YEAR	AADT
2010	3,999
2011	3,875
2012	4,282
2013	4,031
2014	4,287
2015	4,238
2016	4,210
2017	4,440
2018	3,684
2019	4,053
2020	4,128

Trendline



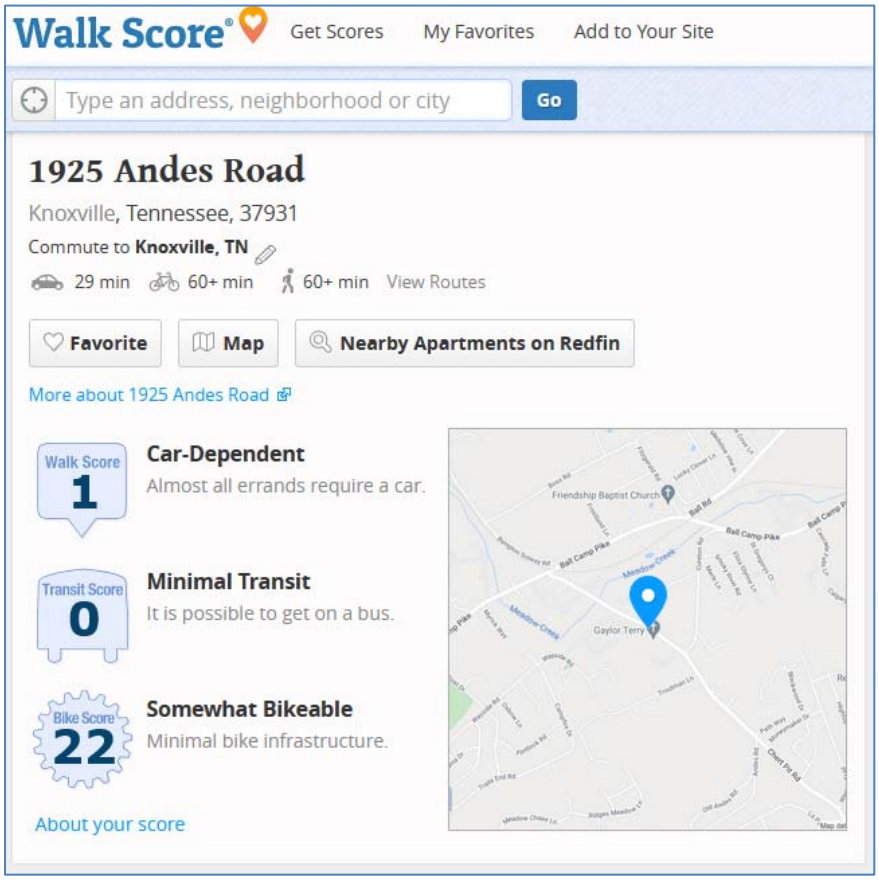
2010 - 2020 Growth Rate = 3.2%
Average Annual Growth Rate = 0.3%


TN TDOT Department of Transportation
MS2
Transportation Data Management System
Home TMC TCLS TTDS RSMS NMDS WQTS RTTV
Login Locate Locate All Email This
Auto-Locate OFF
List View All DIRs
Record 7587 of 15602 Goto Record go
Location ID 47000485
Type SPOT
On NHS
LRS ID 4705619001
SF Group Urban
AF Group 17
GF Group Knox
Class Dist Grp 17
Seas Class Grp
WIM Group
QC Group Default
Fnct'l Class Major Collector
Located On ANDES RD.
Loc On Alias
KNOXVILLE
More Detail
MPO ID
IIPMS ID
On HPMS
LRS Loc Pt. 0.351
Route Type
Route
Active Yes
Category CC
Milepost
STATION DATA
Directions: 2-WAY
AADT
Year AADT DHV-30 K % D % PA BC Src
2020 4,128 478 12 65 3,975 (96%) 153 (4%)
2019 4,053 12 65
2018 3,684 10 65
2017 4,440 11 65
2016 4,210 10 65
1-5 of 12
Travel Demand Model
Google
Beaver Ridge
Ball Rd
Byington Solway Rd
Meadow Creek
Ball Camp Pike
Andes Rd
Knox
5,868 (01)
4,270 (22)
19,130 (22)
4,693 (22)
Middlebrook Pike
Cherri Pit Rd

APPENDIX B

WALK SCORE

WALKSCORE
(from walkscore.com)



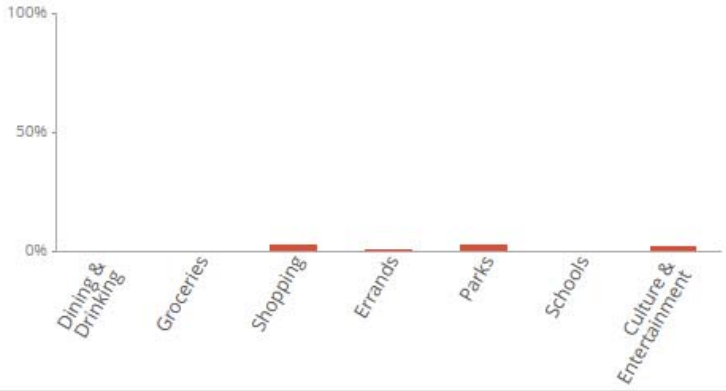
Walk Score 1

Bike Score 22

Walk Score | Transit Score | Bike Score

Score Details | What is Walk Score

The Walk Score for 1925 Andes Road is based on the following categories.



