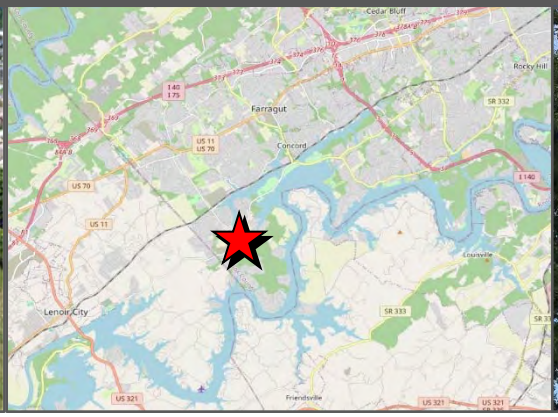
AJAX ENGINEERING

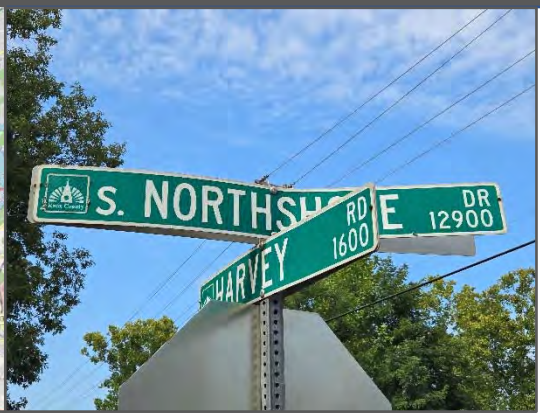
CIVIL ENGINEERING / TRAFFIC ENGINEERING

Transportation Impact Study

The Enclave at Harvey

Knox County, Tennessee





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EXECUTIVE SUMMARY

Preface:

Heritage Land Development Partners, LLC proposes a residential development at the corner of S Northshore Drive and Harvey Road in deep Southwest Knox County near the Loudon County line. The proposed development will include constructing a maximum of 116 single-family detached houses on 42.44 +/- acres. The development is named and referenced in this study as "The Enclave at Harvey". The development proposes two entrances - one on S Northshore Drive at the existing t-intersection with Falcon Pointe Drive and the other at Harvey Road. The development is anticipated to be fully built and occupied by 2028.

The primary purpose of this study is to determine and evaluate the potential impacts of the development on the adjacent transportation system. The study includes a review of the primary access roads and proposed entrances, and it is a Level 1 study established by Knoxville/Knox County Planning. This study also includes a review of the potential impacts of the development on the adjacent 4-way stop-controlled intersection of S Northshore Drive at Harvey Road. Recommendations and mitigation measures are offered to accommodate the new residential subdivision if transportation operations are projected to be below recognized engineering standards.

Study Results:

The significant findings of this study include the following:

- The Enclave at Harvey, with a maximum of 116 single-family detached houses, is estimated to generate 1,157 vehicle trips at full build-out and occupancy on an average weekday. Of these daily trips, 85 are estimated to occur during the AM peak hour and 114 in the PM peak hour in 2028.
- The Proposed Entrances for The Enclave at Harvey are expected to operate with low to acceptable vehicle delays during the projected AM and PM peak hours. The addition of the Proposed Entrance approaches on S Northshore Drive and Harvey Road will operate adequately in 2028 with respect to vehicle capacity.
- The projected 2028 traffic volumes for The Enclave at Harvey will not warrant the construction of separate entering turn lanes on S Northshore Drive or Harvey Road at the Proposed Entrances. Single exiting lanes for the Proposed Entrances will be sufficient.
- Unrelated to The Enclave at Harvey generated trips or transportation impacts, the westbound left-turning vehicles into the existing Falcon Pointe Subdivision are

estimated to warrant a separate left-turn lane on S Northshore Drive in the projected conditions.

Recommendations:

The following recommendations are offered based on the study analyses to minimize the impacts of the proposed development on the adjacent transportation system while attempting to achieve an acceptable traffic flow and improved safety. The recommendations marked with an asterisk indicate an existing or future transportation need and are not associated with the proposed development's projected impacts. More details regarding all the recommendations are discussed at the end of the report.

S Northshore Drive at Harvey Road:

* It is recommended that the sight distance be improved for westbound traffic on S Northshore Drive as it approaches the Harvey Road intersection by removing existing vegetation on the inside of the horizontal curve (north side) of S Northshore Drive. This vegetation must be maintained in the future conditions.
* Currently, a Stop Ahead (W3-1) Sign and a Reverse Curve (W1-4R) are posted on the left (south) side of S Northshore Drive. These signs should also be installed on the opposite side, facing westbound traffic.

S Northshore Drive at Falcon Pointe Drive and Proposed South Entrance:

- It is recommended that a Stop Sign (R1-1) be installed and a 24" white stop bar be applied to the Proposed South Entrance approach at S Northshore Drive. The stop bar should be applied a minimum of 4 feet away from the edge of S Northshore Drive and placed at the desired stopping point that maximizes the sight distance.
- Intersection sight distance at the Proposed South Entrance at S Northshore Drive must not be impacted by future landscaping, signage, or existing or future vegetation. Based on a posted speed limit of 40 mph on S Northshore Drive, the required intersection sight distance is 400 feet for exiting left and right-turning vehicles. The existing sight distances at the Proposed South Entrance location were estimated visually likely to be adequate in both directions. However, due to existing vegetation along the north side of S Northshore Drive, it is recommended that the sight distance be certified by a registered land surveyor. The site designer must ensure that the intersection sight distances are accounted for and provided in the design plans.

- Due to the higher classification of S Northshore Drive, the higher vehicle speeds, and to facilitate westbound right turn movements off the roadway into the development, it is recommended that the intersection radius be increased from the standard 25 feet. To facilitate this movement, it is recommended that the intersection radius at this corner be 50 feet.

* - In the projected 2028 conditions, due to general traffic growth and the trips generated by the Falcon Pointe Subdivision, a separate westbound left turn at this intersection is warranted in the PM peak hour. This warrant threshold is met even without the proposed The Enclave at Harvey development. As part of the construction of the Proposed South Entrance at S Northshore Drive, a separate westbound left turn lane on S Northshore Drive at the intersection is recommended due to meeting this warrant. In addition, while this intersection undergoes modifications, this construction would provide an opportune time to construct an eastbound left-turn lane on S Northshore Drive as well, even though this movement is projected to have minimal left turns into The Enclave at Harvey.

Harvey Road at Proposed West Entrance:

- It is recommended that a Stop Sign (R1-1) be installed and a 24" white stop bar be applied to the Proposed West Entrance approach at Harvey Road. The stop bar should be applied a minimum of 4 feet away from the edge of Harvey Road and placed at the desired stopping point that maximizes the sight distance.
- Intersection sight distance at the Proposed West Entrance at Harvey Road must not be impacted by future landscaping, signage, or existing or future vegetation. Based on a posted speed limit of 30 mph on Harvey Road, the required intersection sight distance is 300 feet for exiting left and right-turning vehicles. The existing sight distances at the Proposed West Entrance location were estimated visually to be adequate in both directions.

The Enclave at Harvey Subdivision Internal Roads:

- A 25 mph Speed Limit (R2-1) sign is recommended to be posted near the beginning of the development entrances off S Northshore Drive and Harvey Road.
- Stop Signs (R1-1) with 24" white stop bars are recommended to be installed at the internal road locations, as shown in the study. It is recommended that the proposed internal mini-roundabout be signed and the pavement approaches marked as shown in Figure 2B-21 in the Manual on Uniform Traffic Control Devices (MUTCD).

- Sight distance at the new internal intersections must not be impacted by new signage, parked cars, or future landscaping. With a speed limit of 25mph in the development, the internal intersection sight distance is 250 feet. The site designer should ensure that internal sight distance lengths are met.
- If directed by the local post office, the site designer should include a parking area and a centralized mail delivery center within the development for the subdivision residents.
- All drainage grates and covers for the residential development must be pedestrian and bicycle-safe.
- A few internal roads in the proposed subdivision will have long, straight road segments. Straight road segments encourage higher vehicle speeds. It is recommended that the civil site designer consider including traffic calming measures on the internal roads, such as speed humps or tables. Specifics regarding this recommendation should be discussed in the design phase with Knox County Engineering.
- The internal sidewalk system should be connected to the proposed sidewalk along the road frontage of S Northshore Drive. Sidewalks should have appropriate ADA-compliant ramps at intersection corners, and the internal sidewalks should be 5 feet minimum in width to meet Knox County regulations. White crosswalks should be marked internally on the road pavement where pedestrians are expected to cross.
- All road and intersection elements should be designed to AASHTO and Knox County specifications and guidelines to ensure proper operation.

DESCRIPTION OF EXISTING CONDITIONS

- **STUDY AREA:**

The location of this new residential development is shown on a map in Figure 1. This development will be located on the northeast corner of S Northshore Drive and Harvey Road in deep Southwest Knox County, TN, less than 1,000 feet from the boundary with Loudon County. The development will be constructed from a single existing parcel and will have two entrances, one south to S Northshore Drive and one west to Harvey Road. As requested, transportation impacts associated with the development were analyzed on these roads, where the proposed development will have road access to and from external destinations.

The scope of work from Knoxville/Knox County Planning also requested that the study include an analysis of the potential increased delay at the nearby 4-way stop-controlled intersection of S Northshore Drive at Harvey Road due to the new development's vehicle trips.

View of Development Site at Corner of S Northshore Drive at Harvey Road (Looking Northeast)

The proposed development property is in a formerly rural area that has been transitioned to a suburban area of Southwest Knox County, TN, particularly in the last 25 years. There are many residential subdivisions in the surrounding area of Knox County and Loudon County further to the west. These adjacent and nearby subdivisions consist entirely of single-family detached houses. The proposed site property is one of the last larger pieces of undeveloped land in this area of Knox County.

The existing development property has relatively mild topography by East Tennessee standards.

Existing Abandoned Houses near Harvey Road

Two creeks have been identified on the property during the development process, and they will be delineated and protected during construction. The existing property is covered with pockets of forest and tree growth along fence lines and the identified creeks. For the most part, the property is open and undeveloped and most recently used for agricultural purposes. Several structures on the existing property have been abandoned, with their road access provided by a gravel driveway off Harvey Road. The structures include two single-family detached houses, barns, and sheds. All these existing structures and the gravel driveway will be removed as part of the subdivision development.

Road access to this area of Knox County is primarily provided by S Northshore Drive, which traverses southwest to northeast. External access to and from areas to the south is limited and unavailable further south due to Fort Loudoun Lake. Road access to the north is available via Harvey Road and Choto Road but is restricted due to a narrow Norfolk Southern Railroad underpass at Boyd Station Road.

Screenshot from Knox County's YouTube Channel

Knox County Engineering recently announced a road improvement plan for S Northshore Drive between The Cove at Concord Park and Choto Road to the northeast of the development site. The road improvements are expected to be completed by 2025 and will include road lane and shoulder widening, side slope improvements, and an extension of a greenway for pedestrians.

Figure 1
Location Map

- **EXISTING ROADWAYS:**

Table 1 lists the characteristics of the existing primary roadways 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
S Northshore Drive	Minor Arterial	40 mph	2 lanes	21.5'	None	No sidewalks adjacent to proposed development site	No bike lanes
Harvey Road	Minor Collector	30 mph	2 lanes	21'	None	No sidewalks	No bike lanes

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

S Northshore Drive traverses in a southwest-northeast direction with a total length of 17.6 miles. To the southwest, it begins in Loudon County at an unsignalized t-intersection with Beals Chapel Road, enters Knox County towards the northeast while snaking along Fort Loudoun Lake, crosses under Interstate 140, and continues to the signalized intersection with Kingston Pike (US 70/US 11/SR 1) in the Bearden area of Knoxville. To the north of the intersection at Kingston Pike, the roadway continues as N Northshore Drive for a short distance of 0.5 miles before terminating at Papermill Drive and an exit ramp for Interstate 40/75. Most of S Northshore Drive's length is designated as State Route 332 and as a Major Arterial. However, adjacent to the proposed development site, S Northshore Drive is not a State Route and is listed as a Minor Arterial. S Northshore Drive loses its designation as a State Route and a Major Arterial at the roundabout intersection with Concord Drive, 3.4 miles from the development site to the northeast. Concord Road continues the SR 332 and Major Arterial designation to the north at the roundabout and continues towards Farragut, TN.

Along its section along the development property, S Northshore Drive has a few minor vertical curves, and except for one notable horizontal curve, as it approaches Harvey Road from the east, the roadway has a straight alignment. S Northshore Drive is delineated with guardrails on both sides at the notable horizontal curve near Harvey Road. These guardrails protect motorists from the elevation drop-off due to the creek that crosses under S Northshore Drive. This creek that crosses under S Northshore Drive bisects the southwest corner of the proposed development

property. A Reverse Curve Sign (W1-4) is posted in advance of this horizontal curve on S Northshore Drive for westbound traffic and supplemented with a 15 mph advisory speed.

Nearly all properties along S Northshore Drive near the development site are residential except for two properties owned and occupied by Shady Grove Missionary Baptist Church near the intersection with Harvey Road. The Church has a small building and cemetery on the southeast corner of the S Northshore Drive and Harvey Road intersection. On the northeast corner of S Northshore Drive at Harvey Road, the Church has a gravel parking lot used for overflow parking on a small sliver of property.

S Northshore Drive has a 2-lane pavement section with white edge lines and a double yellow centerline at the subdivision's Proposed South Entrance location at Falcon Pointe Drive. Roadway lighting is absent in the adjacent study area along S Northshore Drive, except for a solitary light at the intersection with Falcon Pointe Drive. Other roadway features, including curbing, sidewalks, bike lanes, and greenway paths, are not provided along S Northshore Drive adjacent to the development site. However, just to the east, S Northshore Drive has a sidewalk on the south side along the road frontage of the Shady Glen Subdivision. A sidewalk is also on S Northshore Drive in the Choto Road area further east of the development property.

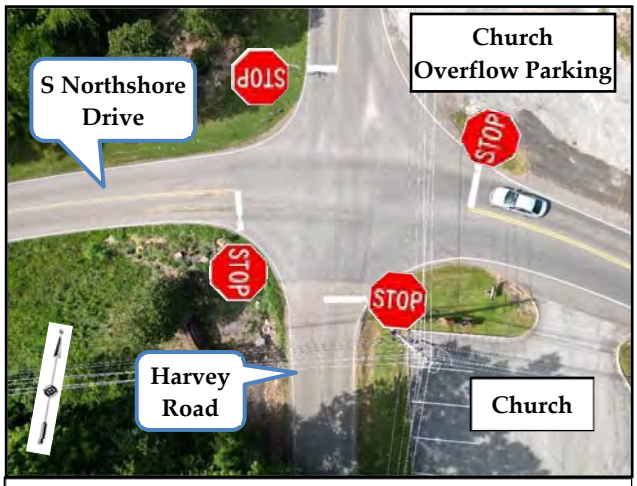
S Northshore Drive at the Proposed South Entrance Location at Falcon Pointe Drive

S Northshore Drive has relatively good pavement conditions and will be the primary road for future residents of The Enclave at Harvey. The asphalt pavement surface outside the white edge lines on S Northshore Drive near the development site is typically only a couple of inches. The pavement width at the Proposed South Entrance is 21.5 feet. No paved shoulders are on S Northshore Drive, with most shoulder areas outside the pavement consisting of grass surfaces or other vegetation. S Northshore Drive is posted with a speed limit of 40 mph in Knox County adjacent to the proposed development site. Further to the southwest in Loudon County, however, the speed limit is posted and reduced to 35 mph.

The Proposed South Entrance for the subdivision will be located across from Falcon Pointe Drive,

the single road access point for the residents in the Falcon Pointe Subdivision. This subdivision has 234 single-family detached houses that exclusively enter and exit via Falcon Pointe Drive at S Northshore Drive. According to aerial historical mapping, this subdivision was fully completed by 2018. Falcon Pointe Drive has a boulevard road section with a landscaped median in the center at the S Northshore Drive intersection.

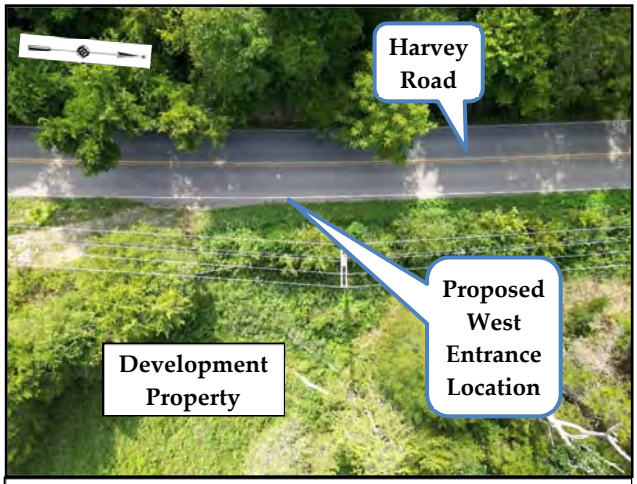
Harvey Road is classified as a Minor Collector and generally traverses north to south and is two miles long. Over its length, Harvey Road has several sharp horizontal turns. To the north, Harvey Road begins at the intersection with Boyd Station Road, just south of a narrow Norfolk Southern railroad underpass. To the south, the Harvey Road designation ends at the intersection of Lakeland Drive and Cabot Ridge Lane, with the roadway continuing as Early Road further to the south.



S Northshore Drive at Harvey Road

All approaches are controlled by Stop Signs (R1-1) at the S Northshore Drive and Harvey Road intersection. All approaches are also provided with Stop Ahead Signs (W3-1), and each Stop Sign has "All Way" (R1-4) supplemental plaques. Adjacent to the intersection, the Church has an entrance and an overflow gravel parking area to the northeast.

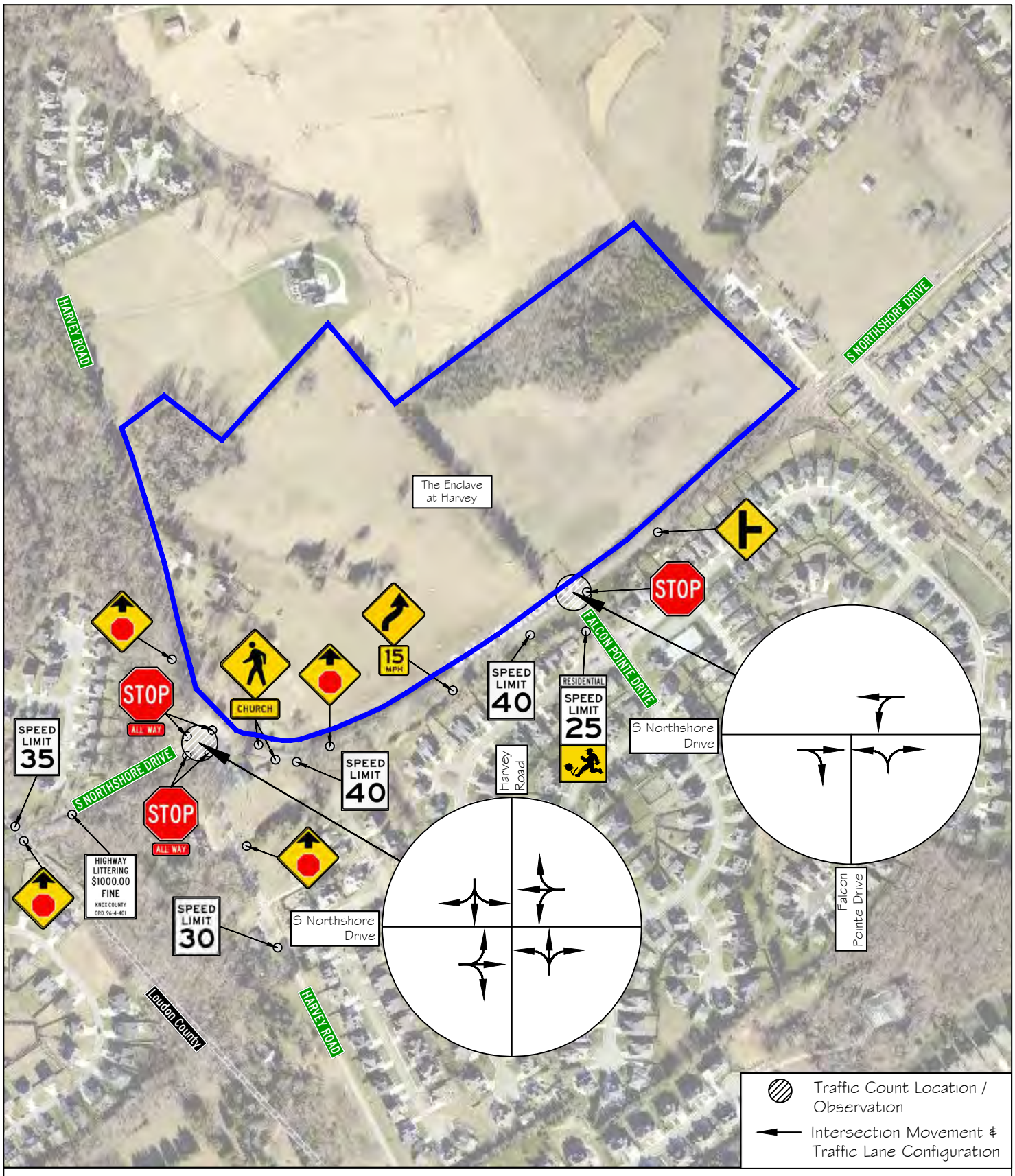
Harvey Road is a 2-lane undivided roadway near the proposed development site with a pavement width of 21 feet near the location of the Proposed West Entrance. Harvey Road has white pavement edge lines and a double yellow centerline at the subdivision's Proposed West Entrance location. Roadway lighting is absent in the adjacent study area along Harvey Road, and the posted speed limit is 30 mph.



Harvey Road at the Proposed West Entrance Location

Figure 2 shows the existing lane configurations of the roadways examined in the study, the traffic count locations, and the current

traffic signage in the study area. The traffic signage shown in Figure 2 only includes warning and regulatory signage near the development site. The pages following Figure 2 give a further overview of the site study area with photographs.



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NOT TO SCALE

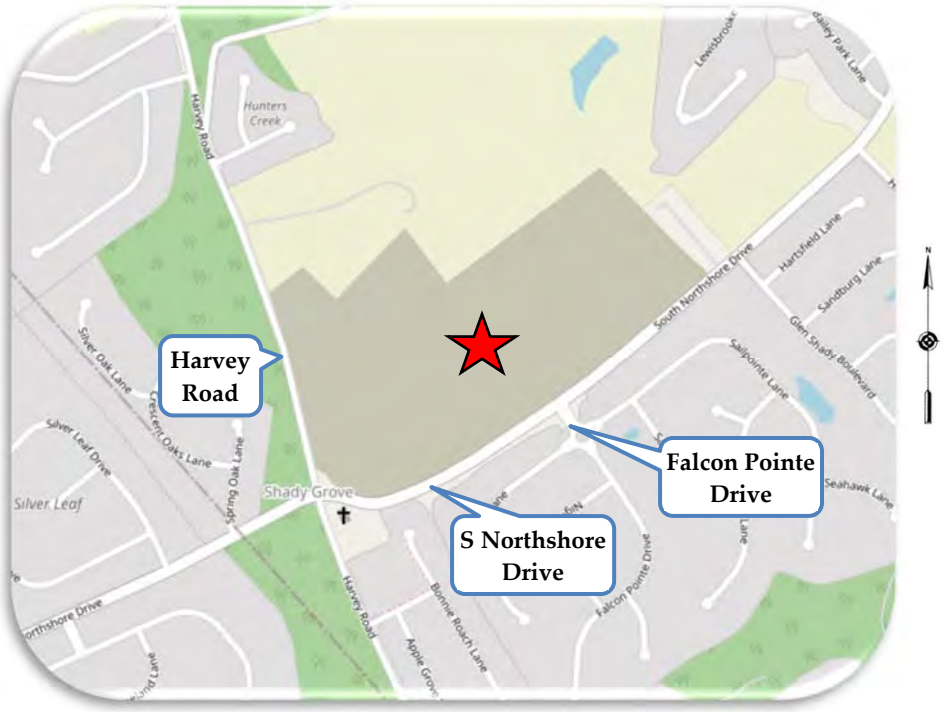
NORTH

FIGURE 2

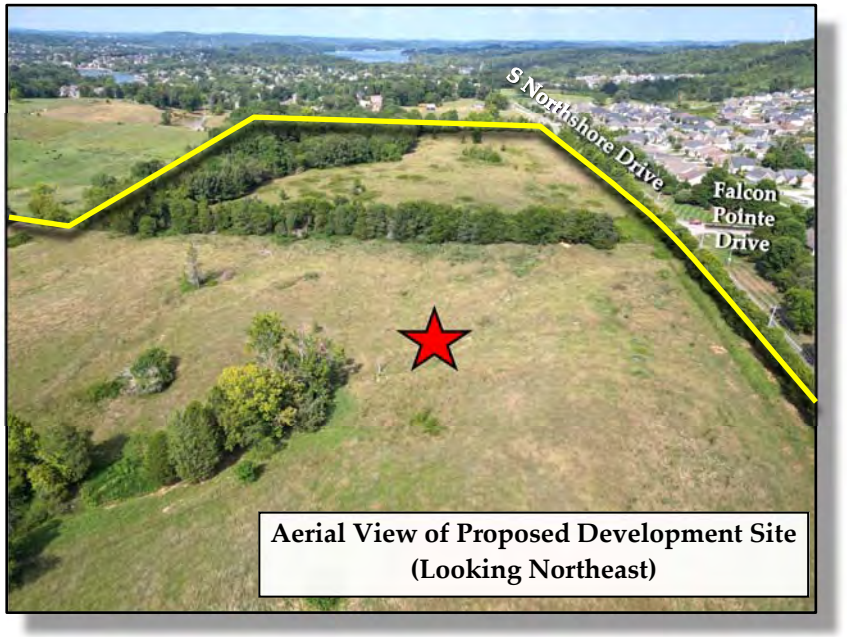
The Enclave at Harvey

Traffic Count Locations, Traffic Signage & Existing Lane Configurations

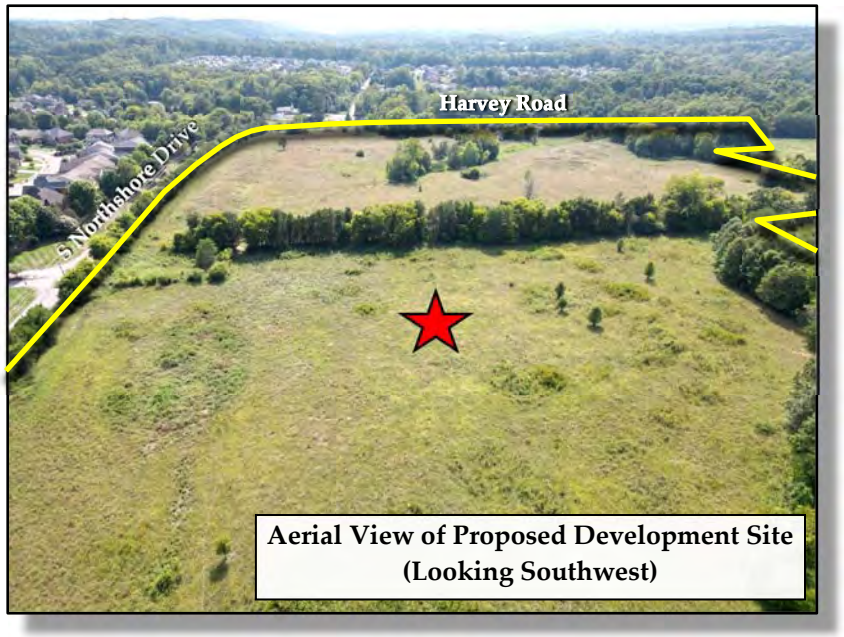
PHOTO EXHIBITS



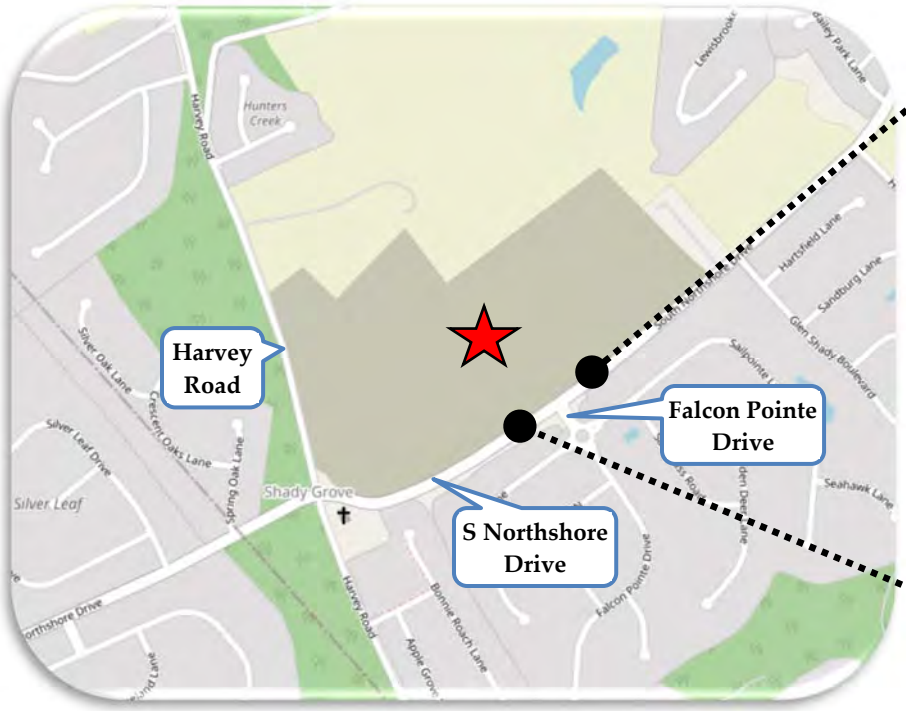
Proposed Development Site



Aerial View of Proposed Development Site (Looking Northeast)



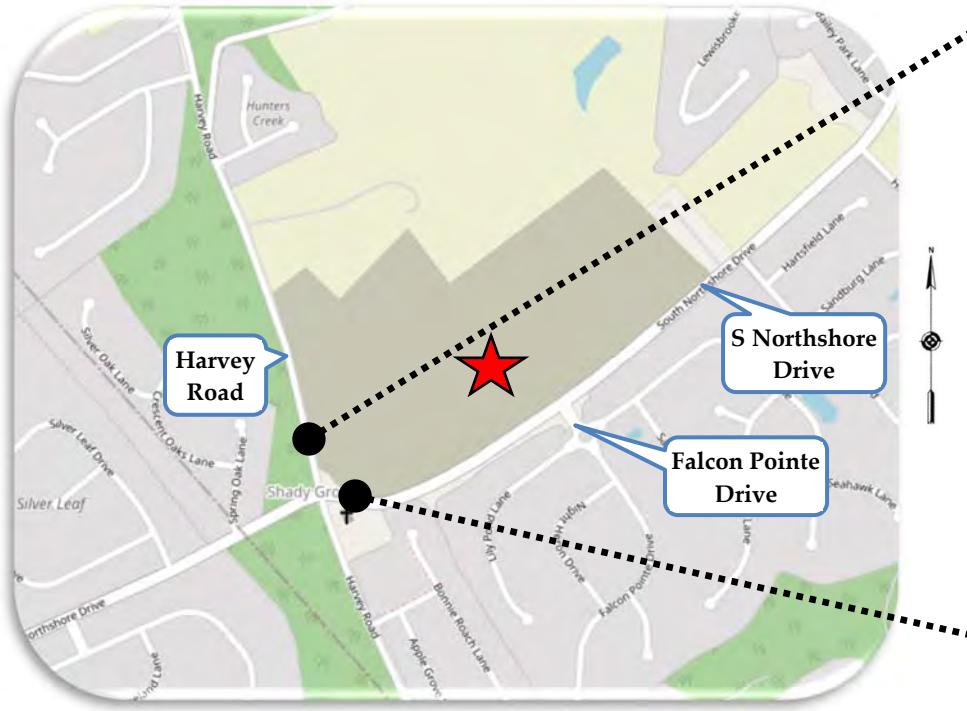
Aerial View of Proposed Development Site (Looking Southwest)



Proposed Development Site

View of S Northshore Drive at Falcon Pointe Drive and Proposed South Entrance Location (Looking Southwest)

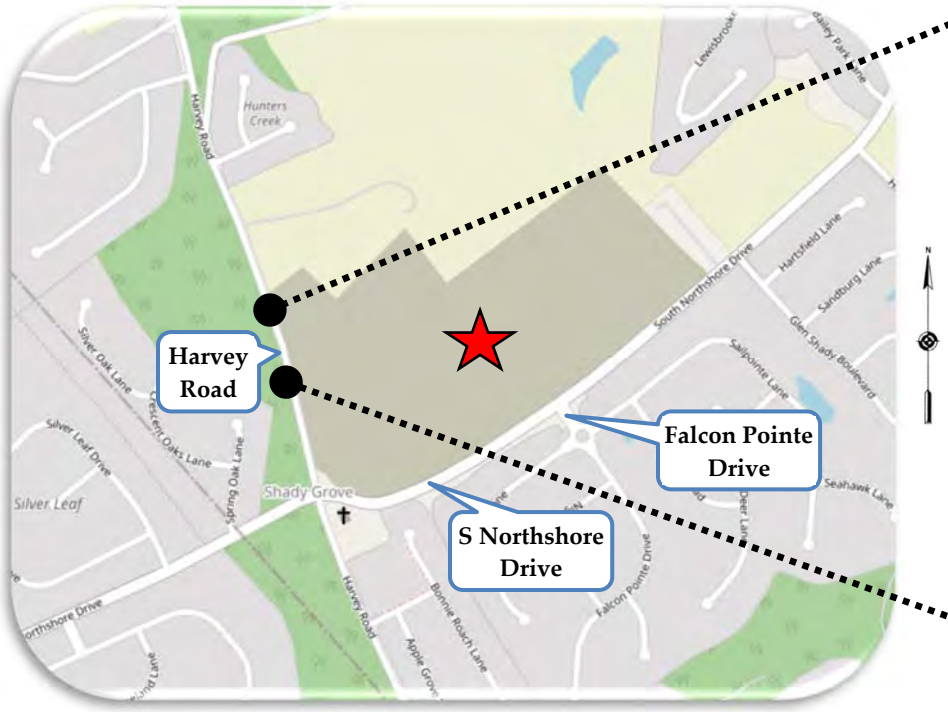
View of S Northshore Drive at Falcon Pointe Drive and Proposed South Entrance Location (Looking Northeast)



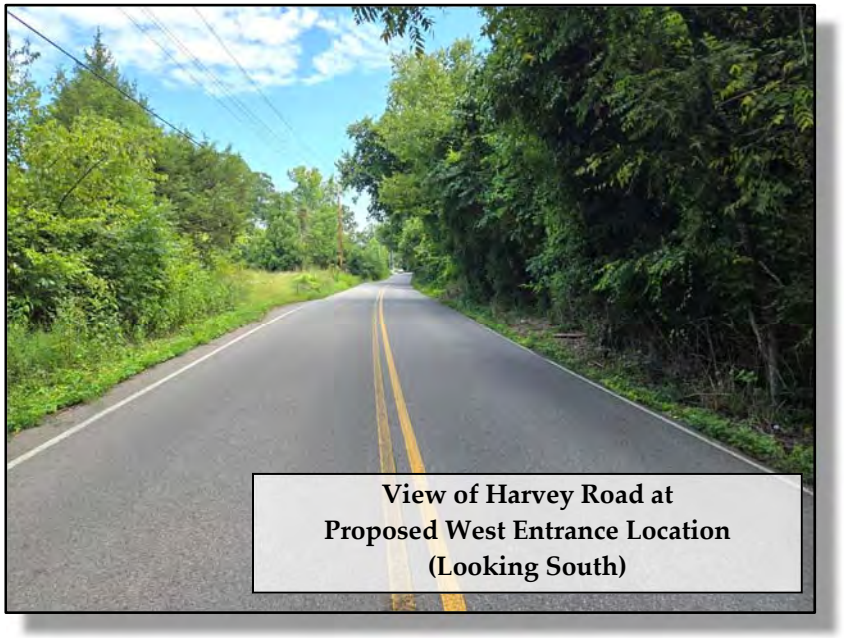
Proposed Development Site

View of Harvey Road at S Northshore Drive (Looking South)

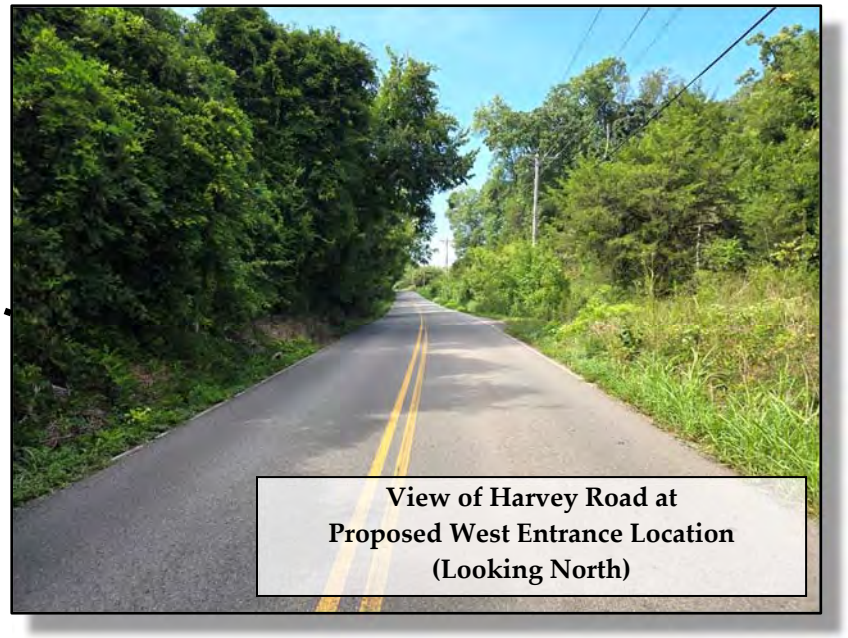
View of S Northshore Drive at Harvey Road (Looking West)



Proposed Development Site



View of Harvey Road at Proposed West Entrance Location (Looking South)



View of Harvey Road at Proposed West Entrance Location (Looking North)

- **EXISTING TRANSPORTATION VOLUMES PER MODE**:

Two annual vehicular traffic count locations are located in the study area, and the Tennessee Department of Transportation (TDOT) conducts both these counts on S Northshore Drive. The count location data is the following and can be viewed with further details in Appendix A:

- Existing vehicular roadway traffic:
  - TDOT reported an Average Daily Traffic (ADT) on S Northshore Drive, east of Harvey Road and adjacent to the development site, at 4,495 vehicles per day in 2023. From 2013 to 2023, this count station has indicated a 0.7% average annual traffic growth rate.
  - TDOT reported an ADT on S Northshore Drive, west of Harvey Road and southwest of the development site, at 2,659 vehicles per day in 2023. From 2016 to 2023, this count station has indicated an 8.1% average annual traffic growth rate.

- Existing bicycle and pedestrian volumes:
  The average daily pedestrian and bicycle traffic along S Northshore Drive and Harvey Road is unknown. However, with the limited number of sidewalks and no bike lanes, these roadways are assumed to have reduced pedestrian and bicyclist activity. During the traffic counts for this project, no bicyclists or pedestrians were observed at the intersections near the development site other than one person walking back and forth on Falcon Pointe Drive in the Falcon Pointe Subdivision.

An online website, strava.com, provides "heat" maps detailing routes taken by pedestrians, joggers, and bicyclists. The provided heat maps show the last two years of data, are updated monthly, and are gathered from individuals allowing their smart devices to track and compile their routes (millions of users). The activities in the maps are shown on the roads with color intensities with darker colors signifying higher activity. The Strava heat maps show some pedestrian

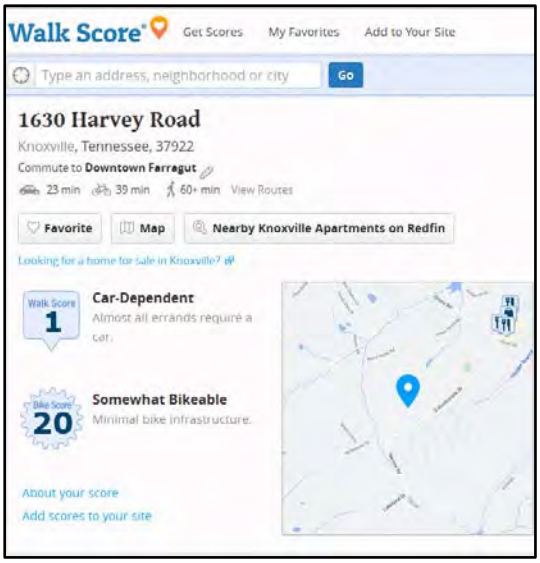
Strava Heat Map for Pedestrian and Joggers

and bicycle activity in the surrounding area. Higher pedestrian travel is shown occurring on the nearby residential streets but with limited activity on S Northshore Drive and Harvey Road. However, a fair amount of bicyclist activity is shown along S Northshore Drive and Harvey Road and less on the nearby residential streets.

Strava Heat Map for Bicyclists

- **WALK SCORE**:

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

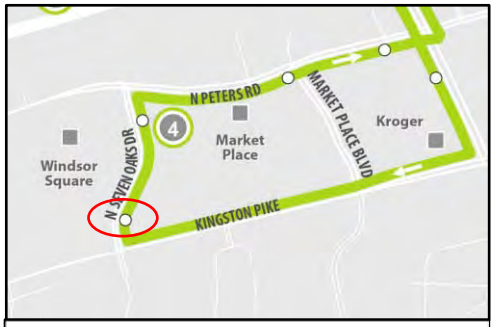


The project site location is graded with a Walk Score of 1 at the development property address (1630 Harvey Road). This Walk Score indicates that almost all errands currently require a vehicle for travel at the development property. The Walk Score is graded very low due to the limited number of sidewalks and nearby amenities. The site is given a Bike Score of 20, meaning there is minimal bike infrastructure. The site is not given a Transit Score since no public transportation locations are near the development site. Overall, for this study, no vehicle trip reductions for pedestrian or bicyclist activity were used or assumed.