Scores for 1925 Andes Road

×

Walk Score 1

Bike Score 22

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

Walk Score 1

Bike Score 22

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	**Biker's Paradise** Daily errands can be accomplished on a bike
70–89	**Very Bikeable** Biking is convenient for most trips
50–69	**Bikeable** Some bike infrastructure
0–49	**Somewhat Bikeable** Minimal bike infrastructure

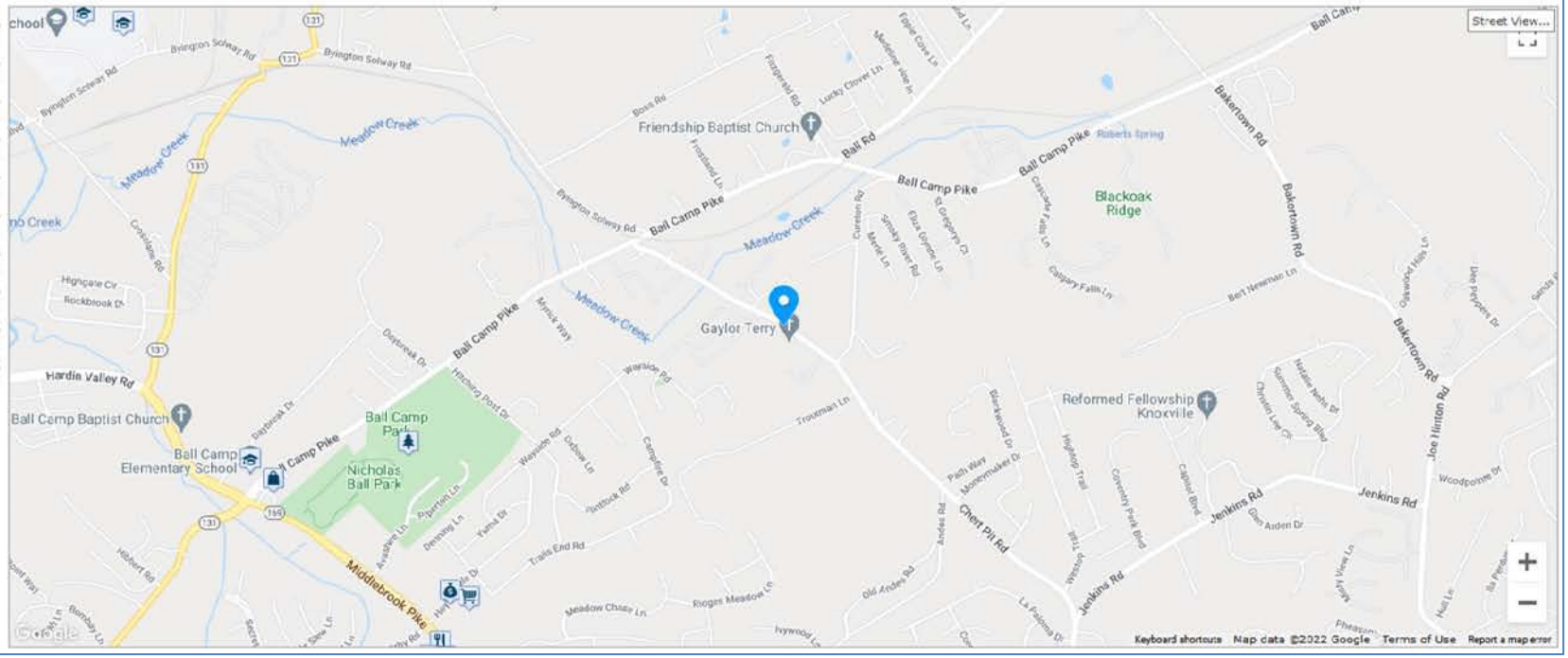
Travel Time Map

Add to your site

Explore how far you can travel by car, bus, bike and foot from 1925 Andes Road.

What's Nearby

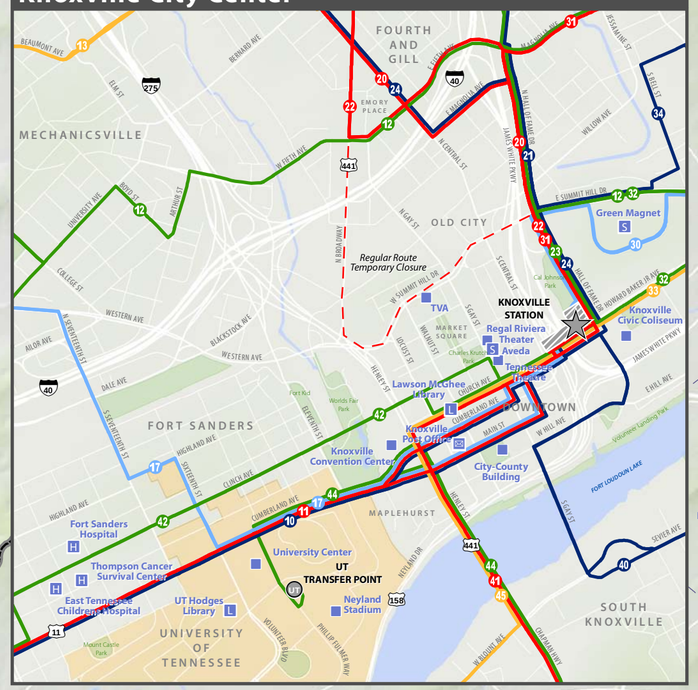
Restaurants:	Panda House	1.1mi
Coffee:	Starbucks	1.1mi
Bars:	Roger	1.6mi
Groceries:	Food City	1mi
Parks:	Ball Camp Park	.9mi
Schools:	Tate's School of Discovery	1.3mi
Shopping:	Insight Eyecare	.8mi
Entertainment:	Redbox	1mi
Errands:	Ornl Federal Credit Union	1mi
Search Nearby:		



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

NORTH

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.

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 or call 637-3000.

BUS STOPS ONLY!

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

KAT HOLIDAYS

KAT buses do not run on the following holidays:

- New Year's Day
- Independence Day
- Thanksgiving
- 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
- Memorial Day
- Labor Day
- Day after Thanksgiving
- Christmas Eve

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

N W E S

0 0.25 0.5 Miles

Map revised: 02.21

16 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

kat KNOXVILLE AREA TRANSIT

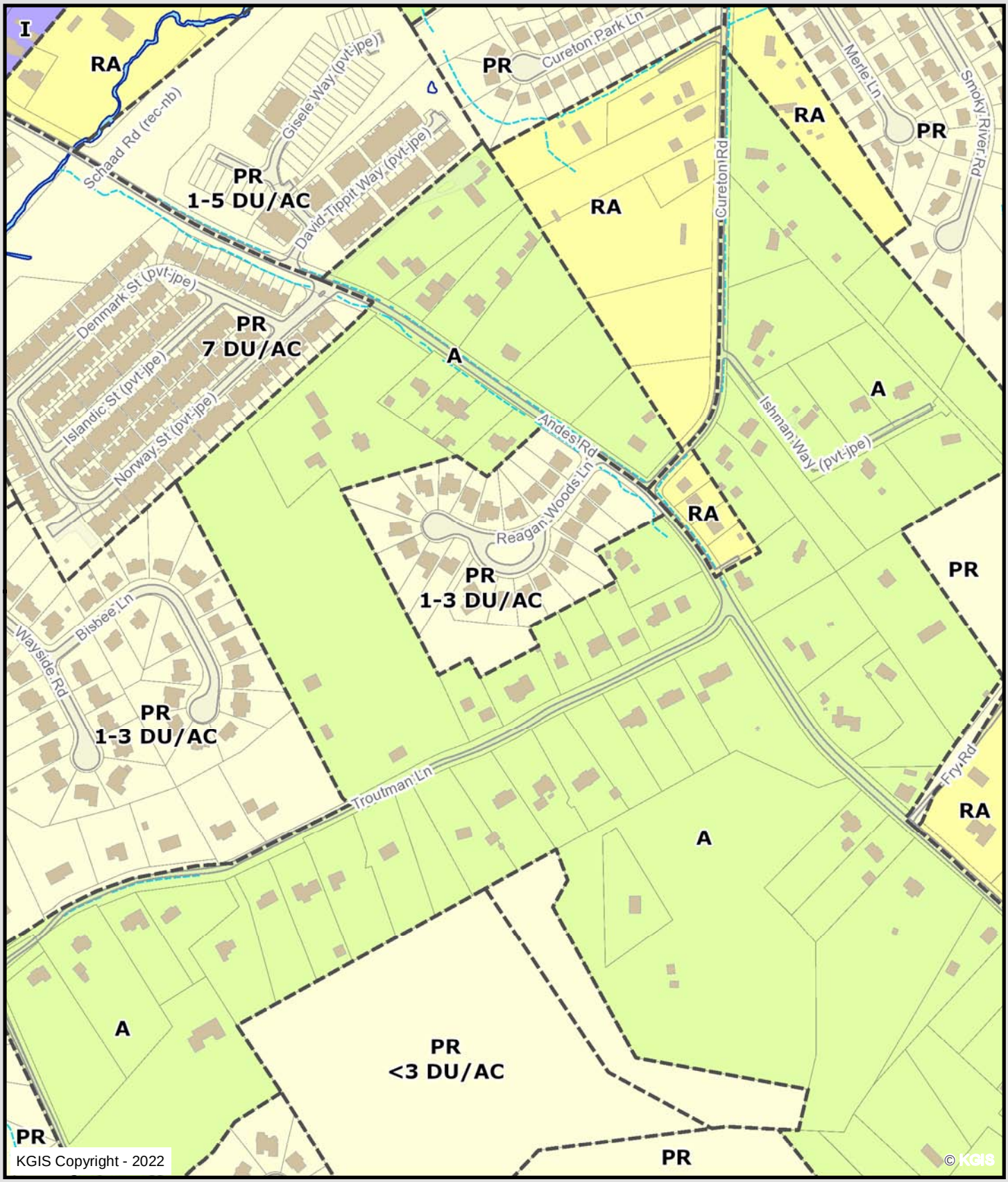
Information Updated: February 1, 2021

	Going from Wal Mart to Windsor Square				*Going from Windsor Square to Wal Mart*		
	T *Transfer to:*						*Rts. 11 & 90*
	Walmart 1	Park Village at Woodpark 2	Parkwest Hospital 3	Windsor Square 4	Parkwest Hospital 5	Cedar Bluff at Fox Lonas 6	Walmart 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	**12:10**
P.M.	**12:15**	**12:27**	**12:32**	**12:42**	**12:50**	**12:54**	**1:10**
	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	**12:10**
P.M.	**12:15**	**12:27**	**12:32**	**12:42**	**12:50**	**12:54**	**1:10**
	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?
Visit www.katbus.com or call 865-637-3000

APPENDIX D

ZONING MAP



Existing Zoning Map

Andes Hill Subdivision

Knoxville - Knox County - KUB Geographic Information System

Printed: 4/15/2022 at 2:34:32 PM

0 200 400 800

ft

APPENDIX E

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: Andes Road (NB and SB)
Minor Street: Norway Street (EB)
Traffic Control: Stop Sign on Norway Street

4/14/2022 (Thursday)
Morning: Overcast/Rain & Afternon: Partly Sunny
Conducted by: Ajax Engineering