- **TRANSIT SERVICES:**

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

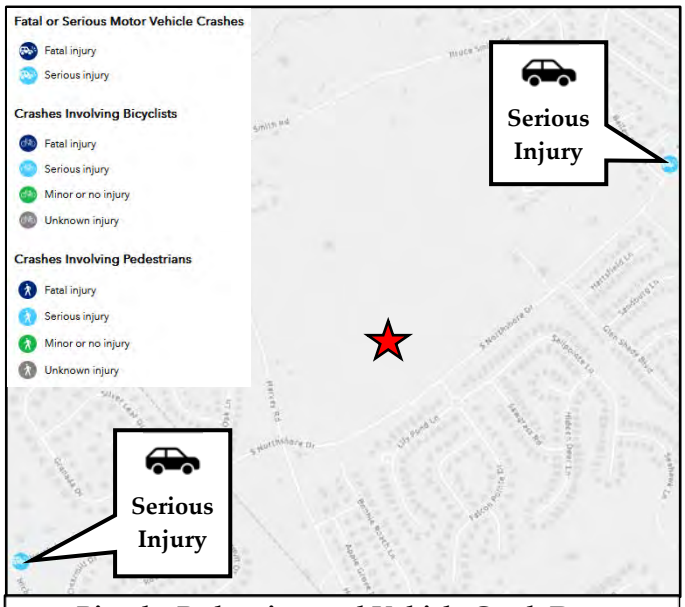
The closest bus stop to the development site is 8.9 miles to the northeast by roadway and is on Route 16, "Middlebrook / Cedar Bluff". This bus stop is at N Seven Oaks Drive in the Windsor Square Development. KAT made several changes and improvements to their routes that began on August 26th, 2024. One of these changes included merging the Middlebrook and Cedar Bluff bus routes into one. This recent change has established bus service every 60 minutes at this bus stop. It operates on weekdays and weekends; the route map is also included in Appendix B. Other transit services in the area include the East Tennessee Human Resource Agency (ETHRA) and the Community Action Committee (CAC), which provides transportation services when requested.



KAT Route 16, "Middlebrook / Cedar Bluff"

Since the distance to the nearest public bus service is several miles away, with limited sidewalks or bike lanes available to access the bus stop without using a private vehicle, the proposed development is not expected to have any reduced vehicle trips due to public transit usage.

- **CRASH DATA**:



Bicycle, Pedestrian, and Vehicle Crash Data in Study Area

The Knoxville TPO provides a website that lists bicycle, pedestrian, and vehicle severe or fatal crashes from October 2016 to September 2021. The data shows none of these incidents occurred near the development site during that time period. However, two vehicular crashes resulted in serious injuries further to the southwest and northeast on S Northshore Drive. These occurred on June 20th, 2019, and June 8th, 2021. No crash factors are identified or listed as to the cause of the crashes. However, one was identified as including a teen driver.

PROJECT DESCRIPTION

- **LOCATION AND SITE PLAN:**

The proposed plan layout with a maximum of 116 single-family detached houses on 42.44 +/- acres is designed by Ardurra and is shown in Figure 3. The design shows six new streets constructed for the residential development, Roads "A" through "F". As shown in the figure, an entrance will be constructed for the development on the south side to S Northshore Drive at Falcon Pointe Drive. Road "E", the entrance road for the Proposed South Entrance, will be constructed with a mini-roundabout a couple of hundred feet north of S Northshore Drive. Road "A" will comprise the entrance road to the west at Harvey Road.

Internally, Road "A" will be the longest road within the development and will provide access to shorter internal roads that include Roads "B" through "E". Several of the internal roads will end at cul-de-sacs. The Proposed West Entrance on Harvey Road, Road "A", will be approximately 625 feet north of the existing 4-way intersection with S Northshore Drive.

Existing Abandoned Houses, Other Structures, and Gravel Driveways near Harvey Road (Looking South)

The Enclave at Harvey will have some open space and common areas for the subdivision residents, that include areas for detention ponds and stormwater control. One of the identified creeks on the southwest corner of the development property will remain relatively undisturbed and provided buffers. The other creek will be provided buffers and protected during the construction of the internal roads, Roads "A" and "B".

The minimum lot dimensions in the development will be around 130 feet deep and 55 feet wide, providing a house lot area of 7,150 square feet. Many house lots will be larger than this minimum, with a few nearly a half-acre. Each house will have a garage and driveway. The developer is not proposing on-site amenities for the future subdivision residents other than providing open common areas and constructing a gazebo or two. An internal sidewalk route is proposed for this

subdivision between S Northshore Drive and Harvey Road, and it will include a sidewalk along the road frontage of S Northshore Drive to meet Knox County regulations.

The schedule for the completion of this new residential development depends on economic factors and construction timelines. This project is also contingent on permitting, design, and other regulatory approvals. Overall, the local real estate market for new housing remains quite competitive. This study assumed that the total construction build-out of the development and full occupancy would occur within the next four years (2028) to provide a conservative outlook.

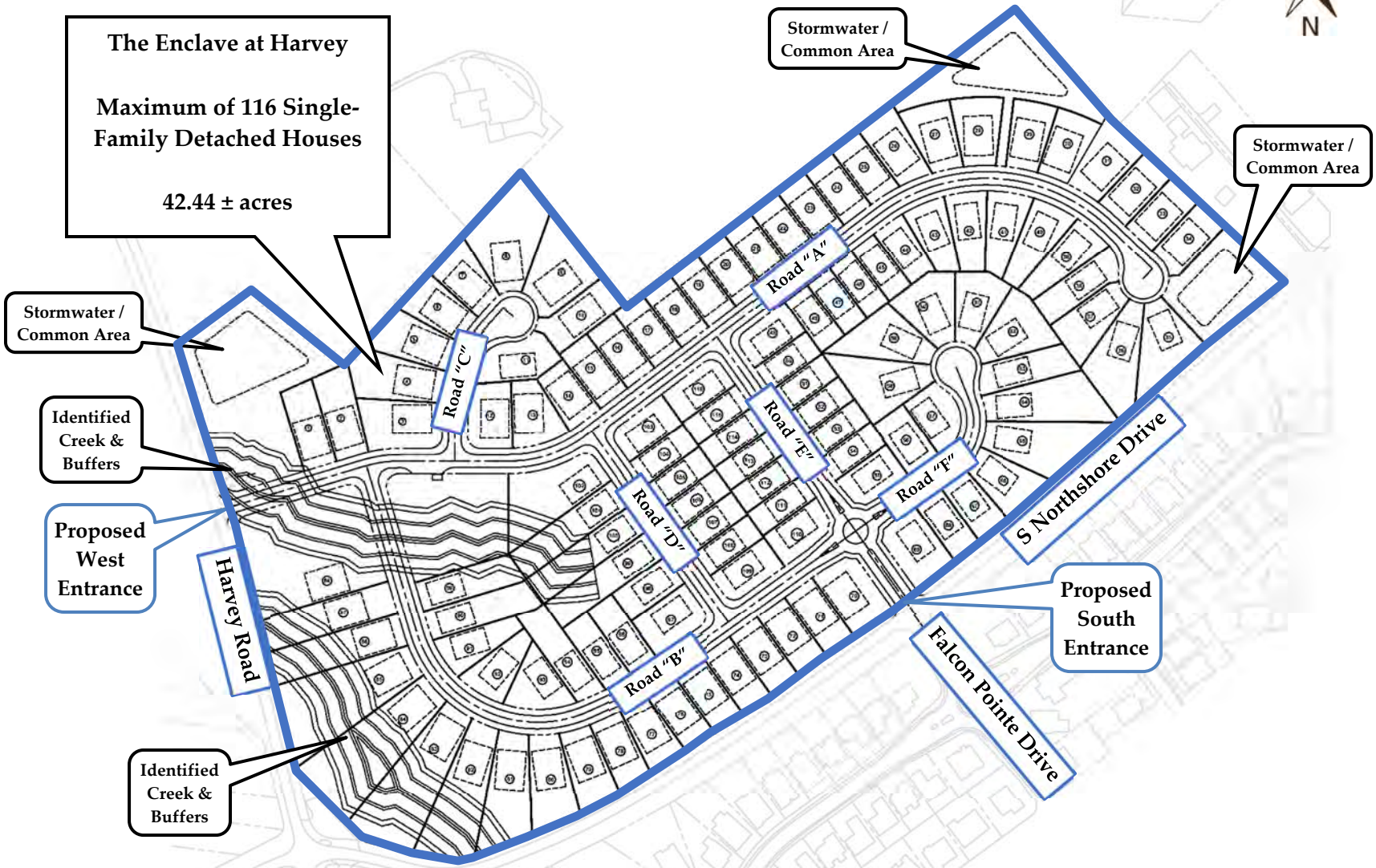


Figure 3
Proposed Plan Layout
The Enclave at Harvey

Not to Scale

- **PROPOSED USES AND ZONING REQUIREMENTS:**

The existing parcel comprising The Enclave at Harvey development property is in Knox County and was recently requested to be rezoned. The Knoxville/Knox County Planning Commission approved the rezoning, and the Knox County Commission gave final approval on February 26th, 2024. The property's previous zoning was Agricultural (A), and it was requested to be changed to Planned Residential (PR). The property rezoning was approved with a density of up to 3 units per acre. Uses permitted in the Planned Residential (PR) zone include single-family dwellings, duplexes, and multi-dwelling structures and developments. The most recently published online KGIS zoning map is provided in Appendix C. The existing adjacent surrounding zoning and land uses are the following:

- S Northshore Drive binds the development site to the south. Across S Northshore Drive, the single-family detached houses in the Falcon Pointe Subdivision are zoned as Planned Residential (PR). The Arbor Gate Subdivision parcels to the southwest across S Northshore Drive are also zoned Planned Residential (PR) and occupied by single-family detached houses. Falcon Pointe Subdivision residents have singular road access to S Northshore Drive via Falcon Pointe Drive to the north. Arbor Gate Subdivision residents have singular road access to Harvey Road via Arbor Branch Lane, south of S Northshore Drive.
- The development property at its southwest corner is adjacent to a small corner sliver of property zoned Agricultural (A). It is located on the northwest corner of the intersection of S Northshore Drive at Harvey Road. This corner property and the property across the street just east of Harvey Road are owned by Shady Grove Missionary Baptist Church. This corner sliver is a gravel parking lot for church overflow parking. The church building has two entrances to S Northshore Drive and a single entrance to Harvey Road to the west. Service times for the Church are Sunday School at 10 a.m., worship at 11 a.m., Sunday evenings at 6 p.m., and Wednesday evenings at 7 p.m.
- Harvey Road binds the development property to the west. Across Harvey Road, four properties are adjacent to the roadway, with three consisting of single-family detached houses in The Oaks at S Northshore Drive Subdivision. The fourth property is 13.42 acres and undeveloped but was recently rezoned to Planned Residential (PR) for possible future development. All four properties across Harvey Road are zoned as Planned Residential (PR). The houses in The Oaks at S Northshore Drive Subdivision have access to S Northshore Drive to the south via Spring Oak Lane.

- To the north of the proposed development property, two parcels are zoned as Agricultural (A), with one being nearly 68 acres in size. This large parcel is used for agricultural purposes and has road access via Bruce Smith Road to the north. A single-family detached house occupies the small parcel to the north, with a private driveway to Harvey Road to the west.
- One small property is adjacent to the development property on the east side. This property is occupied by a single-family detached house and is zoned as Low Density Residential (RA). This house has access to the south to S Northshore Drive via a private driveway.

KGIS Existing Zoning Map

KGIS Existing Land Use Map

- **ON-SITE CIRCULATION:**

The total length of The Enclave at Harvey internal roads will be 5,384 feet (1.02 miles), designed and constructed to Knox County specifications, with several ending at cul-de-sacs. The development will have asphalt-paved internal roadways with 8" extruded concrete curbs. The lane widths internally will be 13 feet each for a total 26-foot pavement width. The public right-of-way width within the development will be 50 feet. A sidewalk route between S Northshore Drive and Harvey Road is proposed on the internal roads in this development and along the road frontage of S Northshore Drive. Knox County will maintain the public streets in the development after construction, and these will be dedicated public roads.

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

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

ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

- **EXISTING TRAFFIC CONDITIONS:**

This study conducted traffic counts at two intersections near the proposed development site on Thursday, August 22nd, 2024. 6-hour traffic counts were conducted at the unsignalized t-intersection of S Northshore Drive at Falcon Pointe Drive and the unsignalized 4-way intersection of S Northshore Drive at Harvey Road. Manual traffic counts were conducted to identify and tabulate the morning and afternoon peak period volumes and the travel directions near the proposed development site. When the traffic counts were conducted, local public schools had been in session for two weeks since the return from summer break. Both intersections had an AM and PM peak hour at 7:00 – 8:00 a.m. and 5:00 – 6:00 p.m. The manual tabulated traffic counts can be reviewed in Figure 4 and Appendix D. Some observations at the intersections include the following:

- No pedestrians or bicyclists were observed in the morning or afternoon traffic counts except for one person walking back and forth internal to the existing subdivision on Falcon Pointe Drive.
- Most vehicles at the intersections were passenger vehicles, but school buses, a few semi-tractor trailer trucks, single-unit trucks, and construction vehicles with trailers were observed.
- School buses were observed entering the Falcon Pointe Subdivision at 7:26 a.m., 3:04 p.m., and 4:02 p.m. These school buses exited Falcon Pointe Drive several minutes after their arrival.
- Much higher eastbound volumes on S Northshore Drive were observed in the morning than westbound volumes. In the afternoon, there was more balanced eastbound and westbound traffic, but overall, higher amounts were still observed heading westbound. At the intersection of Falcon Pointe Drive, the vast majority of entering and exiting traffic for the Falcon Pointe Subdivision was to and from the east.

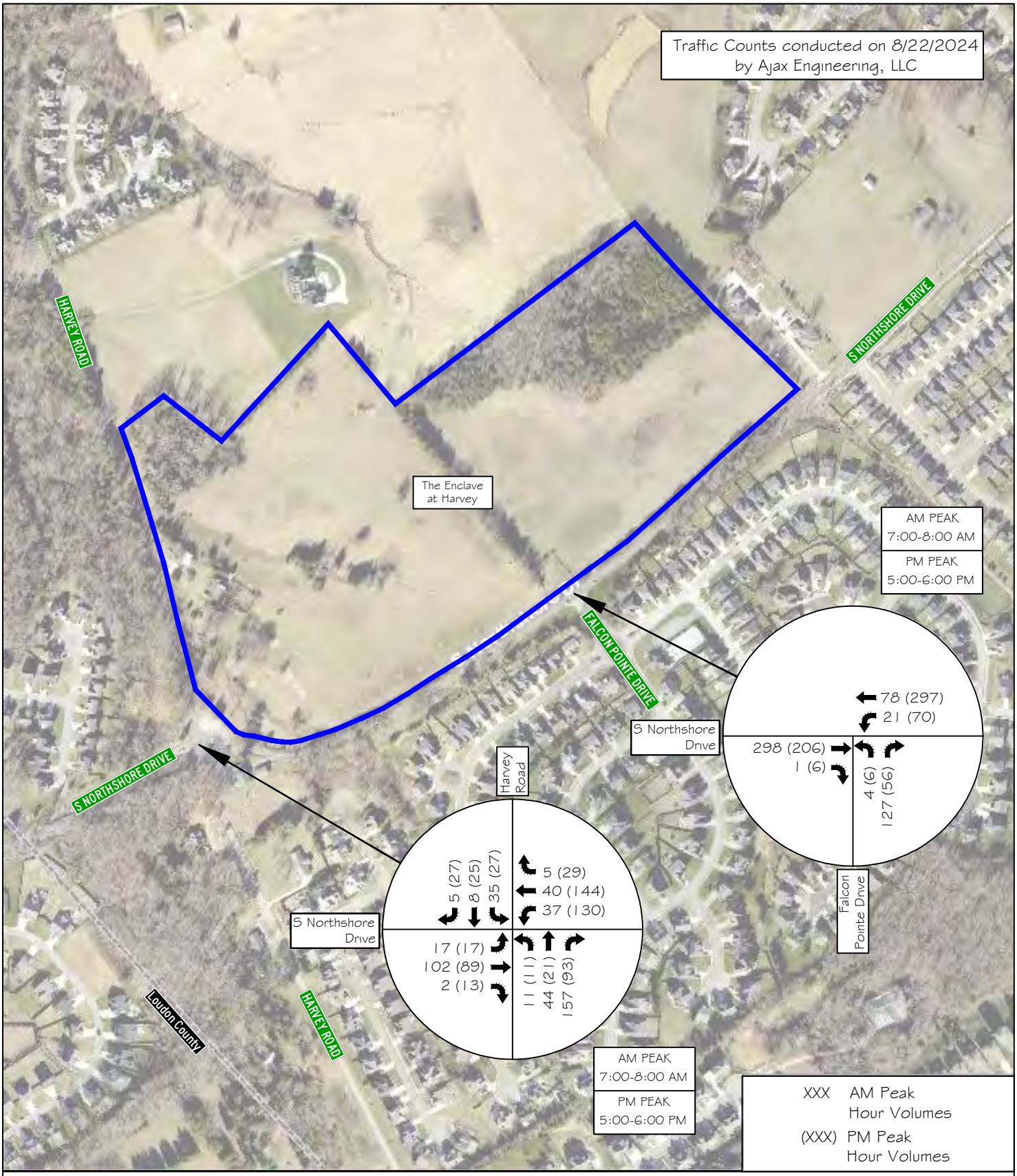


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FIGURE 4

The Enclave at Harvey

2024 Peak Hour Traffic Volumes - EXISTING TRAFFIC CONDITIONS

Capacity analyses were undertaken to determine the Level of Service (LOS) for the existing 2024 intersection traffic volumes shown in Figure 4. The capacity analyses were calculated following the Highway Capacity Manual (HCM) methods and utilizing Synchro Traffic Software (Version 12).

Methodology:

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

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

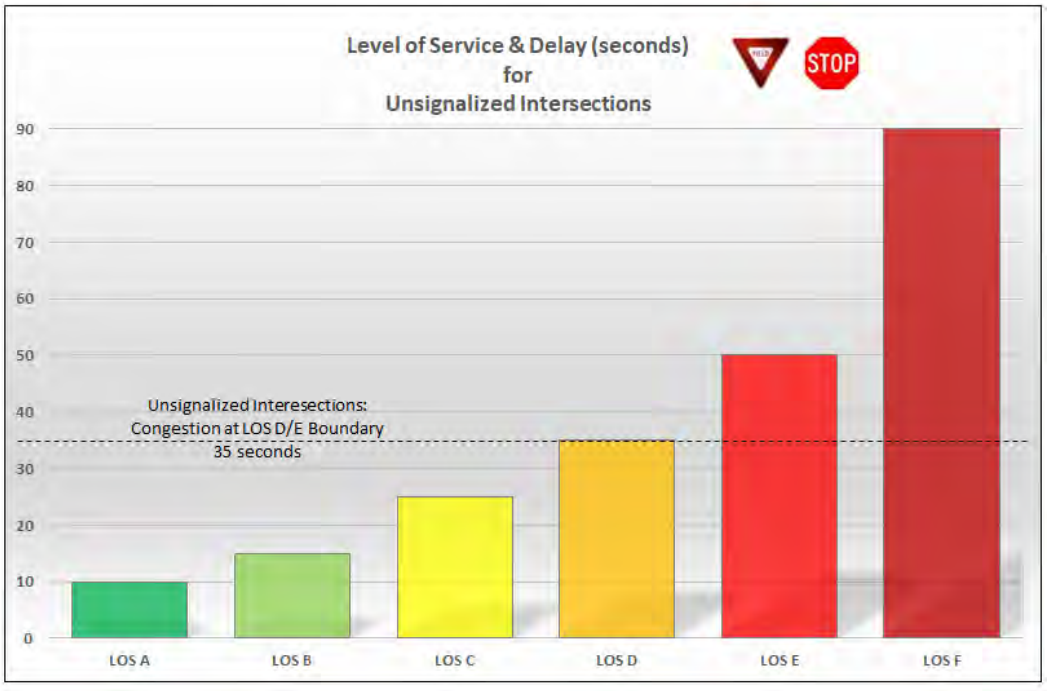
For unsignalized intersections, LOS is measured in terms of delay (in seconds). This measure attempts to quantify delay, including travel time, driver discomfort, and fuel consumption. For unsignalized intersections, the analysis assumes that the mainline thru and right-turn traffic does not stop and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

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

TABLE 2
LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS

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

Source: Highway Capacity Manual, 7th Edition



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

As shown in Table 3, the intersections are calculated to operate with excellent LOS and short vehicle delays in the existing peak hour 2024 conditions.