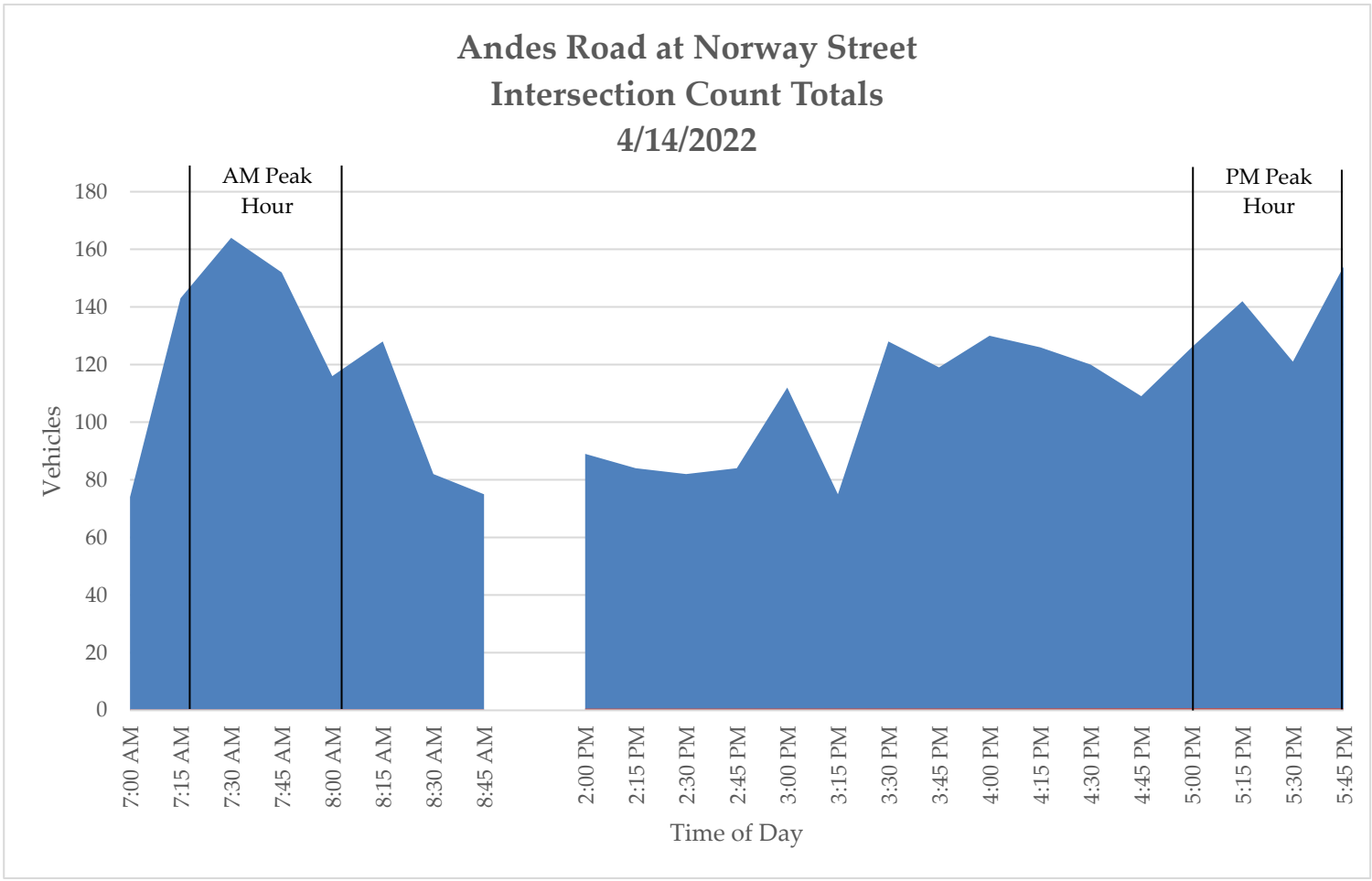
	Andes Road		Andes Road		Norway Street			
TIME	SOUTHBOUND		NORTHBOUND		EASTBOUND		VEHICLE	PEAK
BEGIN	THRU	RT	LT	THRU	LT	RT	TOTAL	HOUR
7:00 AM	37	1	0	29	3	4	74	
7:15 AM	87	2	2	44	3	5	143	**7:15 AM - 8:15 AM**
7:30 AM	116	3	0	32	5	8	164	
7:45 AM	101	1	0	46	1	3	152	
8:00 AM	68	2	0	42	1	3	116	
8:15 AM	88	0	0	31	1	8	128	
8:30 AM	61	1	1	16	0	3	82	
8:45 AM	49	1	0	17	2	6	75	
TOTAL	607	11	3	257	16	40	934	
2:00 PM	37	5	1	41	1	4	89	
2:15 PM	28	4	1	46	2	3	84	
2:30 PM	38	2	1	40	0	1	82	
2:45 PM	39	3	2	39	1	0	84	
3:00 PM	55	5	2	48	1	1	112	
3:15 PM	35	1	1	35	1	2	75	
3:30 PM	73	2	5	45	0	3	128	
3:45 PM	59	2	4	48	2	4	119	
4:00 PM	59	3	5	57	1	5	130	
4:15 PM	58	4	5	54	4	1	126	
4:30 PM	60	6	3	44	0	7	120	
4:45 PM	43	4	6	51	0	5	109	
5:00 PM	67	1	5	49	1	3	126	**5:00 PM - 6:00 PM**
5:15 PM	60	4	4	68	1	5	142	
5:30 PM	54	1	4	60	1	1	121	
5:45 PM	79	4	8	60	1	2	154	
TOTAL	844	51	57	785	17	47	1801	

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

	Andes Road		Andes Road		Norway Street	
TIME	SOUTHBOUND		NORTHBOUND		EASTBOUND	
BEGIN	THRU	RT	LT	THRU	LT	RT
7:15 AM	87	2	2	44	3	5
7:30 AM	116	3	0	32	5	8
7:45 AM	101	1	0	46	1	3
8:00 AM	68	2	0	42	1	3
TOTAL	**372**	**8**	**2**	**164**	**10**	**19**
PHF	**0.80**	**0.67**	**0.25**	**0.89**	**0.50**	**0.59**

2022 PM Peak Hour **5:00 PM - 6:00 PM**

	Andes Road		Andes Road		Norway Street	
TIME	SOUTHBOUND		NORTHBOUND		EASTBOUND	
BEGIN	THRU	RT	LT	THRU	LT	RT
5:00 PM	67	1	5	49	1	3
5:15 PM	60	4	4	68	1	5
5:30 PM	54	1	4	60	1	1
5:45 PM	79	4	8	60	1	2
TOTAL	**260**	**10**	**21**	**237**	**4**	**11**
PHF	**0.82**	**0.63**	**0.66**	**0.87**	**1.00**	**0.55**


Andes Road at Norway Street
Intersection Count Totals
4/14/2022
AM Peak Hour
PM Peak Hour
Vehicles
180
160
140
120
100
80
60
40
20
0
7:00 AM
7:15 AM
7:30 AM
7:45 AM
8:00 AM
8:15 AM
8:30 AM
8:45 AM
2:00 PM
2:15 PM
2:30 PM
2:45 PM
3:00 PM
3:15 PM
3:30 PM
3:45 PM
4:00 PM
4:15 PM
4:30 PM
4:45 PM
5:00 PM
5:15 PM
5:30 PM
5:45 PM
Time of Day