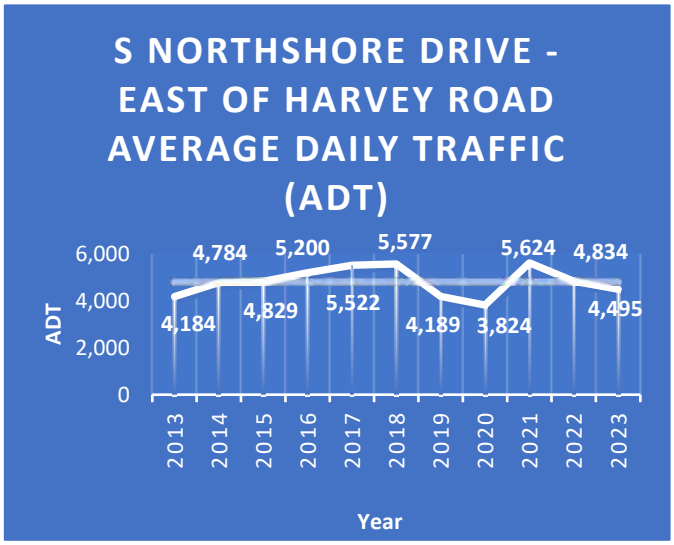
TABLE 3
2024 INTERSECTION CAPACITY ANALYSIS RESULTS -
EXISTING TRAFFIC CONDITIONS

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
S Northshore Drive (WB & EB) at Falcon Pointe Drive (NB)	STOP Unsignalized	Northbound Left/Right	B	12.0	0.243	B	10.6	0.101
		Westbound Left	A	8.2	0.031	A	7.9	0.055
S Northshore Drive (WB & EB) at Harvey Road (SB & NB)	STOP Unsignalized	Northbound Left/Thru/Right	A	8.9	0.278	A	8.8	0.177
		Eastbound Left/Thru/Right	A	9.0	0.201	A	9.2	0.208
		Westbound Left/Thru/Right	A	8.9	0.174	B	11.3	0.437
		Southbound Left/Thru/Right	A	8.5	0.088	A	9.0	0.149

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

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

Horizon year traffic conditions represent the projected traffic volumes in the study area without the proposed project being developed (no-build option). This proposed development's build-out and full occupancy are assumed to occur by 2028.



According to the nearby TDOT count stations, vehicular traffic on S Northshore Drive has shown mixed results over the past few years. The TDOT data shown in Appendix A shows that this road has experienced annual growth between 0.7 and 8.1% over the past several years. This growth is puzzling since the two traffic count locations are near each other, one to the west of Harvey Road and the other to the east. Both locations experienced decreases during the COVID pandemic, but the count location east of Harvey Road experienced much more significant decreases since the pandemic.

Ultimately, for this study, due to the mixed past ADT results, an annual growth rate of 5% was assumed and used to calculate future growth on the studied intersections up to 2028 to account for potential traffic growth in the study area. The annual growth rate of 5% was applied to the existing 2024 volumes tabulated on S Northshore Drive and Harvey Road to estimate the future volumes in the horizon year of 2028 without the potential development traffic. Vehicles to and from Falcon Pointe Drive were not included since these volumes are not expected to increase since the subdivision has reached full capacity. Figure 5 shows the projected 2028 horizon year traffic volumes at the studied intersections without the project during the AM and PM peak hours. Overall, the assumed 5% growth rate is appropriately conservative since the land availability in this area of Knox County is dwindling for future developments.

Capacity analyses were undertaken to determine the projected LOS in 2028 without the project. The results are shown in Table 4, and Appendix E includes the capacity analysis worksheets. The results in Table 4 show only slightly worse vehicle delays for all the intersection approaches in the 2028 projected conditions without the developments' generated trips versus the existing 2024 conditions.

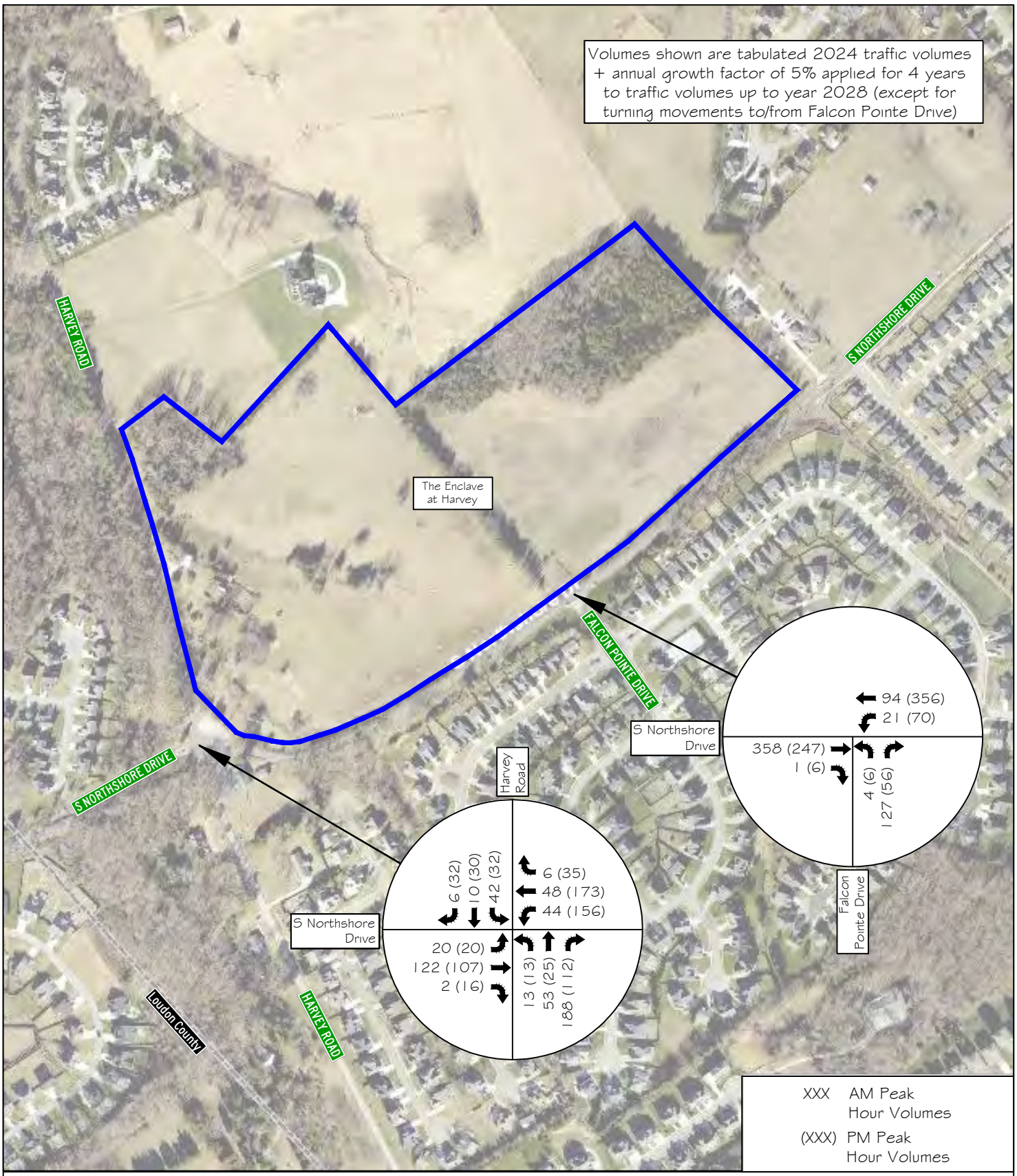


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FIGURE 5

The Enclave at Harvey

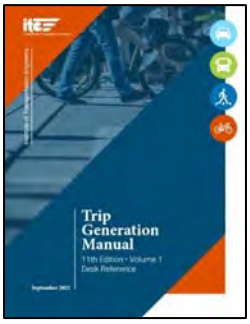
2028 Peak Hour Traffic Volumes - PROJECTED TRAFFIC CONDITIONS WITHOUT THE PROJECT

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

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
S Northshore Drive (WB & EB) at Falcon Pointe Drive (NB)	STOP Unsignalized	Northbound Left/Right	B	13.0	0.268	B	11.2	0.110
		Westbound Left	A	8.4	0.033	A	8.0	0.058
S Northshore Drive (WB & EB) at Harvey Road (SB & NB)	STOP Unsignalized	Northbound Left/Thru/Right	A	9.8	0.347	A	9.7	0.228
		Eastbound Left/Thru/Right	A	9.7	0.250	B	10.1	0.265
		Westbound Left/Thru/Right	A	9.5	0.218	B	14.0	0.549
		Southbound Left/Thru/Right	A	8.9	0.112	A	9.9	0.191

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

- **TRIP GENERATION:**



A generated trip is a single or one-direction vehicle movement entering or exiting the study site. The estimated amount of traffic the proposed 116 (maximum) single-family detached houses in the subdivision will generate was calculated based on rates and equations provided by the Trip Generation Manual, 11th Edition, an Institute of Transportation Engineers (ITE) publication. The Trip Generation Manual is the traditional and most popular resource for determining trip generation rates when transportation impact studies are produced. The data and calculations from ITE for the proposed land use are shown in Appendix F. A summary of this information is presented in the following table:

TABLE 5a
TRIP GENERATION FOR THE ENCLAVE AT HARVEY ROAD
Maximum of 116 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	116 Houses	1,157	25%	75%		63%	37%	
				21	64	85	72	42	114
Total New Volume Site Trips			**1,157**	**21**	**64**	**85**	**72**	**42**	**114**

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

For the proposed residential development, it is estimated that 21 vehicles will enter and 64 will exit, for a total of 85 generated trips during the AM peak hour in the year 2028. Similarly, it is estimated that 72 vehicles will enter and 42 will exit, for a total of 114 generated trips during the PM peak hour in the year 2028. The calculated trips generated for an average weekday are estimated to be 1,157 vehicles for the proposed development. No vehicle trip reductions were included in the calculations or analysis.

Additional trip generation calculations were made for two nearby known residential developments in various planning stages to estimate future development in the surrounding area further. The first, Bodak LLC on Northshore Drive, proposes 14 single-family detached houses. This proposed subdivision will be on an L-shaped property adjacent to the Loudon County boundary, west of Harvey Road, and the south side of S Northshore Drive. The latest concept

plan shows 12 of the 14 lots having access to S Northshore Drive to the north via an entrance and two lots with driveways accessing Harvey Road to the east. The trip generation for this other residential development is shown in Table 5b.

TABLE 5b
TRIP GENERATION FOR BODAK LLC ON NORTHSHORE DRIVE
14 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	14 Houses	165	25%	75%		63%	37%	
				3	9	12	10	6	16
Total New Volume Site Trips			**165**	**3**	**9**	**12**	**10**	**6**	**16**

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

Mesana Investments owns the other known potential nearby property that could be developed for a residential subdivision. This 13.4-acre property across Harvey Road was recently rezoned to Planned Residential (PR). A concept plan for this property has been recently published, and 27 single-family detached house lots are possible based on the rezoning. The trip generation for this other residential development is shown in Table 5c.

TABLE 5c
TRIP GENERATION FOR MESANA INVESTMENTS
27 Single-Family Detached Houses

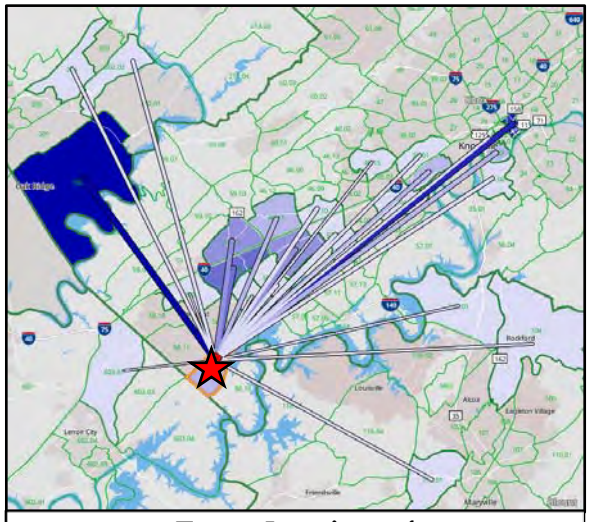
ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	27 Houses	303	25%	75%		63%	37%	
				6	17	23	18	11	29
Total New Volume Site Trips			**303**	**6**	**17**	**23**	**18**	**11**	**29**

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

- **TRIP DISTRIBUTION AND ASSIGNMENT:**

The projected trip distribution and assignment for The Enclave at Harvey development are based on several sources and engineering judgment. The first source is based on the existing traffic count volumes and the observed travel directions collected on S Northshore Drive and Harvey Road near the proposed development site.

During the traffic counts, motorists on S Northshore Drive and Harvey Road preferred northbound and eastbound travel in the morning and the opposite in the afternoon peak period. The intersection of S Northshore Drive at Falcon Pointe Drive is an excellent indicator of residential-related traffic in the nearby area since all 234 houses in this subdivision only have external road access at this entrance. Exiting traffic from the Falcon Pointe Subdivision in the AM and PM was observed to be heavily weighted towards the east versus the west. Entering traffic in the AM and PM was also heavily weighted coming from the east versus the west. The Falcon Pointe Subdivision splits were over 90% for vehicles exiting to the east and entering from the east.

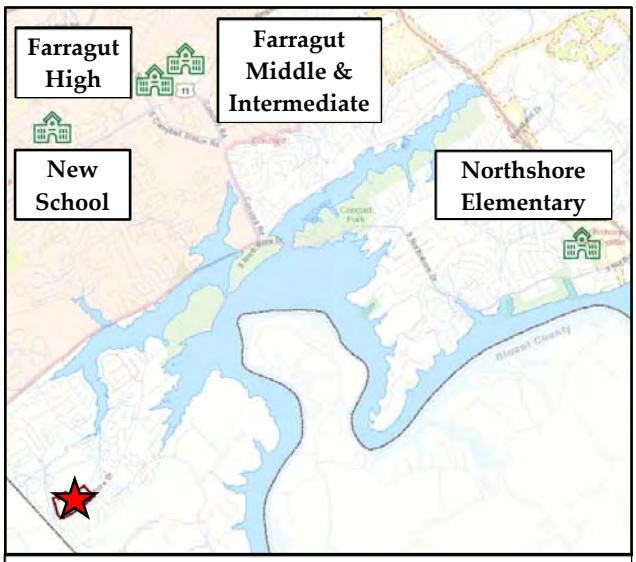


Top 25 Locations of 2021 Census Bureau Work-Based Trips to & from Census Tract 58.14

The second source for determining the projected trip distribution is based on work-related trips in the local area. Work-based trips will be a significant impetus for trips generated by the development, and these trips are more likely to travel to and from the north and east. This assertion is based on data from the United States Bureau website for Census Tract 58.14, where the development property is located. Based on 2021 (latest available) census data and as presented in Appendix G, most work-based trips in the surrounding area correspond to Oak Ridge, TN, downtown Knoxville, the University of Tennessee, and areas of West Knoxville. Some of these work-based trips also correspond to Alcoa and Maryville, TN areas.

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 Northshore Elementary and Farragut Middle, Intermediate, and

High School. A new Farragut Elementary School on Boring Road in Farragut, TN, is currently planned to open in 2026. At this point, it is unknown if the property for The Enclave at Harvey will be rezoned for this new school. However, all the zoned public schools and this new school are located north and east of the development site. The existing zoned schools are between 5.7 and 7.8 miles from the proposed development entrances by roadway. Using Google Maps, the shortest and quickest routes from the subdivision will be to and from the east on S Northshore Drive.



Zoned Public School Locations

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

Based on these factors, Figure 6 shows the projected distribution of traffic entering and exiting the residential subdivision at the Proposed Entrances. Overall, the majority of traffic generated by future residents in the subdivision is expected to occur to and from the east via S Northshore Drive.

Figure 7a shows the traffic assignment of the computed trips generated by The Enclave at Harvey and is based on the assumed distribution of trips shown in Figure 6. Figure 7b shows the traffic assignment of the computed trips generated by the Bodak LLC on Northshore Drive Subdivision. Figure 7c shows the proposed Mesana Investments development assignment. These additional future residential developments are also assumed to be fully occupied by 2028, and the trips shown in Figures 7b and 7c are also based on the projected distribution patterns shown in Figure 6. Note: For this study, the Mesana Investments development with a potential of 27 lots is assumed to have a single entrance on Harvey Road between S Northshore Drive and the Proposed West Entrance for The Enclave at Harvey to simulate a worst-case impact on the studied intersections.