APPENDIX F

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 11)

EXISTING CONDITIONS

Intersection	
Int Delay, s/veh	1

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	372	8	2	164	10	19
Future Vol, veh/h	372	8	2	164	10	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	-1	0	-
Peak Hour Factor	80	67	25	89	50	59
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	465	12	8	184	20	32

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	477	0	671	471
Stage 1	-	-	-	-	471	-
Stage 2	-	-	-	-	200	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1096	-	425	597
Stage 1	-	-	-	-	632	-
Stage 2	-	-	-	-	838	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1096	-	422	597
Mov Cap-2 Maneuver	-	-	-	-	422	-
Stage 1	-	-	-	-	632	-
Stage 2	-	-	-	-	831	-

Approach	EB	WB	NE
HCM Control Delay, s	0	0.3	12.8
HCM LOS			B

Minor Lane/Major Mvmt	NELn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	515	-	-	1096	-
HCM Lane V/C Ratio	0.101	-	-	0.007	-
HCM Control Delay (s)	12.8	-	-	8.3	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	260	10	21	237	4	11
Future Vol, veh/h	260	10	21	237	4	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	-1	0	-
Peak Hour Factor	82	63	66	87	100	55
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	317	16	32	272	4	20

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	333	0	661	325
Stage 1	-	-	-	-	325	-
Stage 2	-	-	-	-	336	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1238	-	431	721
Stage 1	-	-	-	-	737	-
Stage 2	-	-	-	-	728	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1238	-	418	721
Mov Cap-2 Maneuver	-	-	-	-	418	-
Stage 1	-	-	-	-	737	-
Stage 2	-	-	-	-	706	-

Approach	EB	WB	NE
HCM Control Delay, s	0	0.8	10.8
HCM LOS			B

Minor Lane/Major Mvmt	NELn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	643	-	-	1238	-
HCM Lane V/C Ratio	0.037	-	-	0.026	-
HCM Control Delay (s)	10.8	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

PROJECTED HORIZON YEAR (WITH THE PROJECT)

Intersection	
Int Delay, s/veh	1.4

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	402	7	4	171	14	26
Future Vol, veh/h	402	7	4	171	14	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	-3	0	-
Peak Hour Factor	80	67	25	89	50	59
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	503	10	16	192	28	44

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	513	0	732	508
Stage 1	-	-	-	-	508	-
Stage 2	-	-	-	-	224	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1063	-	391	569
Stage 1	-	-	-	-	608	-
Stage 2	-	-	-	-	818	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1063	-	384	569
Mov Cap-2 Maneuver	-	-	-	-	384	-
Stage 1	-	-	-	-	608	-
Stage 2	-	-	-	-	804	-

Approach	EB	WB	NE
HCM Control Delay, s	0	0.6	13.8
HCM LOS			B

Minor Lane/Major Mvmt	NELn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	479	-	-	1063	-
HCM Lane V/C Ratio	0.15	-	-	0.015	-
HCM Control Delay (s)	13.8	-	-	8.4	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	279	14	27	265	12	21
Future Vol, veh/h	279	14	27	265	12	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	-3	0	-
Peak Hour Factor	82	63	66	87	100	55
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	340	22	41	305	12	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	362	0	738	351
Stage 1	-	-	-	-	351	-
Stage 2	-	-	-	-	387	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1208	-	388	697
Stage 1	-	-	-	-	717	-
Stage 2	-	-	-	-	691	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1208	-	372	697
Mov Cap-2 Maneuver	-	-	-	-	372	-
Stage 1	-	-	-	-	717	-
Stage 2	-	-	-	-	663	-

Approach	EB	WB	NE
HCM Control Delay, s	0	1	11.8
HCM LOS			B

Minor Lane/Major Mvmt	NELn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	577	-	-	1208	-
HCM Lane V/C Ratio	0.087	-	-	0.034	-
HCM Control Delay (s)	11.8	-	-	8.1	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.1	-

APPENDIX G

LOCAL TRIP GENERATION RATES

Local Apartment
Trip Generation Study

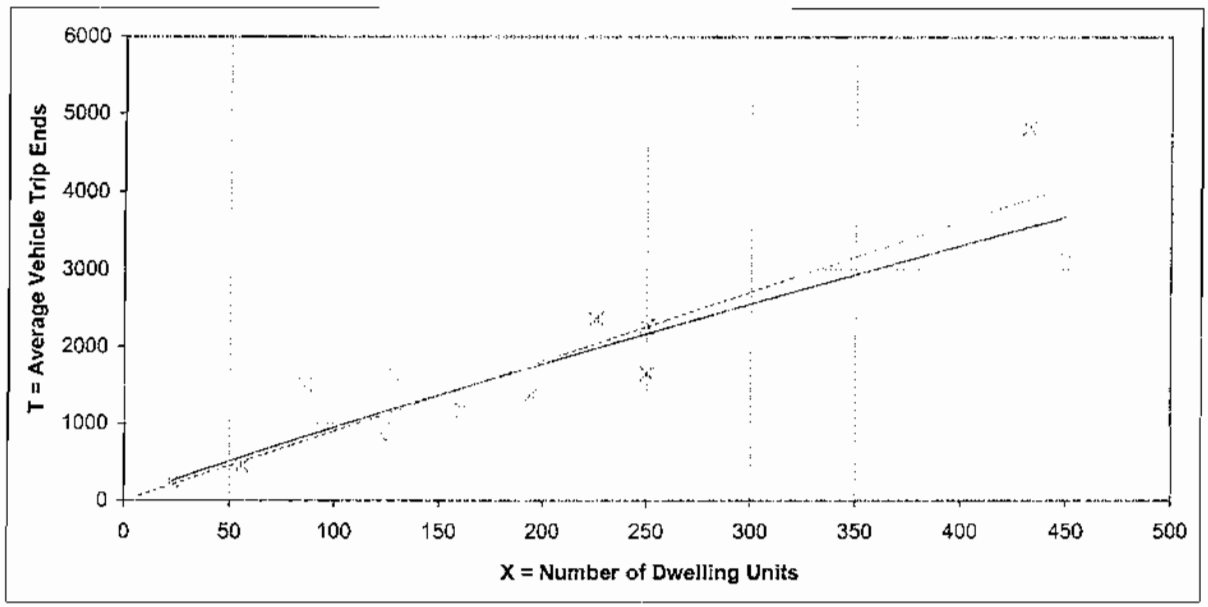
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

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

Trip Generation Per Dwelling Unit

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

Data Plot and Equation



X Actual Data Points ——— Fitted Curve Average Rate

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

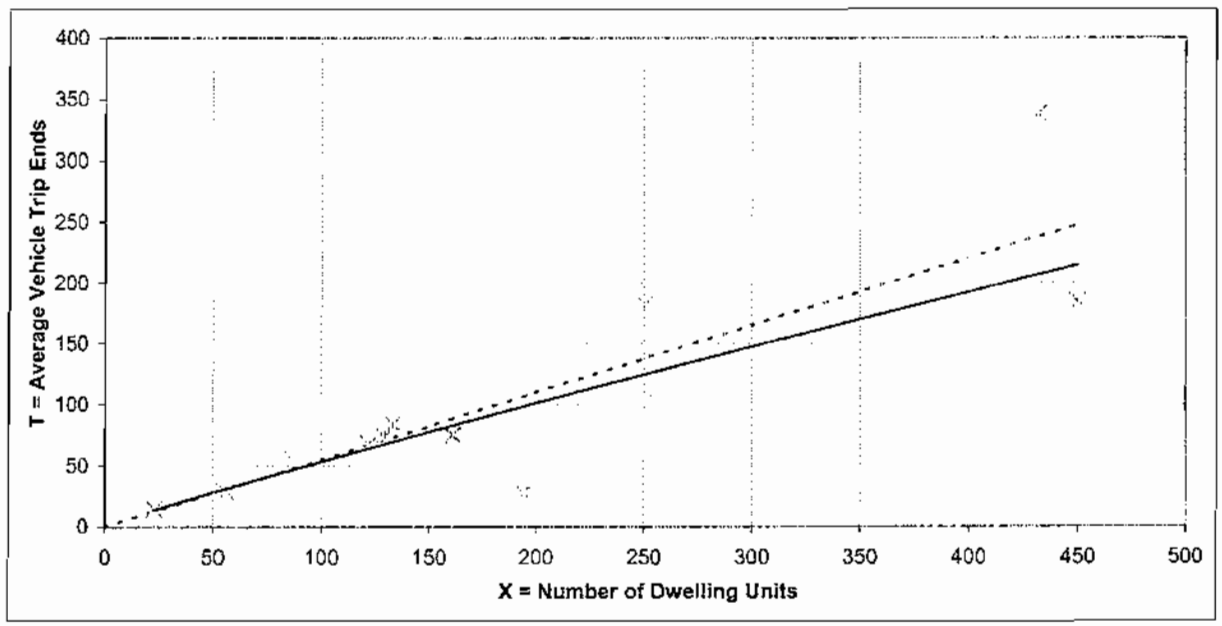
Local Apartment
Trip Generation Study

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

Trip Generation Per Dwelling Unit

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

Data Plot and Equation



X Actual Data Points ——— Fitted Curve Average Rate

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

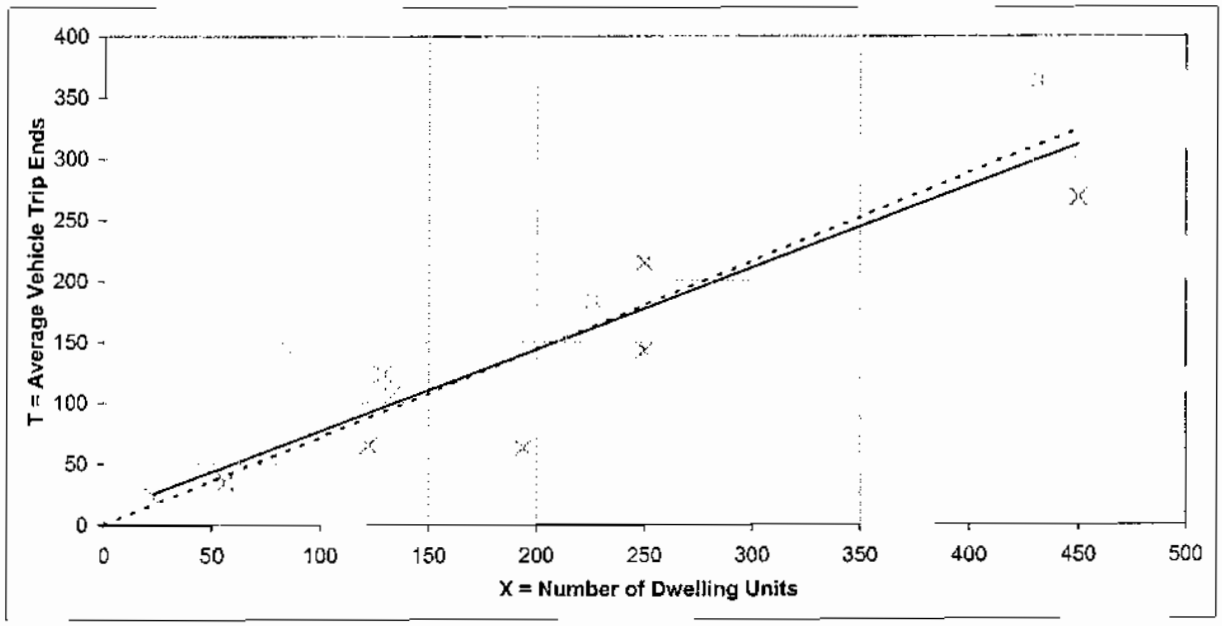
Local Apartment
Trip Generation Study

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

Trip Generation Per Dwelling Unit

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

Data Plot and Equation



X Actual Data Points ——— Fitted Curve Average Rate

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

TRIP GENERATION FOR ANDES HILL SUBDIVISION

95 Multi-Family Townhouse Units

ITE LAND USE CODE	LAND USE DESCRIPTION	# OF UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Local Trip Rate	Multi-Family Townhouses	95	911	22%	78%		55%	45%	
				11	40	51	41	33	74
Total New Volume Site Trips			**911**	**11**	**40**	**51**	**41**	**33**	**74**