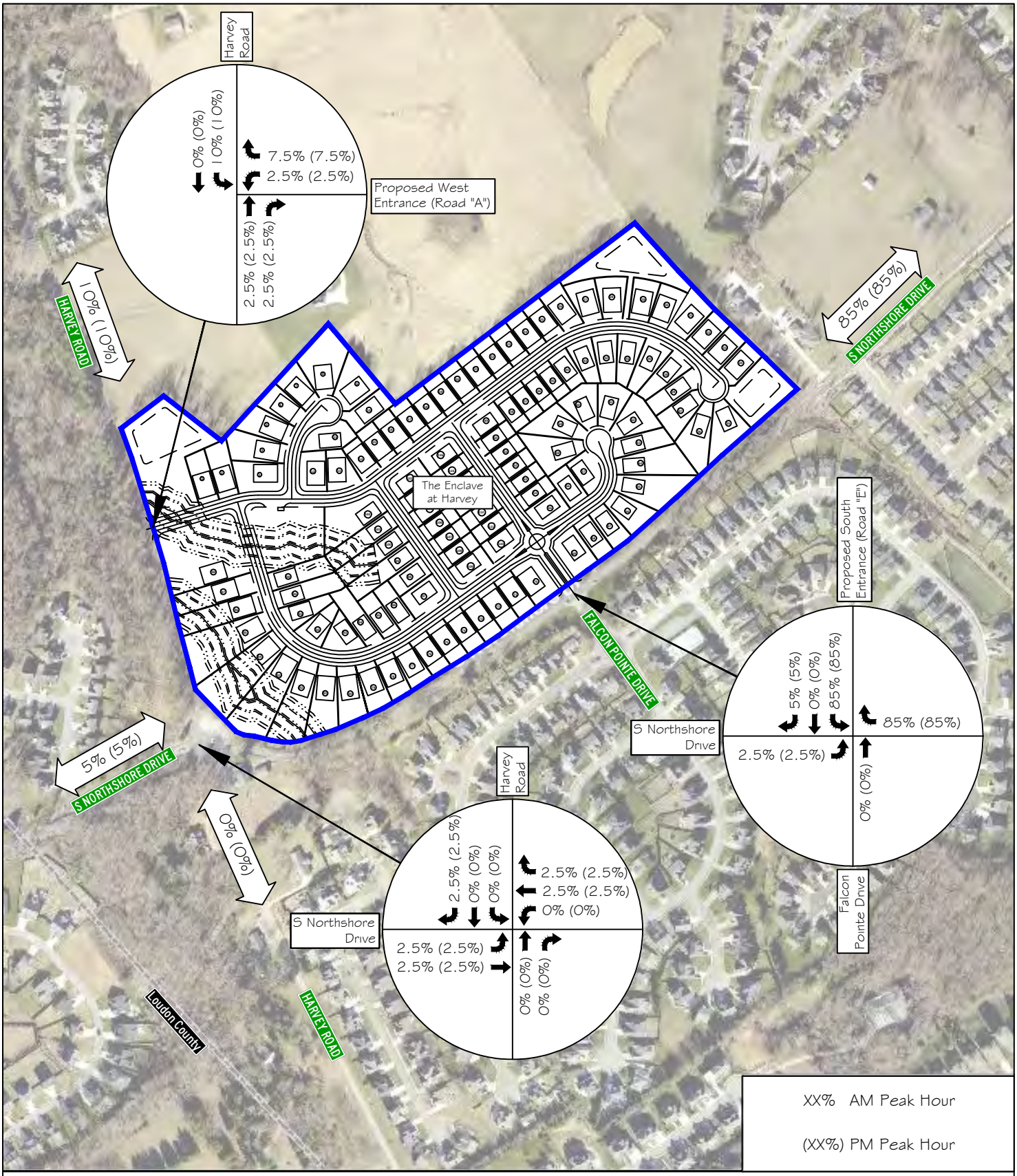


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FIGURE 6

The Enclave at Harvey

Directional Distribution of Generated Traffic during AM and PM Peak Hour

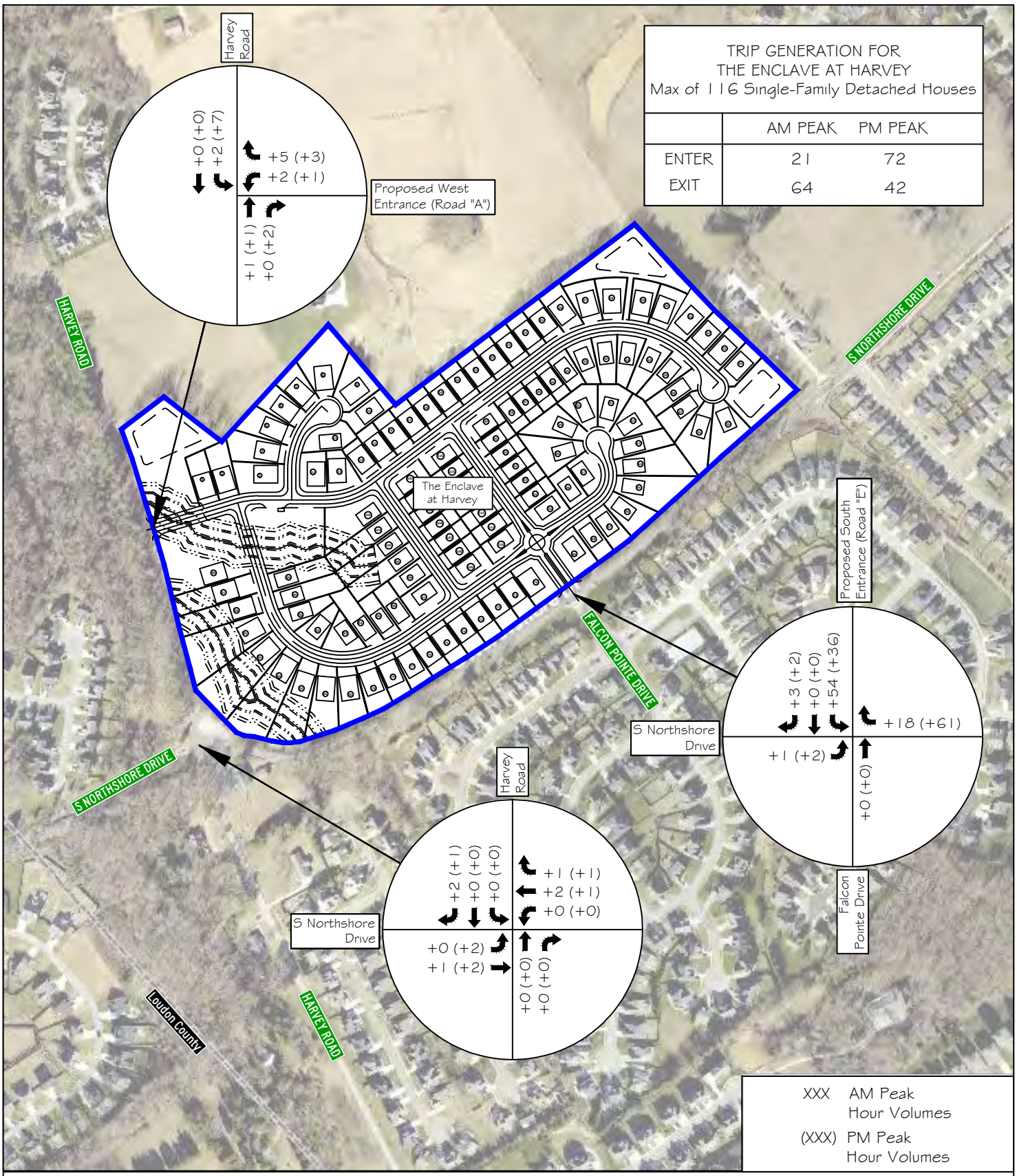

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FIGURE 7a

The Enclave at Harvey

Traffic Assignment of Generated Traffic during AM and PM Peak Hour for The Enclave at Harvey

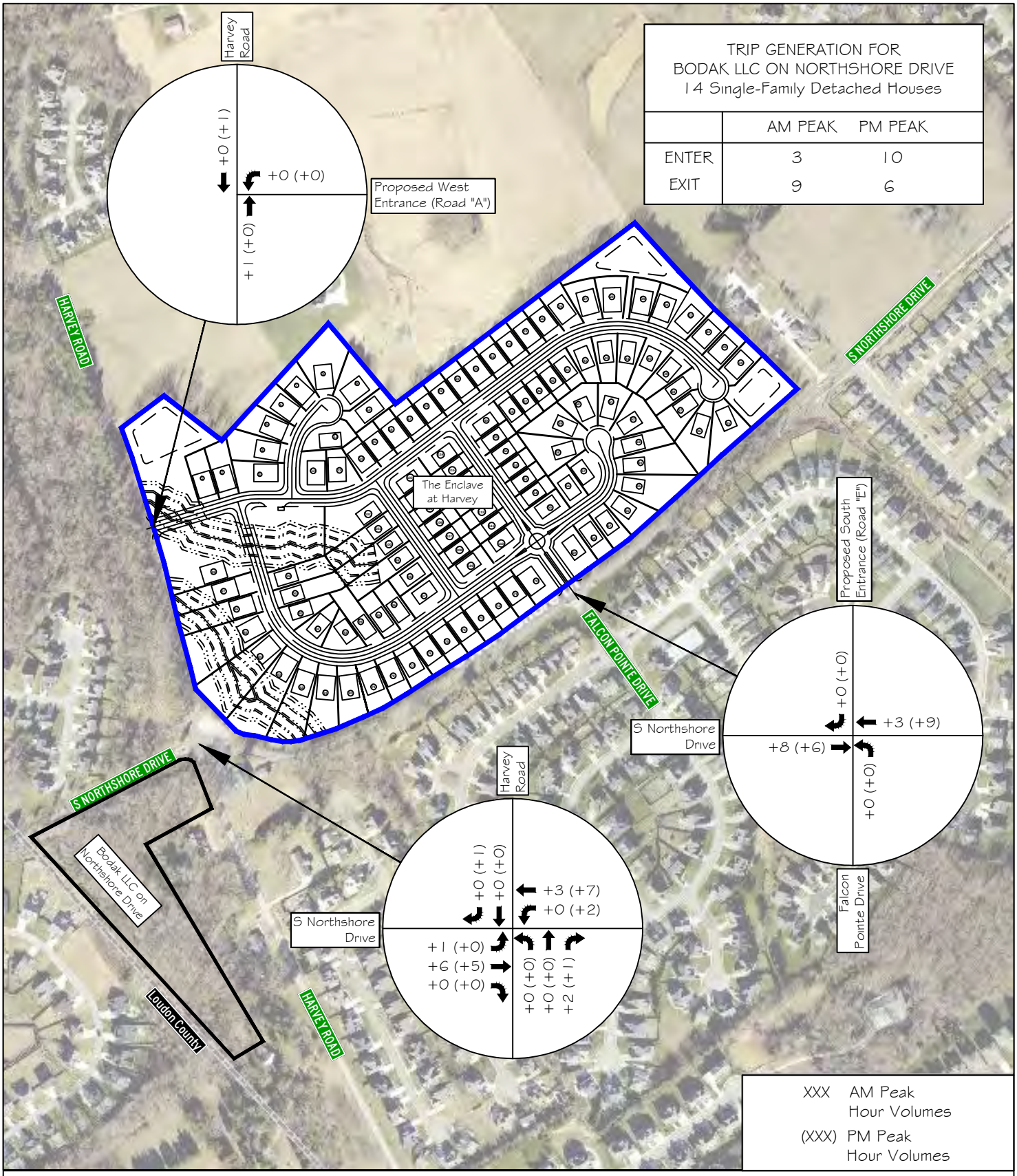

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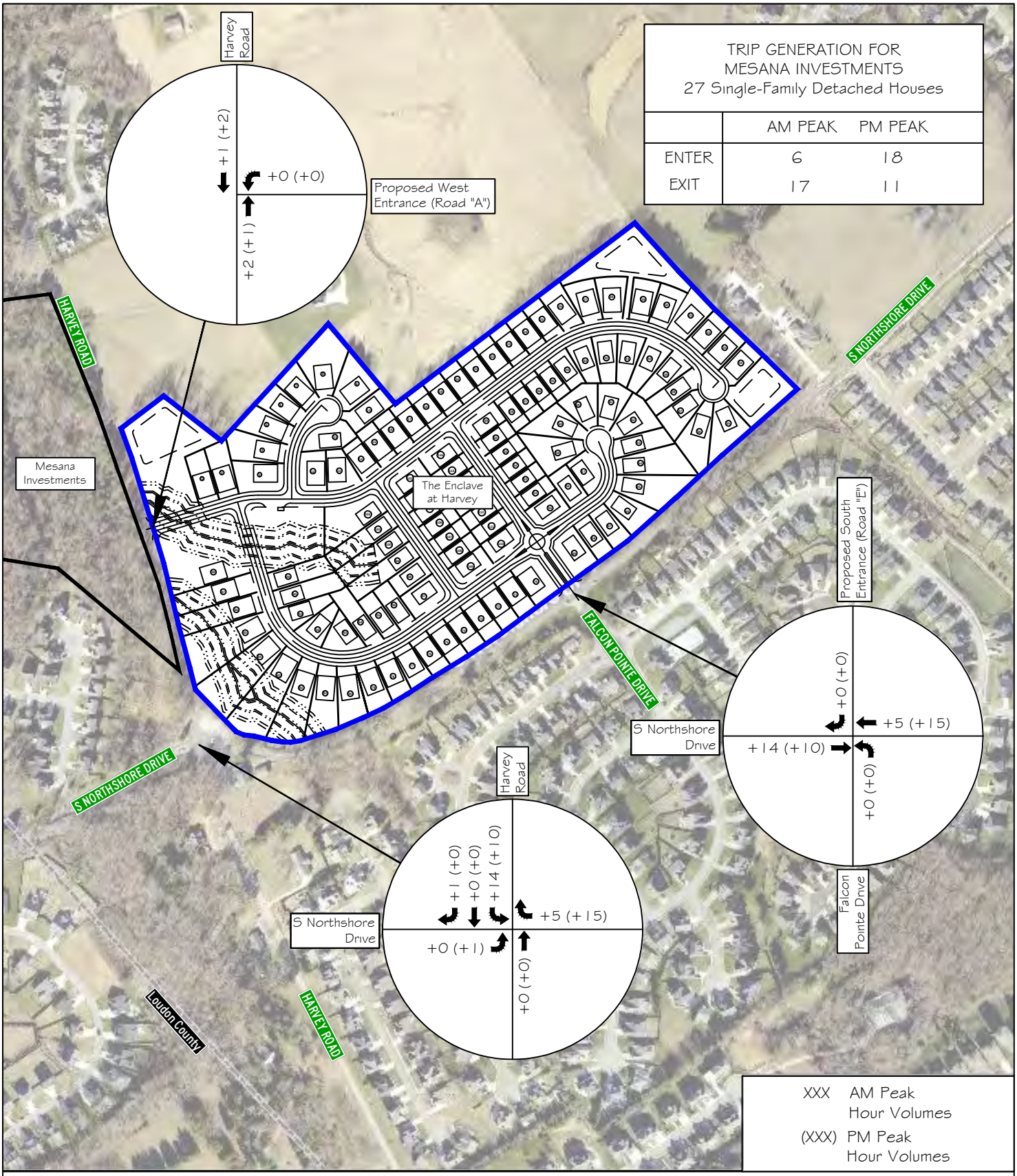
FIGURE 7b

The Enclave at Harvey

Traffic Assignment of Generated Traffic during AM and PM Peak Hour for Bodak LLC on Northshore Drive



TRIP GENERATION FOR
MESANA INVESTMENTS
27 Single-Family Detached Houses

	AM PEAK	PM PEAK
ENTER	6	18
EXIT	17	11

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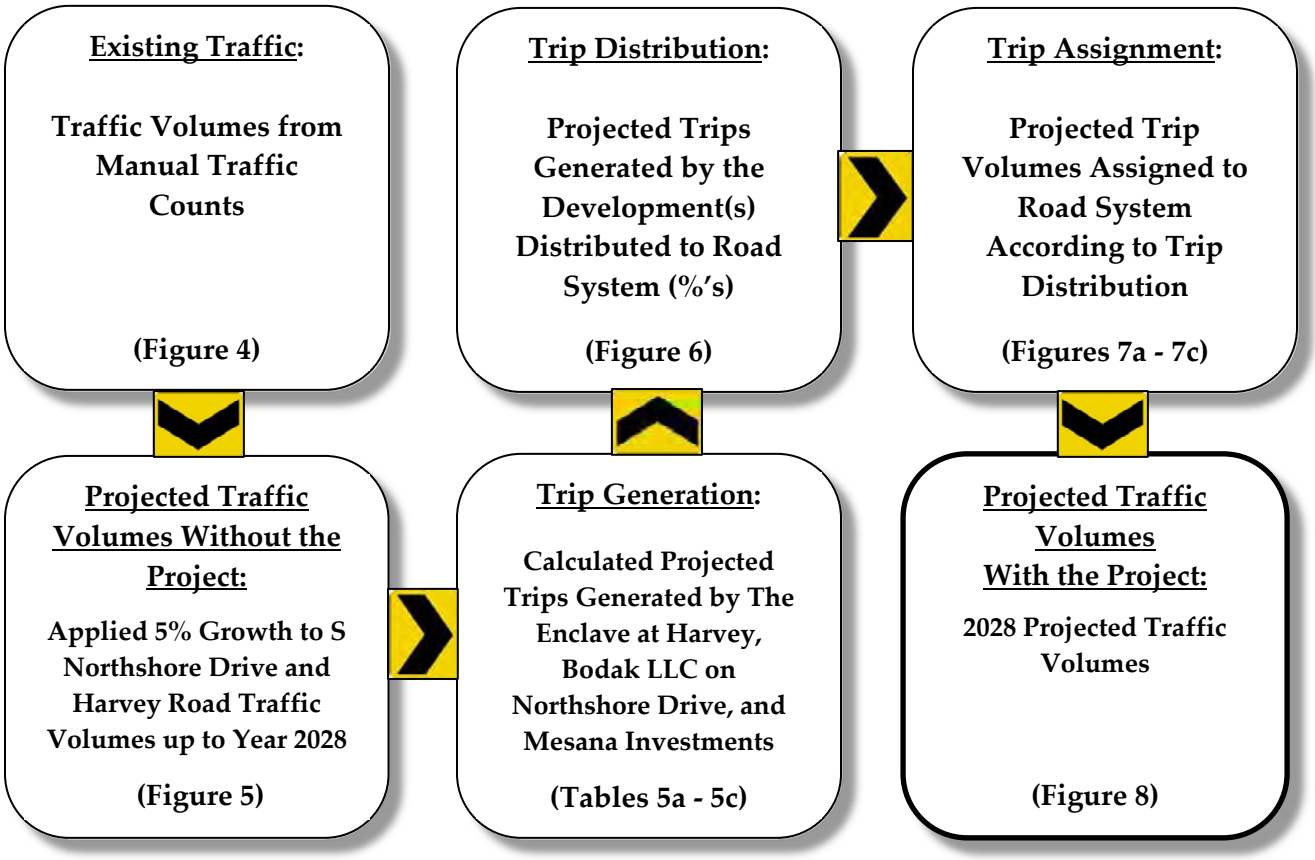
FIGURE 7c

The Enclave at Harvey

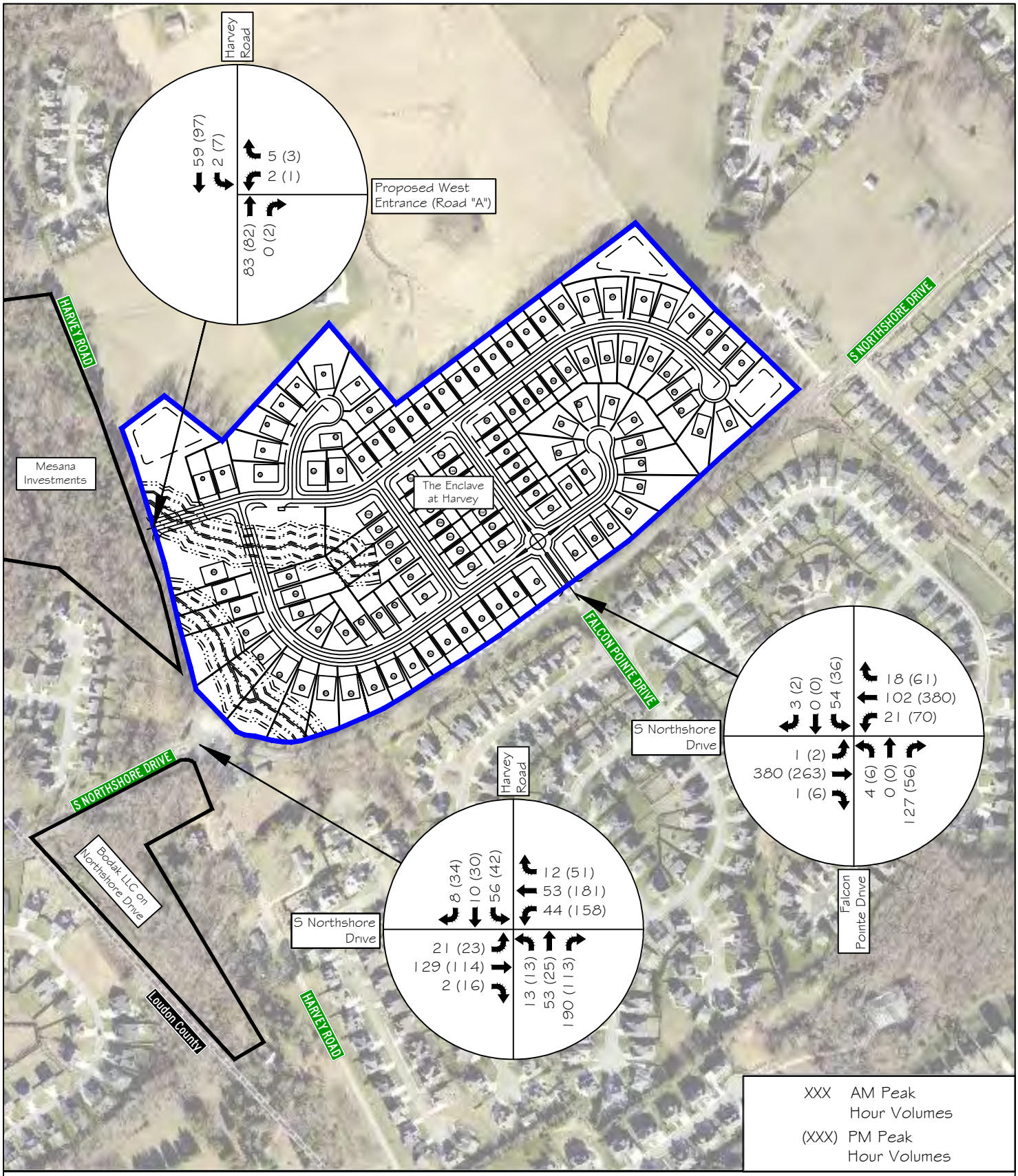
Traffic Assignment of Generated Traffic during AM and PM Peak Hour for Mesana Investments

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

Several additive steps were taken to estimate the total projected traffic volumes at the studied intersections when the development is constructed and fully occupied in 2028. The steps are illustrated below for clarity and review:



The calculated peak hour traffic generated by The Enclave at Harvey was added to the 2028 horizon year traffic by following the predicted trip distributions and assignments. This procedure was completed to obtain the total projected traffic volumes at the studied intersections when The Enclave at Harvey is fully built and occupied in 2028. In addition to The Enclave at Harvey trips, projected 2028 volumes were also calculated to include the additional trips by the known adjacent other proposed residential developments of Bodak LLC on Northshore Drive and Mesana Investments. Figure 8 shows the projected 2028 AM and PM peak hour volumes for The Enclave at Harvey trips, including the trips from the other two proposed non-related residential developments that are also expected to be fully built and occupied by 2028.



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Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

NOT TO SCALE

NORTH

FIGURE 8

The Enclave at Harvey

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

Capacity analyses were conducted to determine the projected LOS with the development traffic in 2028, shown in Figure 8. Intersection capacity results from the projected 2028 peak hour traffic are shown in Table 6. Appendix E includes the worksheets for the projected 2028 peak hour capacity analyses. As shown in Table 6, the unsignalized intersections are calculated to operate very well with reasonable vehicle delays in the projected 2028 conditions.

TABLE 6
2028 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS WITH THE PROJECT

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
S Northshore Drive (WB & EB) at Falcon Pointe Drive (NB) and Proposed South Entrance (SB)	Unsignalized	Northbound Left/Thru/Right	B	13.5	0.279	B	11.7	0.118
		Eastbound Left	A	7.6	0.001	A	8.2	0.002
		Westbound Left	A	8.4	0.033	A	8.1	0.059
		Southbound Left/Thru/Right	C	24.2	0.253	C	24.5	0.186
S Northshore Drive (WB & EB) at Harvey Road (SB & NB)	Unsignalized	Northbound Left/Thru/Right	B	10.1	0.359	A	10.0	0.237
		Eastbound Left/Thru/Right	A	10.0	0.270	B	10.6	0.291
		Westbound Left/Thru/Right	A	9.9	0.245	C	15.4	0.599
		Southbound Left/Thru/Right	A	9.2	0.146	B	10.3	0.221
Harvey Road (SB & NB) at Proposed West Entrance (WB)	Unsignalized	Westbound Left/Right	A	8.9	0.008	A	9.0	0.005
		Southbound Left	A	7.4	0.001	A	7.4	0.005

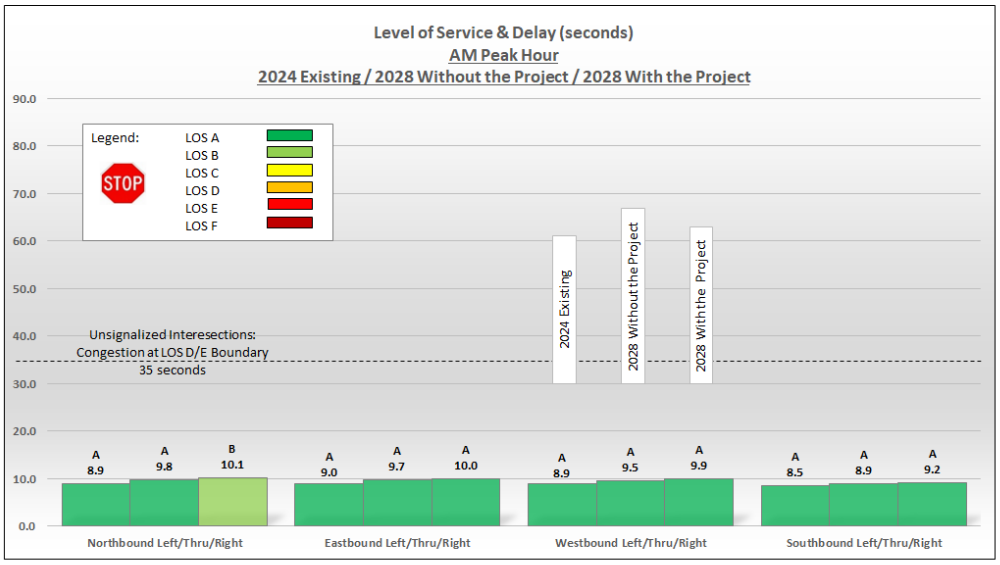
Note: All analyses were calculated in Synchro 12 software and reported using 7th Edition intersection methodology
[a] Level of Service , [b] Average Delay (sec/vehicle) , [c] Volume-to-Capacity Ratio

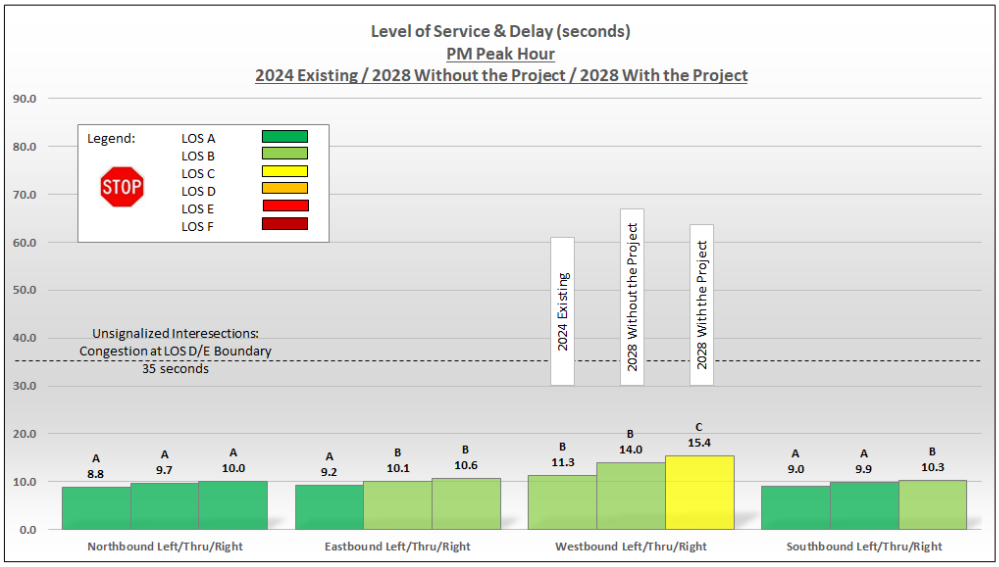
A summary of the capacity analyses for the 4-way intersection of S Northshore Drive at Harvey Road is presented in Table 7. This table provides a side-by-side summary and comparison of the intersection for the existing 2024 conditions, projected conditions in 2028 without the project, and the projected conditions in 2028 with the project, which includes the impact of the other two nearby known proposed residential subdivisions. As seen in the table, adding these proposed residential subdivisions to the adjacent road network will have minimal impact on the vehicle delays at the 4-way intersection.

TABLE 7
INTERSECTION CAPACITY ANALYSIS SUMMARY
S NORTHSHORE DRIVE AT HARVEY ROAD

LOCATION / PEAK HOUR MOVEMENT	2024 EXISTING			2028 WITHOUT THE PROJECT			2028 WITH THE PROJECT		
	LOS[a]	Delay[b]	v/c[c]	LOS[a]	Delay[b]	v/c[c]	LOS[a]	Delay[b]	v/c[c]
AM Peak									
Northbound Left/Thru/Right	A	8.9	0.278	A	9.8	0.347	B	10.1	0.359
Eastbound Left/Thru/Right	A	9.0	0.031	A	9.7	0.250	A	10.0	0.270
Westbound Left/Thru/Right	A	8.9	0.000	A	9.5	0.218	A	9.9	0.245
Southbound Left/Thru/Right	A	8.5	0.000	A	8.9	0.112	A	9.2	0.146
Intersection Vehicle Delay [b]	A	8.9		A	9.6		A	9.9	
PM Peak									
Northbound Left/Thru/Right	A	8.8	0.177	A	9.7	0.228	A	10.0	0.237
Eastbound Left/Thru/Right	A	9.2	0.208	B	10.1	0.265	B	10.6	0.291
Westbound Left/Thru/Right	B	11.3	0.437	B	14.0	0.549	C	15.4	0.599
Southbound Left/Thru/Right	A	9.0	0.149	A	9.9	0.191	B	10.3	0.221
Intersection Vehicle Delay [b]	B	10.1		B	11.8		B	12.7	

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





- **POTENTIAL TRANSPORTATION SAFETY ISSUES:**

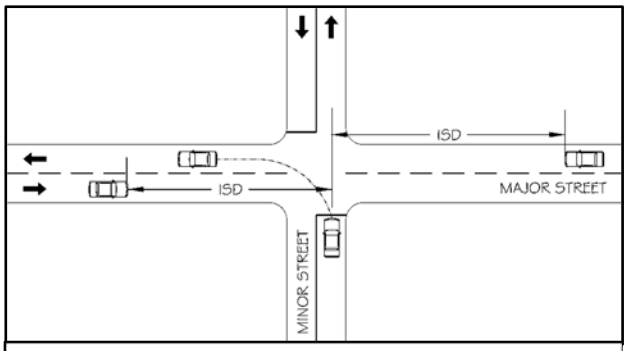
The study area was investigated for potential existing and future safety issues when the development is constructed. These transportation features are discussed in the following pages.

- **EVALUATION OF SIGHT DISTANCE**

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

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

ISD is the required visibility distance standard for evaluating the safety of an intersection per section 3.04.J.5 in the Knoxville-Knox County Subdivision Regulations. ISD is based on the time required to perceive, react, and complete the desired traffic maneuver once a motorist on a minor street decides to perform a traffic maneuver.



Intersection Sight Distance Diagram

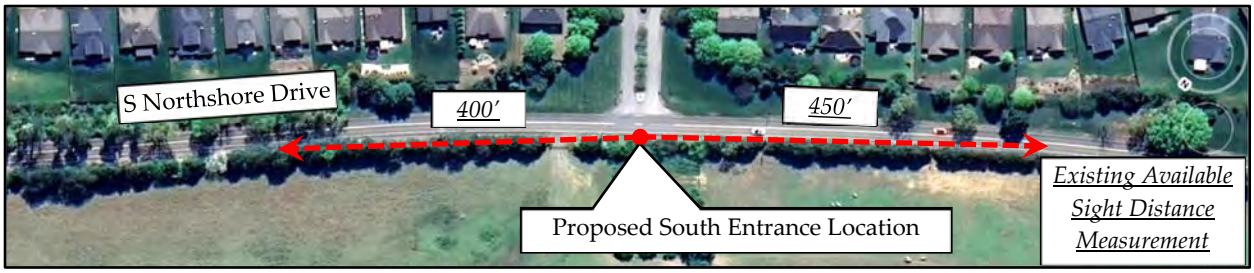
Three traffic maneuvers are available for vehicles stopped on a minor street at a 4-way intersection: (1) left-turn, (2) right-turn, (3) or a crossing maneuver across the major street. For turns from the minor street, ISD is needed to allow a stopped motorist to turn onto a major street without being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

S Northshore Drive has a posted speed limit of 40 mph. Based on Knox County's policy of requiring 10 feet of sight distance per 1 mph of speed, the required intersection sight distance is 400 feet. This distance is required for a motorist to exit safely to the left and right at the Proposed South Entrance. Harvey Road has a posted speed limit of 30 mph. The required distance for a motorist to exit safely to the left and right at the Proposed West Entrance is 300 feet.

Visual observations of the sight distances at the Proposed Entrances were undertaken. Using a Nikon Laser Rangefinder at the Proposed South Entrance location, the available sight distances were visually estimated to be 400 feet to the east and 450 feet to the west on S Northshore Drive. A full estimation of the available sight distance was difficult due to the existing vegetation on the north side of S Northshore Drive along the existing fence line. It is assumed that this vegetation will be removed during construction. Thus, based on visual observation, the available sight distance from the Proposed South Entrance at S Northshore Drive will likely be adequate for motorists exiting the development.

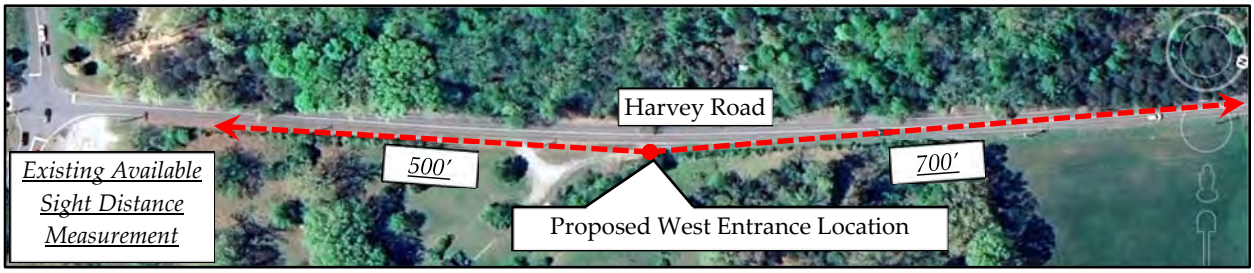
At the Proposed West Entrance location on Harvey Road, the visually estimated distance was measured to be 500 feet to the south and 700 feet to the north. Sight distance to the south from the Proposed West Entrance would be available up to the existing 4-way intersection of S Northshore Drive at Harvey Road if vegetation was removed and an earthen bank on the east side of Harvey Road was removed. Nonetheless, the available sight distance from the Proposed West Entrance at Harvey Road will be adequate for motorists exiting the development.

Images of the existing sight distances at the Proposed Entrance locations are labeled below with the ISD and visually measured sight distances.



View of Sight Distance on S Northshore Drive at the Proposed South Entrance Location (Looking East)

View of Sight Distance on S Northshore Drive at the Proposed South Entrance Location (Looking West)



View of Sight Distance on Harvey Road at the Proposed West Entrance Location (Looking South)

View of Sight Distance on Harvey Road at the Proposed West Entrance Location (Looking North)

- **EVALUATION OF TURN LANE THRESHOLDS**

The need for separate entering turn lanes was evaluated in the projected 2028 conditions for the Proposed Entrances at S Northshore Drive and Harvey Road.

The criteria used for these turn lane evaluations were based on Knox County's "Access Control and Driveway Design Policy". This design policy relates vehicle volume thresholds based on prevailing speeds for two-lane and four-lane roadways. The location of the Proposed South Entrance on S Northshore Drive is within a 40 mph speed zone, and the Proposed West Entrance on Harvey Road is within a 30 mph speed zone; thus, these entrances were evaluated based on these posted speeds. The worksheets for these evaluations are provided in Appendix H.

Based on the projected 2028 traffic volumes at the intersections, none of the Proposed Entrances warrant separate entering left or right-turn lanes on S Northshore Drive or Harvey Road.

- **PROJECTED VEHICLE QUEUES**

An additional software program calculated the 2028 AM and PM peak hour projected vehicle queues at the studied intersections. The previously mentioned Synchro traffic software includes SimTraffic. The Synchro portion of the software performs the macroscopic calculations for intersections, and SimTraffic performs micro-simulation and animation of vehicular traffic. SimTraffic software was utilized to estimate the projected vehicle queues at the intersections.

The 95th percentile vehicle queue is the recognized measurement in the transportation engineering profession as the design standard used when considering vehicle queue lengths. A 95th percentile vehicle queue length means 95% certainty that the vehicle queue will not extend beyond that point. The calculated vehicle queue results were based on averaging the outcome obtained during ten traffic simulations in the software. The 95th percentile vehicle queue lengths at the intersections are shown in Table 8 for the projected 2028 conditions. The vehicle queue worksheet results from the SimTraffic software are in Appendix I.

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

INTERSECTION	APPROACH/ MOVEMENT	SYNCHRO 95th PERCENTILE QUEUE LENGTH (ft)	
		AM PEAK HOUR	PM PEAK HOUR
S Northshore Drive (WB & EB) at Falcon Pointe Drive (NB) and Proposed South Entrance (SB)	Eastbound Left/Thru/Right	0	6
	Westbound Left/Thru/Right	31	57
	Northbound Left/Thru/Right	70	51
	Southbound Left/Thru/Right	52	48
S Northshore Drive (WB & EB) at Harvey Road (SB & NB)	Eastbound Left/Thru/Right	56	55
	Westbound Left/Thru/Right	34	89
	Northbound Left/Thru/Right	82	57
	Southbound Left/Thru/Right	50	52
Harvey Road (SB & NB) at Proposed West Entrance (WB)	Westbound Left/Right	24	19
	Southbound Left/Thru	4	7

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

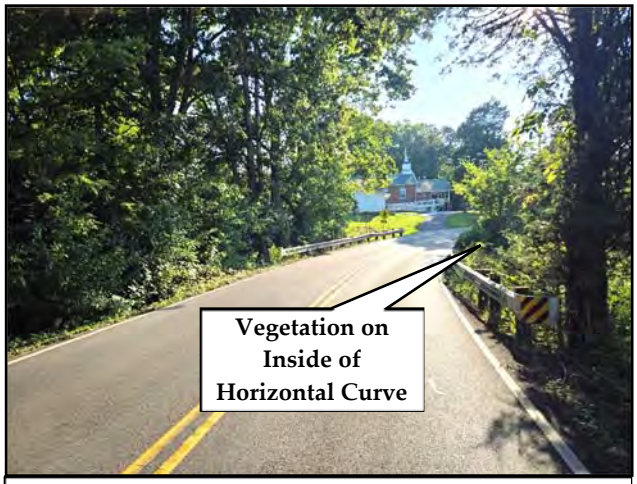
Table 8 shows minimal vehicle queue lengths on all the studied intersection approaches in the 2028 AM and PM peak hours. Based on these results, the longest queues at the intersection of S Northshore Drive at Harvey Road. These queues will be just over three passenger vehicles, assuming a length of 25 feet per vehicle.

CONCLUSIONS & RECOMMENDATIONS

The following is an overview of recommendations to minimize the transportation impacts of The Enclave at Harvey on the adjacent transportation system while attempting to achieve an acceptable traffic flow and safety level. The recommendations also consider the nearby non-related proposed residential subdivisions on S Northshore Drive and Harvey Road.

1 **S Northshore Drive at Harvey Road**: The 2028 projected level of service calculations for this intersection resulted in minimal to average vehicle delays and LOS for all the approaches in the AM and PM peak hours. It is expected that the overall vehicle delays in the projected 2028 conditions will be minimally increased compared to the existing conditions. Overall, the intersection was calculated to only increase the overall average vehicle stop delay by 1 second in the AM peak hour and 2.6 seconds in the PM peak hour between the existing 2024 and projected 2028 conditions.

1a) There are no particular recommendations for this intersection other than improving the sight distance for westbound traffic on S Northshore Drive as it approaches Harvey Road. Removing the existing vegetation and maintaining it in the future will significantly increase road safety.



**S Northshore Drive at
Sharp Horizontal Curve East of Harvey Road
(Looking West)**

S Northshore Drive intersects Harvey Road, just west of a horizontal curve. Along this curve, guardrails delineate the edges, and vegetation has overtaken the inside curve of S Northshore Drive on the north side, severely restricting stopping sight distance for motorists approaching Harvey Road. Furthermore, Pedestrian (W11-2) Signs with supplemental "Church" plaques are posted on both sides of S Northshore Drive just east of Harvey Road. The Pedestrian (W11-2) sign on the inside curve of S Northshore Drive is nearly obscured due to vegetation. These pedestrian signs are installed for the Shady Grove Missionary Baptist Church. The vegetation on the inside curve of S Northshore Drive creates dangerous conditions by obscuring potential stopped traffic backing up

from Harvey Road or pedestrians crossing the roadway to and from the Church's overflow parking. This vegetation must be removed and maintained in the future conditions.

S Northshore Drive at Sharp Horizontal Curve East of Harvey Road (Looking West)

1b) It is recommended that the County install matching warning signs on the right (north) side of S Northshore Drive facing westbound traffic. Currently, a Stop Ahead (W3-1) Sign and a Reverse Curve (W1-4R) are posted on the left (south) side of S Northshore Drive. These signs should also be installed on the opposite side, facing westbound traffic.

2 **S Northshore Drive at Falcon Pointe Drive and Proposed South Entrance**: The 2028 projected level of service calculations for this intersection resulted in minimal to average vehicle delays and good LOS for all the approaches in the AM and PM peak hours. Vehicle queues at this intersection are expected to be minimal, and entering left- and right-turn lanes on S Northshore Drive are not warranted due to trips generated by The Enclave at Harvey. Overall, minimal entering left turns from S Northshore Drive is expected.

2a) It is recommended that a Stop Sign (R1-1) be installed and a 24" white stop bar be applied to the Proposed South Entrance approach at S Northshore Drive. The stop bar should be applied a minimum of 4 feet away from the edge of S Northshore Drive and placed at the desired stopping point that maximizes the sight distance.

2b) A single exit lane for the Proposed South Entrance will be sufficient. The southbound exiting lane at S Northshore Drive is proposed as a shared left/thru/right lane.

The longest vehicle queue in the projected 2028 conditions on this exiting approach is calculated to be 52 feet in the AM peak hour and 48 feet in the PM peak hour. These queue lengths are reasonable and translate to just two passenger cars, assuming a length of 25 feet per vehicle. The longest vehicle queue is calculated to be 70 feet in the AM peak hour and 57 feet in the PM peak hour on Falcon Pointe Drive.

2c) Intersection sight distance at the Proposed South Entrance at S Northshore Drive must not be impacted by future landscaping, signage, or existing or future vegetation. Based on a posted speed limit of 40 mph on S Northshore Drive, the required intersection sight distance is 400 feet for exiting left and right-turning vehicles. The existing sight distances at the Proposed South Entrance location were estimated visually to be likely adequate in both directions. However, due to existing vegetation along the north side of S Northshore Drive, it is recommended that the sight distance be certified by a registered land surveyor. The site designer must ensure that the intersection sight distances are accounted for and provided in the design plans.

2d) Due to the higher classification of S Northshore Drive, the higher vehicle speeds, and to facilitate westbound right turn movements off the roadway into the development, it is recommended that the intersection radius be increased from the standard 25 feet. To facilitate this movement, it is recommended that the intersection radius at this corner be 50 feet.

2e) As requested after the initial review of this study, an examination of the need for a separate left-turn lane for residents entering the Falcon Pointe Subdivision to the south was conducted. In the projected 2028 conditions, due to general traffic growth and the trips generated by the Falcon Pointe Subdivision, a separate westbound left turn at this intersection is warranted in the PM peak hour. This warrant threshold is met even without the proposed The Enclave at Harvey development. These additional turn lane warrant evaluations are provided in Appendix H. As part of the construction of the Proposed South Entrance at S Northshore Drive, a separate westbound left turn lane on S Northshore Drive at the intersection is recommended due to meeting this warrant.

In addition, while this intersection undergoes modifications, the construction would provide an opportune time to construct an eastbound left-turn lane on S Northshore Drive as well, even though this movement is projected to have minimal left turns into The Enclave at Harvey. Providing this additional turn lane would reduce interruptions and facilitate the thru movements on S Northshore Drive.

Harvey Drive at Proposed West Entrance: The 2028 projected level of service calculations for this intersection resulted in minimal to average vehicle delays and excellent LOS for all the approaches in the AM and PM peak hours. Vehicle queues at this intersection are expected to be minimal, and entering left- and right-turn lanes on Harvey Road are not warranted due to trips generated by The Enclave at Harvey. Overall, minimal entering and exiting traffic is expected at the entrance.