Calculated from Local Trip Rates

Trips calculated by using Fitted Curve Equations

TRIP GENERATION FOR ANDES HILL SUBDIVISION

95 Multi-Family Townhouse Units

95 Townhouses = X

Weekday:

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

T = 15 * 59.98

T = 911 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T = 0.758 * 67

T = 51 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

T = 0.669 * 95 + 10.07

T = 74 trips

APPENDIX H

2019 CENSUS BUREAU DATA

OnTheMap

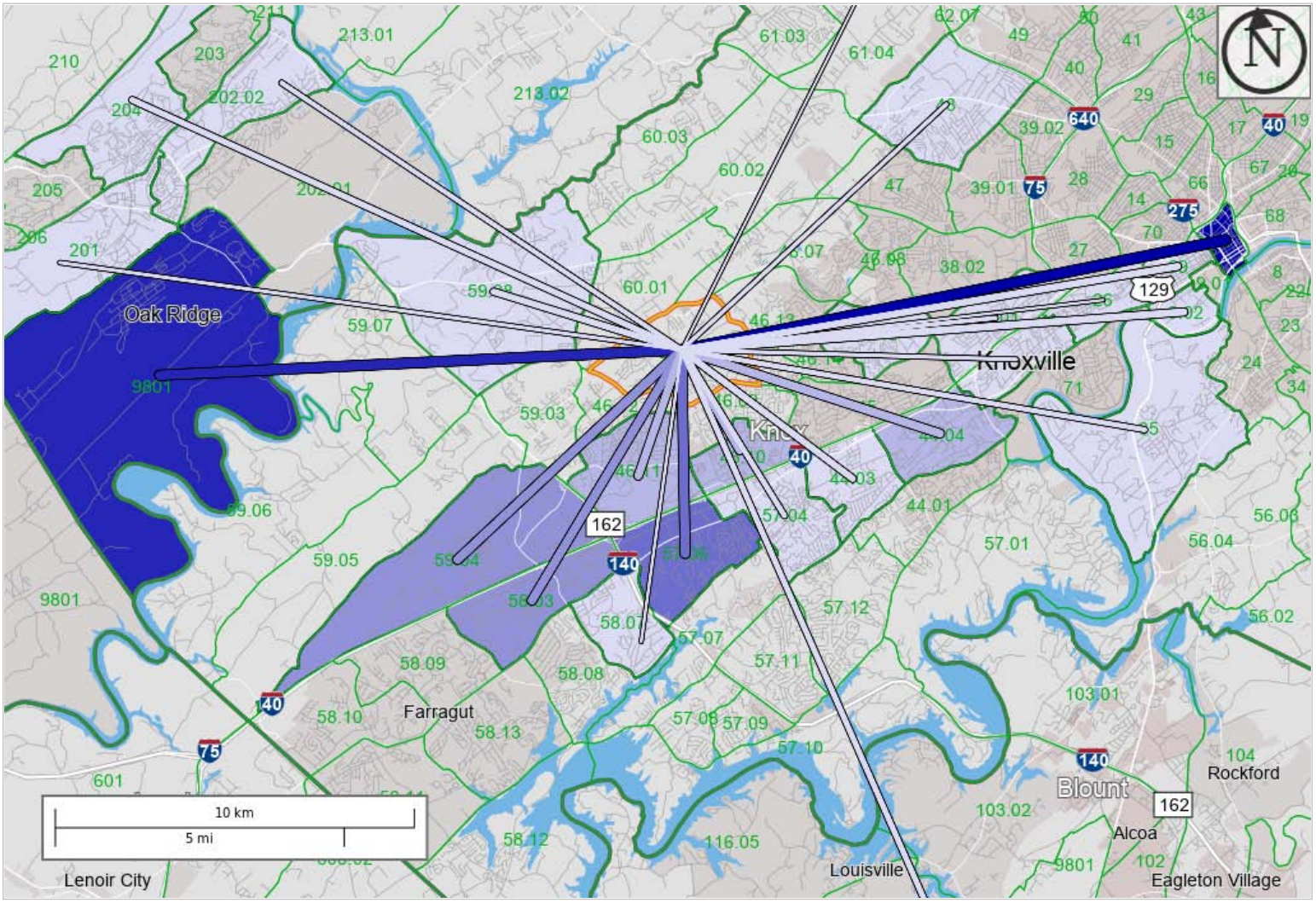
Work Destination Report - Home Selection Area to Work Census Tracts

All Jobs for All Workers in 2019

Created by the U.S. Census Bureau's OnTheMap https://onthemap.ces.census.gov on 04/15/2022