3a) It is recommended that a Stop Sign (R1-1) be installed and a 24" white stop bar be applied to the Proposed West Entrance approach at Harvey Road. The stop bar should be applied a minimum of 4 feet away from the edge of Harvey Road and placed at the desired stopping point that maximizes the sight distance.

3b) A single exit lane for the Proposed West Entrance will be sufficient. The westbound exiting lane at Harvey Road is proposed as a shared left/thru/right lane.

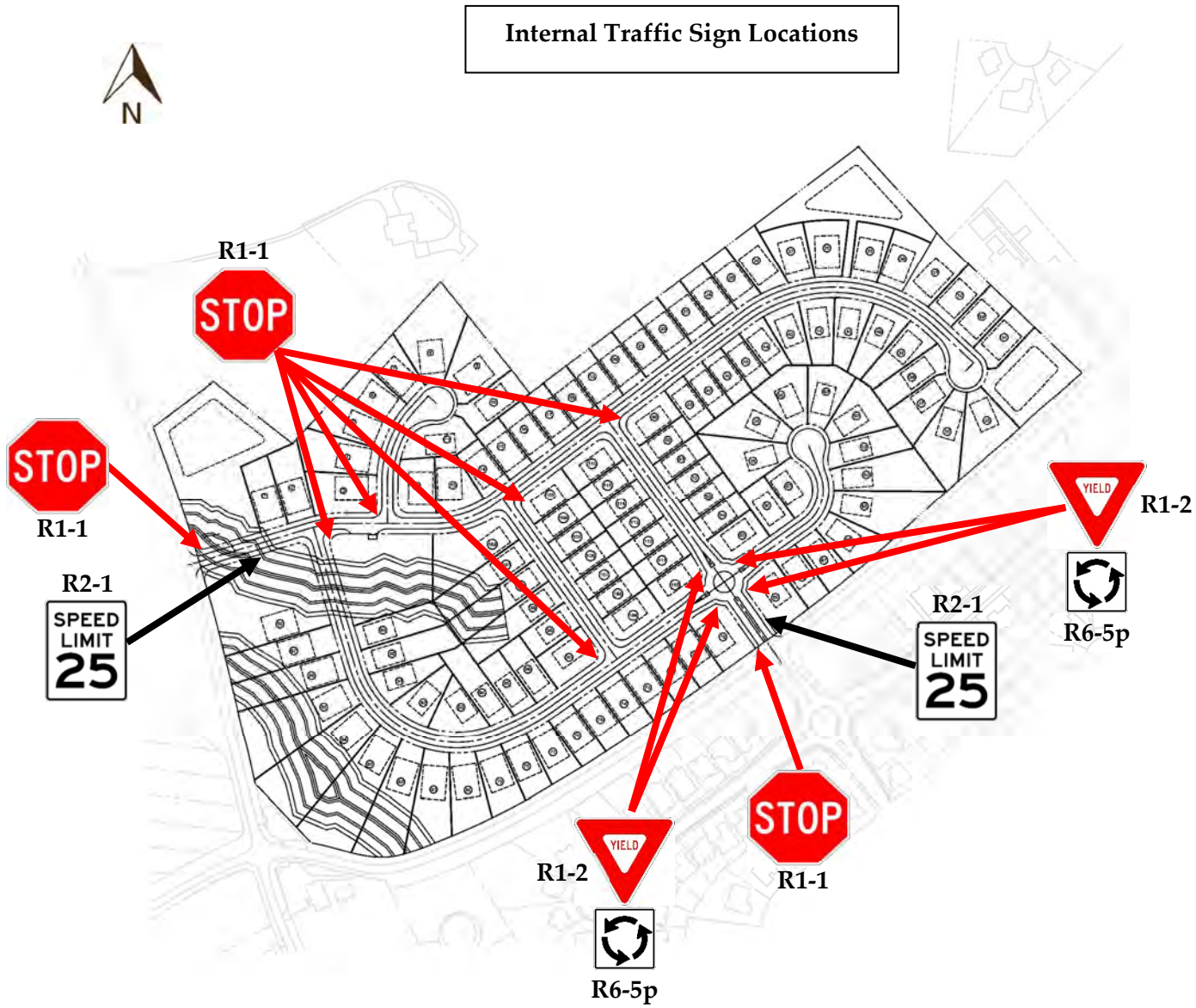
The longest vehicle queue in the projected 2028 conditions on this exiting approach is calculated to be 24 feet in the AM peak hour and 19 feet in the PM peak hour. These queue lengths are reasonable and translate to one passenger car, assuming a length of 25 feet per vehicle.

3c) Intersection sight distance at the Proposed West Entrance at Harvey Road must not be impacted by future landscaping, signage, or existing or future vegetation. Based on a posted speed limit of 30 mph on Harvey Road, the required intersection sight distance is 300 feet for exiting left and right-turning vehicles. The existing sight distances at the Proposed West Entrance location were estimated visually to be adequate in both directions. The site designer must ensure that the intersection sight distances are accounted for and provided in the design plans.

4 **The Enclave at Harvey Internal Roads:** The layout plan shows two entrances constructed for the development, one at S Northshore Drive and the other at Harvey Road, as shown in Figure 3.

4a) A 25 mph Speed Limit (R2-1) sign is recommended to be posted near the beginning of the development entrances off S Northshore Drive and Harvey Road.

4b) Stop Signs (R1-1) with 24" white stop bars are recommended to be installed at the internal road locations, as shown in the image below. It is recommended that the proposed internal mini-roundabout be signed and the pavement approaches marked as shown in Figure 2B-21 in the Manual on Uniform Traffic Control Devices (MUTCD).



4c) Sight distance at the new internal intersections must not be impacted by new signage, parked cars, or future landscaping. With a speed limit of 25 mph in the development, the internal intersection sight distance is 250 feet. The site designer should ensure that internal sight distance lengths are met.

4d) If directed by the local post office, the site designer should include a parking area and a centralized mail delivery center within the development for the subdivision residents.

4e) All drainage grates and covers for the residential development must be pedestrian and bicycle-safe.

4f) A few internal roads in the proposed subdivision will have long, straight road segments. Straight road segments encourage higher vehicle speeds. It is recommended that the civil site designer consider including traffic calming measures on the internal roads, such as speed humps or tables. Specifics regarding this recommendation should be discussed in the design phase with Knox County Engineering.

4g) The internal sidewalk system should be connected to the proposed sidewalk along the road frontage of S Northshore Drive. Sidewalks should have appropriate ADA-compliant ramps at intersection corners, and the internal sidewalks should be 5 feet minimum in width to meet Knox County regulations. White crosswalks should be marked internally on the road pavement where pedestrians are expected to cross.

4h) All road and intersection elements should be designed to AASHTO and Knox County specifications and guidelines to ensure proper transportation operations.

APPENDIX A

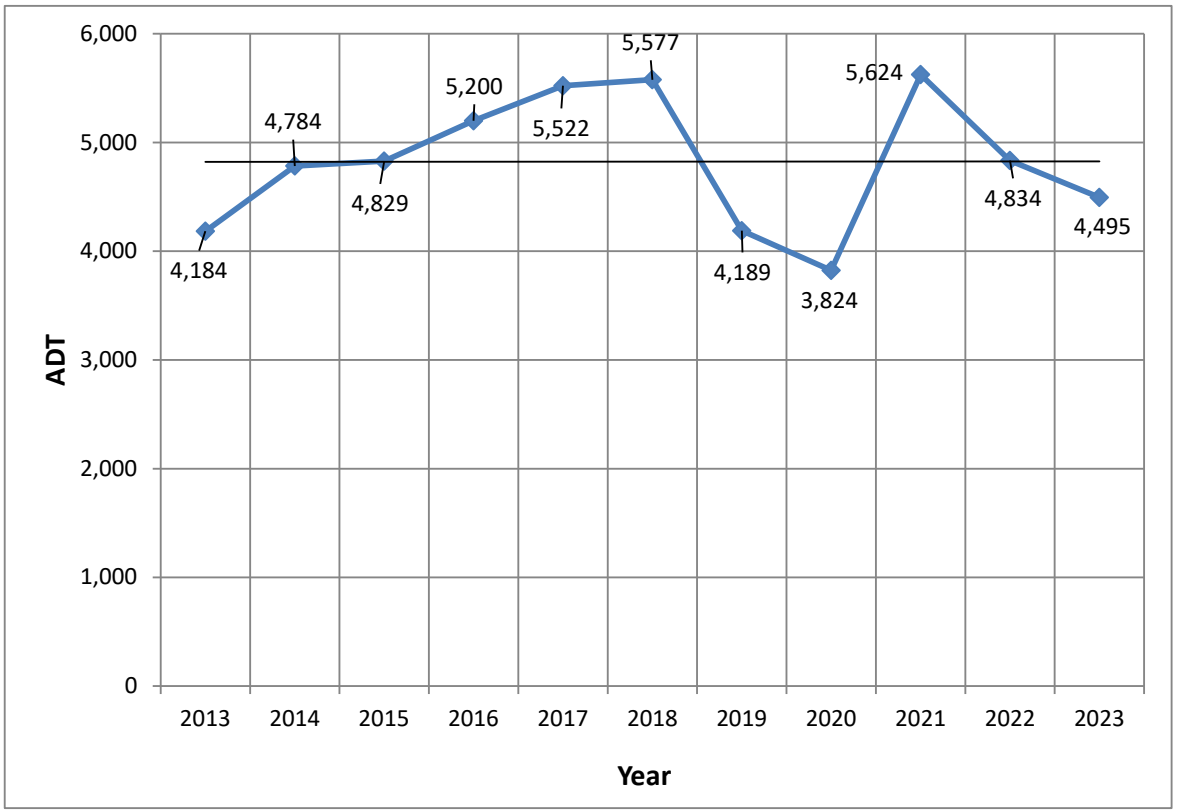
HISTORICAL TRAFFIC COUNT DATA

Historical Traffic Counts

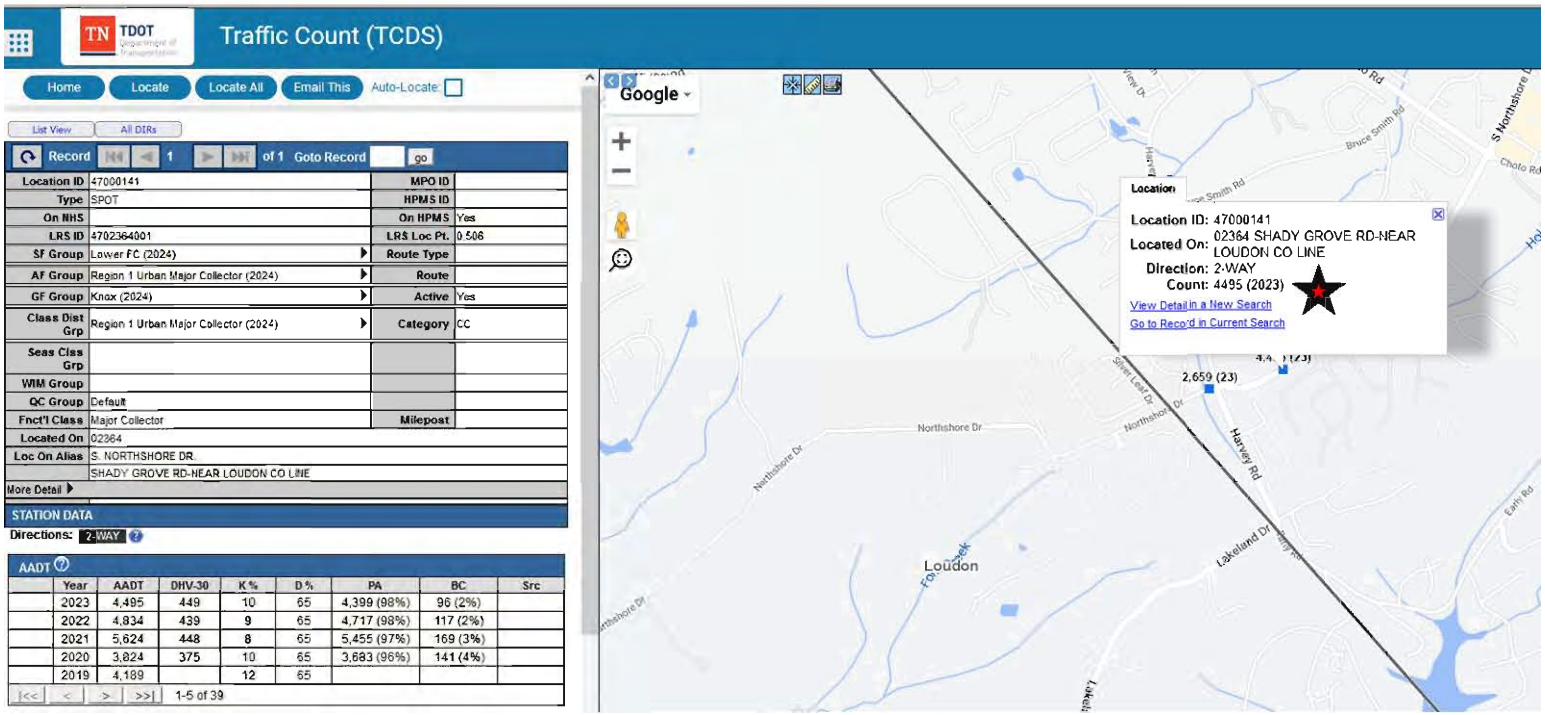
Organization: TDOT
Station ID #: 47000141
Location: Northshore Drive, east of Harvey Road

YEAR	AADT
2013	4,184
2014	4,784
2015	4,829
2016	5,200
2017	5,522
2018	5,577
2019	4,189
2020	3,824
2021	5,624
2022	4,834
2023	4,495

Trendline



2013 - 2023 Growth Rate = 7.4%
Average Annual Growth Rate = 0.7%

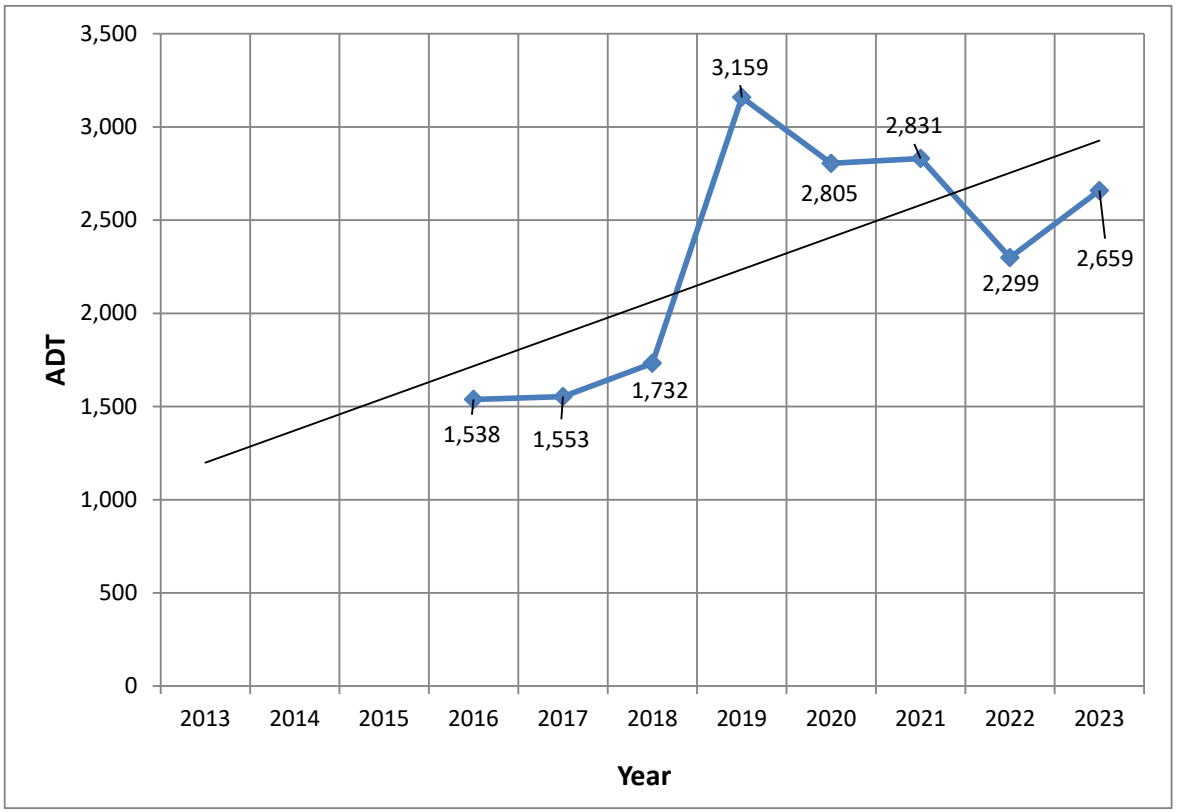

TN TDOT
Traffic Count (TCDS)
Home
Locate
Locate All
Email This
Auto-Locate:
List View
All DIRs
Record 1 of 1 Goto Record go
Location ID 47000141
Type SPOT
On NHS
LRS ID 4702364001
SF Group Lower FC (2024)
AF Group Region 1 Urban Major Collector (2024)
GF Group Knox (2024)
Class Dist Grp Region 1 Urban Major Collector (2024)
Seas Clss Grp
WIM Group
QC Group Default
Fnct'l Class Major Collector
Located On 02364
Loc On Alias S. NORTHSHORE DR
SHADY GROVE RD-NEAR LOUDON CO LINE
More Detail
MPO ID
HPMS ID
On HPMS Yes
LRS Loc Pt. 0.506
Route Type
Route
Active Yes
Category CC
Milepost
STATION DATA
Directions: 2-WAY
AADT
Year AADT DHV-30 K % D % PA BC Src
2023 4,495 449 10 65 4,399 (98%) 96 (2%)
2022 4,834 439 9 65 4,717 (98%) 117 (2%)
2021 5,624 448 8 65 5,455 (97%) 169 (3%)
2020 3,824 375 10 65 3,683 (96%) 141 (4%)
2019 4,189 12 65
1-5 of 39
Google
Location
Location ID: 47000141
Located On: 02364 SHADY GROVE RD-NEAR LOUDON CO LINE
Direction: 2-WAY
Count: 4495 (2023)
View Detail in a New Search
Go to Record in Current Search
2,659 (23)
Northshore Dr
Harvey Rd
Lakeland Dr
Loudon
Bruce Smith Rd
Choto Rd
Early Rd

Historical Traffic Counts

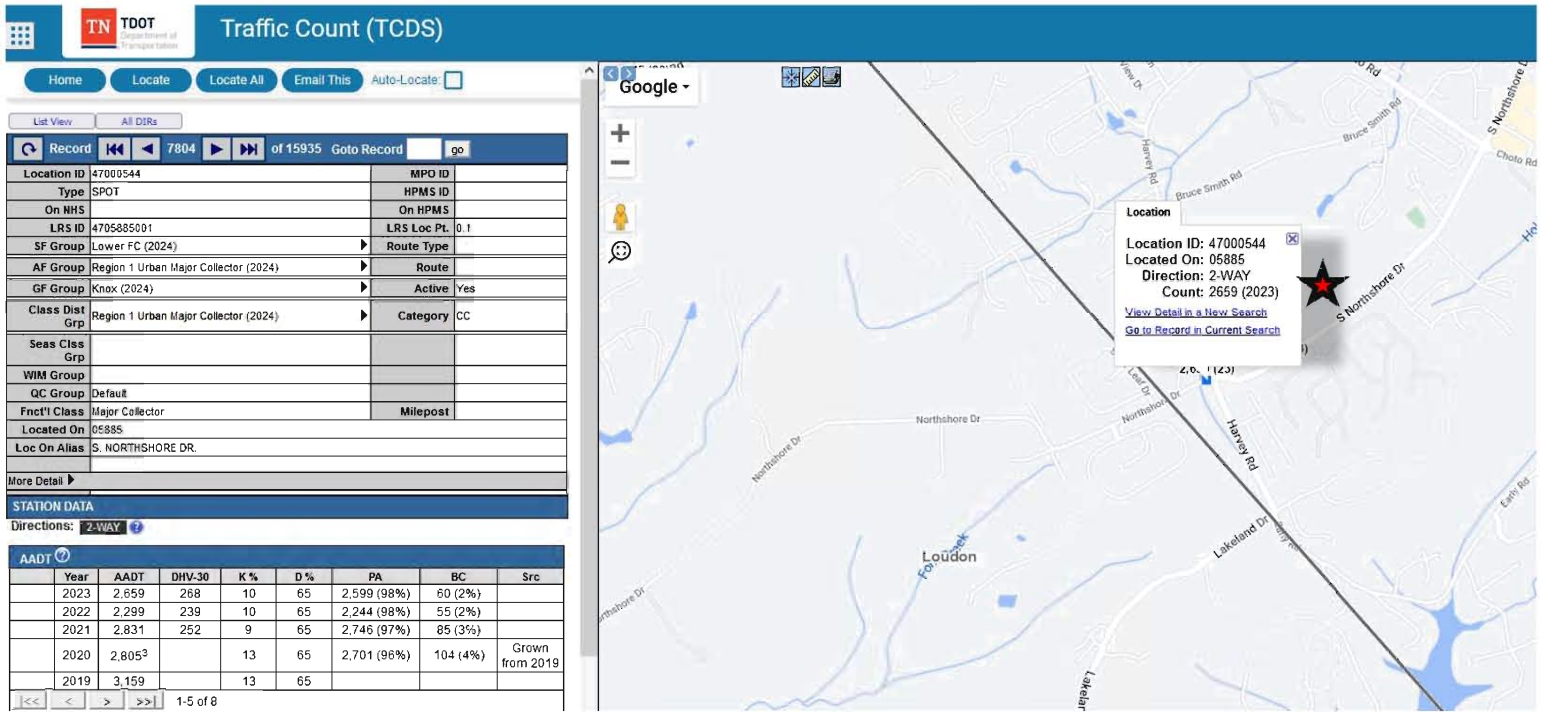
Organization: TDOT
Station ID #: 47000544
Location: Northshore Drive, west of Harvey Road