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

All Workers



Map Legend

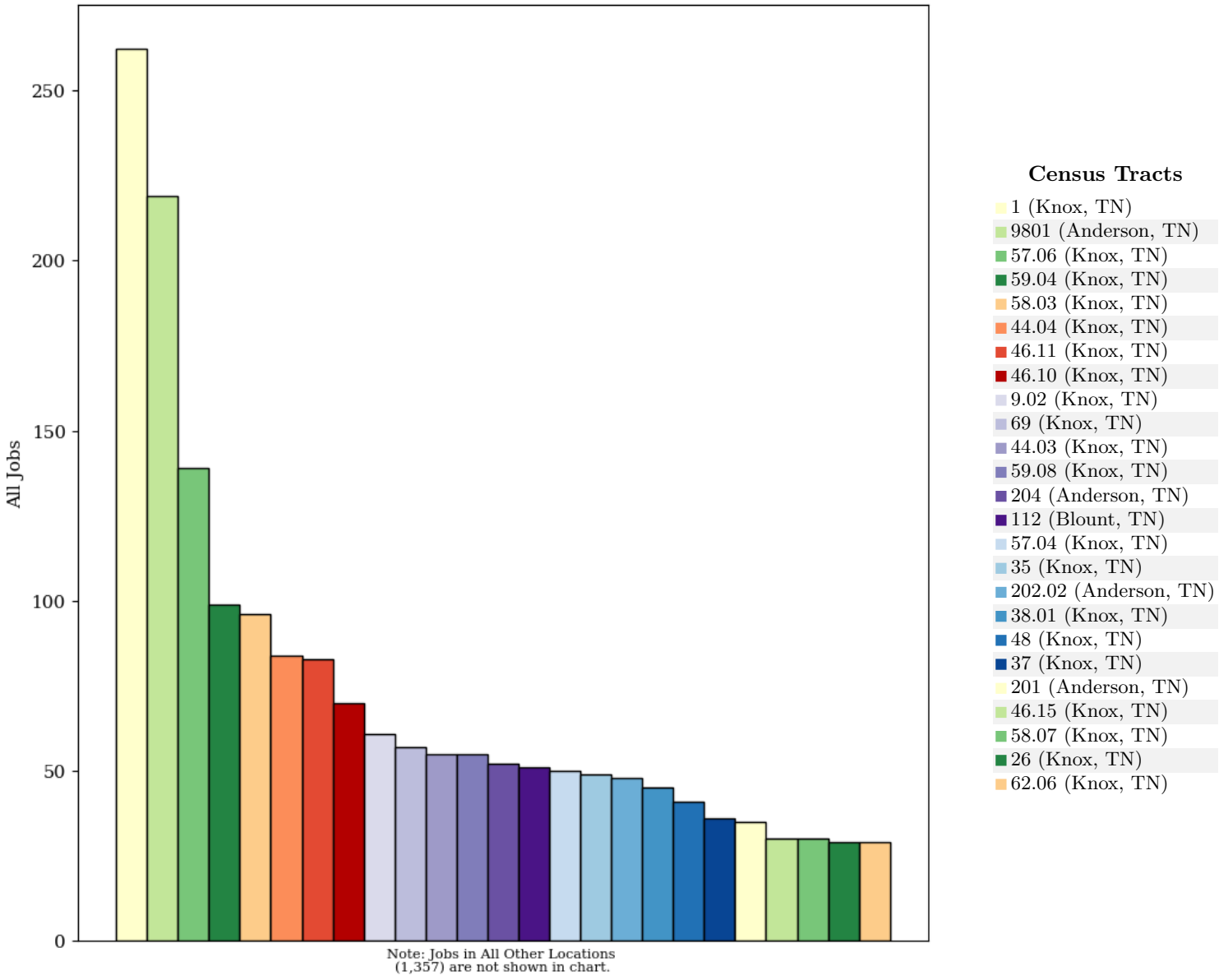
Job Count
- 229 - 262
- 196 - 228
- 163 - 195
- 129 - 162
- 96 - 128
- 63 - 95
- 29 - 62

Selection Areas
- Analysis Selection

Job Count
- 229 - 262
- 196 - 228
- 163 - 195
- 129 - 162
- 96 - 128
- 63 - 95
- 29 - 62

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

All Workers



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

All Workers

Census Tracts as Work Destination Area	2019 Count	2019 Share
All Census Tracts	3,162	100.0
1 (Knox, TN)	262	8.3
9801 (Anderson, TN)	219	6.9
57.06 (Knox, TN)	139	4.4
59.04 (Knox, TN)	99	3.1
58.03 (Knox, TN)	96	3.0
44.04 (Knox, TN)	84	2.7
46.11 (Knox, TN)	83	2.6
46.10 (Knox, TN)	70	2.2
9.02 (Knox, TN)	61	1.9
69 (Knox, TN)	57	1.8

Census Tracts as Work Destination Area	2019 Count	Share
44.03 (Knox, TN)	55	1.7
59.08 (Knox, TN)	55	1.7
204 (Anderson, TN)	52	1.6
112 (Blount, TN)	51	1.6
57.04 (Knox, TN)	50	1.6
35 (Knox, TN)	49	1.5
202.02 (Anderson, TN)	48	1.5
38.01 (Knox, TN)	45	1.4
48 (Knox, TN)	41	1.3
37 (Knox, TN)	36	1.1
201 (Anderson, TN)	35	1.1
46.15 (Knox, TN)	30	0.9
58.07 (Knox, TN)	30	0.9
26 (Knox, TN)	29	0.9
62.06 (Knox, TN)	29	0.9
All Other Locations	1,357	42.9

Additional Information

Analysis Settings

Analysis Type	Destination
Destination Type	Census Tracts
Selection area as	Home
Year(s)	2019
Job Type	All Jobs
Selection Area	46.06 (Knox, TN) from Census Tracts
Selected Census Blocks	59
Analysis Generation Date	04/15/2022 15:35 - OnTheMap 6.8.1
Code Revision	f9358819d46a60bb89052036516a1c8fe8bbbeac
LODES Data Version	20211018_1647

Data Sources

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

Notes

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

APPENDIX I

KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS

TABLE 4A

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

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

171

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

7+402 = 409

Andes Road at Proposed Entrance

2025 Projected AM NB Left Turns = 4

Turn Lane NOT Warranted

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

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

TABLE 4B

RIGHT-TURN LANE VOLUME THRESHOLDS

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

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

402

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
7 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 Yes
300 - 349 350 - 399	Yes Yes	Yes Yes			Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes			Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

Andes Road at
Proposed Entrance

2025 Projected AM
SB Right Turns = 7

Turn Lane NOT
Warranted

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

TABLE 4A

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

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

265

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

14+279 = 293

Andes Road at Proposed Entrance

2025 Projected PM NB Left Turns = 27

Turn Lane NOT Warranted

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

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

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

279

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

Andes Road at Proposed Entrance

2025 Projected PM SB Right Turns = 14

Turn Lane NOT Warranted

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

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

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