YEAR	AADT
2013	
2014	
2015	
2016	1,538
2017	1,553
2018	1,732
2019	3,159
2020	2,805
2021	2,831
2022	2,299
2023	2,659

Trendline



2016 - 2023 Growth Rate = 72.9%
Average Annual Growth Rate = 8.1%


TN TDOT
Traffic Count (TCDS)
Home
Locate
Locate All
Email This
Auto-Locate:
List View
All DIRs
Record
7804
of 15935
Goto Record
go
Location ID 47000544
Type SPOT
On NHS
LRS ID 4705885001
SF Group Lower FC (2024)
AF Group Region 1 Urban Major Collector (2024)
GF Group Knox (2024)
Class Dist Grp Region 1 Urban Major Collector (2024)
Seas Clss Grp
WIM Group
QC Group Default
Fnct'l Class Major Collector
Located On 05885
Loc On Alias S. NORTHSHORE DR.
More Detail
MPO ID
HPMS ID
On HPMS
LRS Loc Pt. 0.1
Route Type
Route
Active Yes
Category CC
Milepost
STATION DATA
Directions: 2-WAY
AADT
Year AADT DHV-30 K % D % PA BC Src
2023 2,659 268 10 65 2,599 (98%) 60 (2%)
2022 2,299 239 10 65 2,244 (98%) 55 (2%)
2021 2,831 252 9 65 2,746 (97%) 85 (3%)
2020 2,805[3] 13 65 2,701 (96%) 104 (4%) Grown from 2019
2019 3,159 13 65
1-5 of 8
Google
Location
Location ID: 47000544
Located On: 05885
Direction: 2-WAY
Count: 2659 (2023)
View Detail in a New Search
Go to Record in Current Search
S Northshore Dr
Harvey Rd
Bruce Smith Rd
Northshore Dr
Loudon
Lakeland Dr

APPENDIX B

KNOXVILLE AREA TRANSIT MAP AND INFORMATION

Route 16 - Middlebrook / Cedar Bluff
WEEKDAY

Going away from downtown					*Going toward downtown*					
Knoxville Station Bay C	**State Office Building**	**Middlebrook Pk WB and Lake Brook Blvd**	**Walmart**	**Parkwest Medical Center**	**Windsor Square on Market Place Blvd**	**Parkwest Medical Center**	**Walmart**	**Middlebrook Pk EB and Dowell Springs**	**State Office Building**	**Knoxville Station Bay C**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
			Transfer to Rt. 11				*Transfer to Rt. 11*			
					5:40 AM	5:48 AM	6:15 AM	6:25 AM	6:35 AM	7:05 AM
					6:40 AM	6:48 AM	7:15 AM	7:25 AM	7:35 AM	8:05 AM
6:15 AM	6:30 AM	6:48 AM	7:15 AM	7:30 AM	7:40 AM	7:48 AM	8:15 AM	8:25 AM	8:35 AM	9:05 AM
7:15 AM	7:30 AM	7:48 AM	8:15 AM	8:30 AM	8:40 AM	8:48 AM	9:15 AM	9:25 AM	9:35 AM	10:05 AM
8:15 AM	8:30 AM	8:48 AM	9:15 AM	9:30 AM	9:40 AM	9:48 AM	10:15 AM	10:25 AM	10:35 AM	11:05 AM
9:15 AM	9:30 AM	9:48 AM	10:15 AM	10:30 AM	10:40 AM	10:48 AM	11:15 AM	11:25 AM	11:35 AM	**12:05 PM**
10:15 AM	10:30 AM	10:48 AM	11:15 AM	11:30 AM	11:40 AM	11:48 AM	**12:15 PM**	**12:25 PM**	**12:35 PM**	**1:05 PM**
11:15 AM	11:30 AM	11:48 AM	**12:15 PM**	**12:30 PM**	**12:40 PM**	**12:48 PM**	**1:15 PM**	**1:25 PM**	**1:35 PM**	**2:05 PM**
12:15 PM	**12:30 PM**	**12:48 PM**	**1:15 PM**	**1:30 PM**	**1:40 PM**	**1:48 PM**	**2:15 PM**	**2:25 PM**	**2:35 PM**	**3:05 PM**
1:15 PM	**1:30 PM**	**1:48 PM**	**2:15 PM**	**2:30 PM**	**2:40 PM**	**2:48 PM**	**3:15 PM**	**3:25 PM**	**3:35 PM**	**4:05 PM**
2:15 PM	**2:30 PM**	**2:48 PM**	**3:15 PM**	**3:30 PM**	**3:40 PM**	**3:48 PM**	**4:15 PM**	**4:25 PM**	**4:35 PM**	**5:05 PM**
3:15 PM	**3:30 PM**	**3:48 PM**	**4:15 PM**	**4:30 PM**	**4:40 PM**	**4:48 PM**	**5:15 PM**	**5:25 PM**	**5:35 PM**	**6:05 PM**
4:15 PM	**4:30 PM**	**4:48 PM**	**5:15 PM**	**5:30 PM**	**5:40 PM**	**5:48 PM**	**6:15 PM**	**6:25 PM**	**6:35 PM**	**7:05 PM**
5:15 PM	**5:30 PM**	**5:48 PM**	**6:15 PM**	**6:30 PM**	**6:40 PM**	**6:48 PM**	**7:15 PM**	**7:25 PM**	**7:35 PM**	**8:05 PM**
6:15 PM	**6:30 PM**	**6:48 PM**	**7:15 PM**	**7:30 PM**	**7:40 PM**	**7:48 PM**	**8:15 PM**	**8:25 PM**	**8:35 PM**	**9:05 PM**
7:15 PM	**7:30 PM**	**7:48 PM**	**8:15 PM**	**8:30 PM**	**8:40 PM**	**8:48 PM**	**9:15 PM**	**9:25 PM**	**9:35 PM**	**10:05 PM**
8:15 PM	**8:30 PM**	**8:48 PM**	**9:15 PM**	**9:30 PM**	**9:40 PM**	**9:48 PM**	**10:15 PM**			

Route 16 - Middlebrook / Cedar Bluff
Saturday

Going away from downtown					*Going toward downtown*					
Knoxville Station Bay C	**State Office Building**	**Middlebrook Pk WB and Lake Brook Blvd**	**Walmart**	**Parkwest Medical Center**	**Windsor Square on Market Place Blvd**	**Parkwest Medical Center**	**Walmart**	**Middlebrook Pk EB and Dowell Springs**	**State Office Bldg.**	**Knoxville Station Bay C**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
			Transfer to Rt. 11				*Transfer to Rt. 11*			
					6:40 AM	6:48 AM	7:15 AM	7:25 AM	7:35 AM	8:05 AM
					7:40 AM	7:48 AM	8:15 AM	8:25 AM	8:35 AM	9:05 AM
7:15 AM	7:30 AM	7:48 AM	8:15 AM	8:30 AM	8:40 AM	8:48 AM	9:15 AM	9:25 AM	9:35 AM	10:05 AM
8:15 AM	8:30 AM	8:48 AM	9:15 AM	9:30 AM	9:40 AM	9:48 AM	10:15 AM	10:25 AM	10:35 AM	11:05 AM
9:15 AM	9:30 AM	9:48 AM	10:15 AM	10:30 AM	10:40 AM	10:48 AM	11:15 AM	11:25 AM	11:35 AM	**12:05 PM**
10:15 AM	10:30 AM	10:48 AM	11:15 AM	11:30 AM	11:40 AM	11:48 AM	**12:15 PM**	**12:25 PM**	**12:35 PM**	**1:05 PM**
11:15 AM	11:30 AM	11:48 AM	**12:15 PM**	**12:30 PM**	**12:40 PM**	**12:48 PM**	**1:15 PM**	**1:25 PM**	**1:35 PM**	**2:05 PM**
12:15 PM	**12:30 PM**	**12:48 PM**	**1:15 PM**	**1:30 PM**	**1:40 PM**	**1:48 PM**	**2:15 PM**	**2:25 PM**	**2:35 PM**	**3:05 PM**
1:15 PM	**1:30 PM**	**1:48 PM**	**2:15 PM**	**2:30 PM**	**2:40 PM**	**2:48 PM**	**3:15 PM**	**3:25 PM**	**3:35 PM**	**4:05 PM**
2:15 PM	**2:30 PM**	**2:48 PM**	**3:15 PM**	**3:30 PM**	**3:40 PM**	**3:48 PM**	**4:15 PM**	**4:25 PM**	**4:35 PM**	**5:05 PM**
3:15 PM	**3:30 PM**	**3:48 PM**	**4:15 PM**	**4:30 PM**	**4:40 PM**	**4:48 PM**	**5:15 PM**	**5:25 PM**	**5:35 PM**	**6:05 PM**
4:15 PM	**4:30 PM**	**4:48 PM**	**5:15 PM**	**5:30 PM**	**5:40 PM**	**5:48 PM**	**6:15 PM**	**6:25 PM**	**6:35 PM**	**7:05 PM**
5:15 PM	**5:30 PM**	**5:48 PM**	**6:15 PM**	**6:30 PM**	**6:40 PM**	**6:48 PM**	**7:15 PM**	**7:25 PM**	**7:35 PM**	**8:05 PM**
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8:15 PM	**8:30 PM**	**8:48 PM**	**9:15 PM**	**9:30 PM**	**9:40 PM**	**9:48 PM**	**10:15 PM**			

Route 16 - Middlebrook / Cedar Bluff
Sunday

Going away from downtown					*Going toward downtown*					
Knoxville Station Bay C	**State Office Building**	**Middlebrook Pk WB and Lake Brook Blvd**	**Walmart**	**Parkwest Medical Center**	**Windsor Square on Market Place Blvd**	**Parkwest Medical Center**	**Walmart**	**Middlebrook Pk EB and Dowell Springs**	**State Office Bldg.**	**Knoxville Station Bay C**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
			Transfer to Rt. 11				*Transfer to Rt. 11*			
							8:15 AM	8:25 AM	8:35 AM	9:05 AM
					8:40 AM	8:48 AM	9:15 AM	9:25 AM	9:35 AM	10:05 AM
8:15 AM	8:30 AM	8:48 AM	9:15 AM	9:30 AM	9:40 AM	9:48 AM	10:15 AM	10:25 AM	10:35 AM	11:05 AM
9:15 AM	9:30 AM	9:48 AM	10:15 AM	10:30 AM	10:40 AM	10:48 AM	11:15 AM	11:25 AM	11:35 AM	12:05 PM
10:15 AM	10:30 AM	10:48 AM	11:15 AM	11:30 AM	11:40 AM	11:48 AM	**12:15 PM**	**12:25 PM**	**12:35 PM**	**1:05 PM**
11:15 AM	11:30 AM	11:48 AM	**12:15 PM**	**12:30 PM**	**12:40 PM**	**12:48 PM**	**1:15 PM**	**1:25 PM**	**1:35 PM**	**2:05 PM**
12:15 PM	**12:30 PM**	**12:48 PM**	**1:15 PM**	**1:30 PM**	**1:40 PM**	**1:48 PM**	**2:15 PM**	**2:25 PM**	**2:35 PM**	**3:05 PM**
1:15 PM	**1:30 PM**	**1:48 PM**	**2:15 PM**	**2:30 PM**	**2:40 PM**	**2:48 PM**	**3:15 PM**	**3:25 PM**	**3:35 PM**	**4:05 PM**
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3:15 PM	**3:30 PM**	**3:48 PM**	**4:15 PM**	**4:30 PM**	**4:40 PM**	**4:48 PM**	**5:15 PM**	**5:25 PM**	**5:35 PM**	**6:05 PM**
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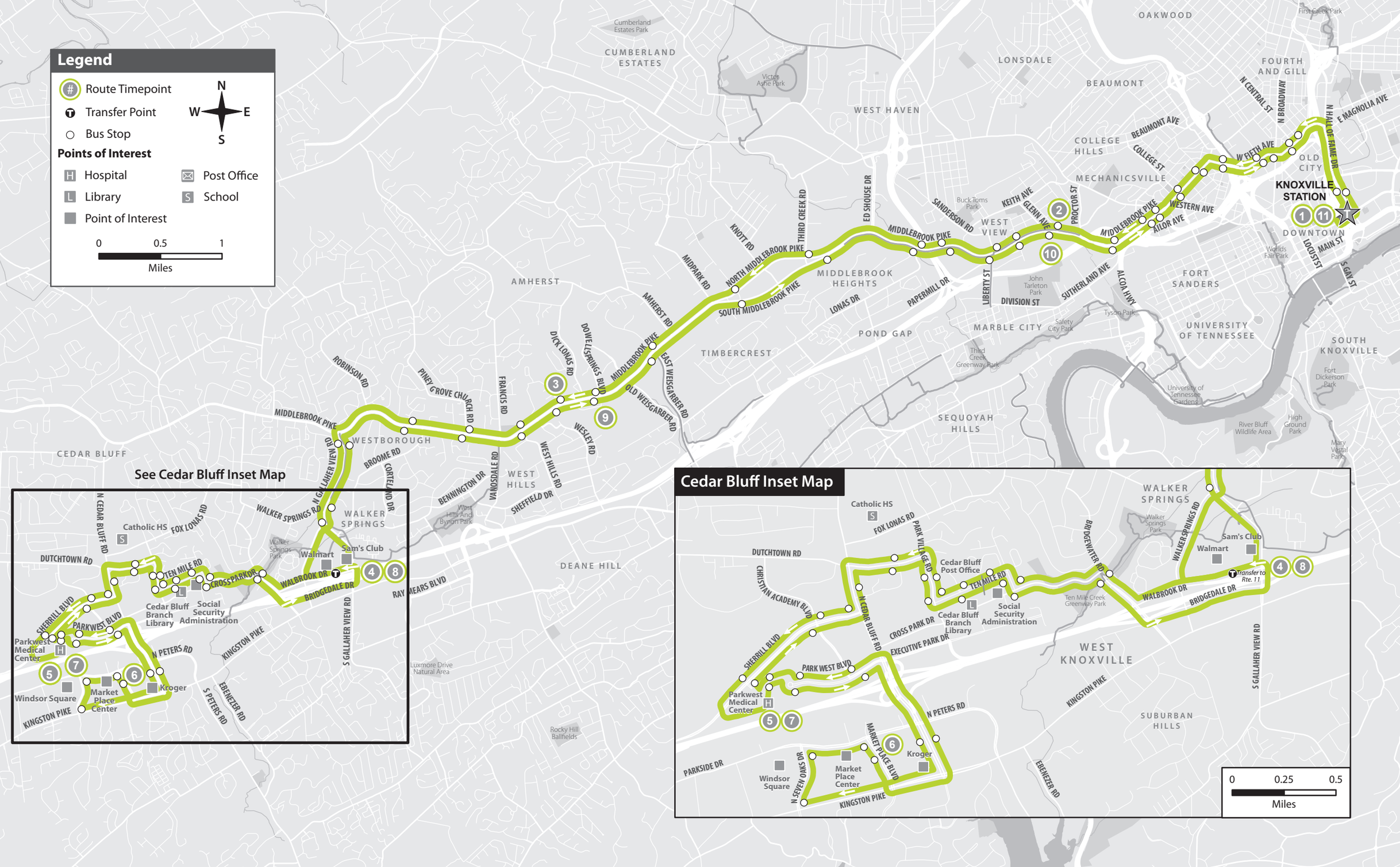
5:15 PM	**5:30 PM**	**5:48 PM**	**6:15 PM**	**6:30 PM**	**6:40 PM**	**6:48 PM**	**7:15 PM**	**7:25 PM**	**7:35 PM**	**8:05 PM**
6:15 PM	**6:30 PM**	**6:48 PM**	**7:15 PM**	**7:30 PM**	**7:40 PM**	**7:48 PM**	**8:15 PM**	**8:25 PM**	**8:35 PM**	**9:05 PM**
7:15 PM	**7:30 PM**	**7:48 PM**	**8:15 PM**	**8:30 PM**	**8:40 PM**	**8:48 PM**				
8:15 PM	**8:30 PM**	**8:48 PM**								


Legend
Route Timepoint
Transfer Point
Bus Stop
Points of Interest
Hospital
Post Office
Library
School
Point of Interest
0
0.5
1
Miles
N
W
E
S
See Cedar Bluff Inset Map
Cedar Bluff Inset Map
CUMBERLAND ESTATES
OAKWOOD
LONSDALE
BEAUMONT
FOURTH AND GILL
WEST HAVEN
COLLEGE HILLS
MECHANICSVILLE
OLD CITY
KNOXVILLE STATION
DOWNTOWN
WEST VIEW
MIDDLEBROOK HEIGHTS
AMHERST
FORT SANDERS
MARBLE CITY
POND GAP
TIMBERCREST
UNIVERSITY OF TENNESSEE
SOUTH KNOXVILLE
SEQUOYAH HILLS
CEDAR BLUFF
WESTBOROUGH
WEST HILLS
DEANE HILL
WALKER SPRINGS
SUBURBAN HILLS
WEST KNOXVILLE
Cumberland Estates Park
Victor Ashe Park
Buck Toms Park
John Tarleton Park
Safety City Park
Tyson Park
Third Creek Greenway Park
University of Tennessee Gardens
First Creek Park
Worlds Fair Park
Fort Dickerson Park
River Bluff Wildlife Area
High Ground Park
Mary Vestal Park
West Hills Ang Byron Park
Walker Springs Park
Luxmore Drive Natural Area
Rocky Hill Ballfields
Ten Mile Creek Greenway Park
N CENTRAL ST
N BROADWAY
E MAGNOLIA AVE
N HALL OF FAME DR
W FIFTH AVE
BEAUMONT AVE
COLLEGE ST
KEITH AVE
GLENN AVE
PROCTOR ST
SANDERSON RD
MIDDLEBROOK PIKE
WESTERN AVE
AILOR AVE
LIBERTY ST
DIVISION ST
SUTHERLAND AVE
ALCOA HWY
LOCUST ST
MAIN ST
S GAY ST
KNOTT RD
THIRD CREEK RD
ED SHOUSE DR
MIDPARK RD
NORTH MIDDLEBROOK PIKE
SOUTH MIDDLEBROOK PIKE
LONAS DR
PAPERMILL DR
AMHERST RD
DICK LONAS RD
DOWELL SPRINGS BLVD
EAST WEISGARBER RD
OLD WEISGARBER RD
WESLEY RD
WEST HILLS RD
SHEFFIELD DR
VANOSDALE RD
BENNINGTON DR
FRANCIS RD
PINEY GROVE CHURCH RD
ROBINSON RD
BROOME RD
CORTELAND DR
N GALLAHER VIEW RD
WALKER SPRINGS RD
RAY MEARS BLVD
S GALLAHER VIEW RD
EBENEZER RD
S PETERS RD
KINGSTON PIKE
N PETERS RD
N CEDAR BLUFF RD
DUTCHTOWN RD
FOX LONAS RD
Catholic HS
TEN MILE RD
CROSS PARK DR
WALBROOK DR
BRIDGEDALE DR
SHERRILL BLVD
PARKWEST BLVD
Parkwest Medical Center
Cedar Bluff Branch Library
Social Security Administration
Walmart
Sam's Club
Windsor Square
Market Place Center
Kroger
CHRISTIAN ACADEMY BLVD
PARK VILLAGE RD
Cedar Bluff Post Office
BRIDGEWATER RD
WALKER SPRINGS RD
EXECUTIVE PARK DR
PARK WEST BLVD
MARKET PLACE BLVD
N SEVEN OAKS DR
PARKSIDE DR
Transfer to Rte. 11
0
0.25
0.5
Miles

APPENDIX C

ZONING MAP

Zoning Map

8.22.24

Knoxville - Knox County - KUB Geographic Information System

Printed: 8/22/2024 at 4:46:36 PM

0 250 500 1,000

ft

APPENDIX D

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: S Northshore Drive (WB and EB)
Minor Street: Harvey Road (SB and NB)
Traffic Control: 4-Way Stop

8/22/2024 (Thursday)
Mostly Sunny and Warm
Conducted by: Ajax Engineering

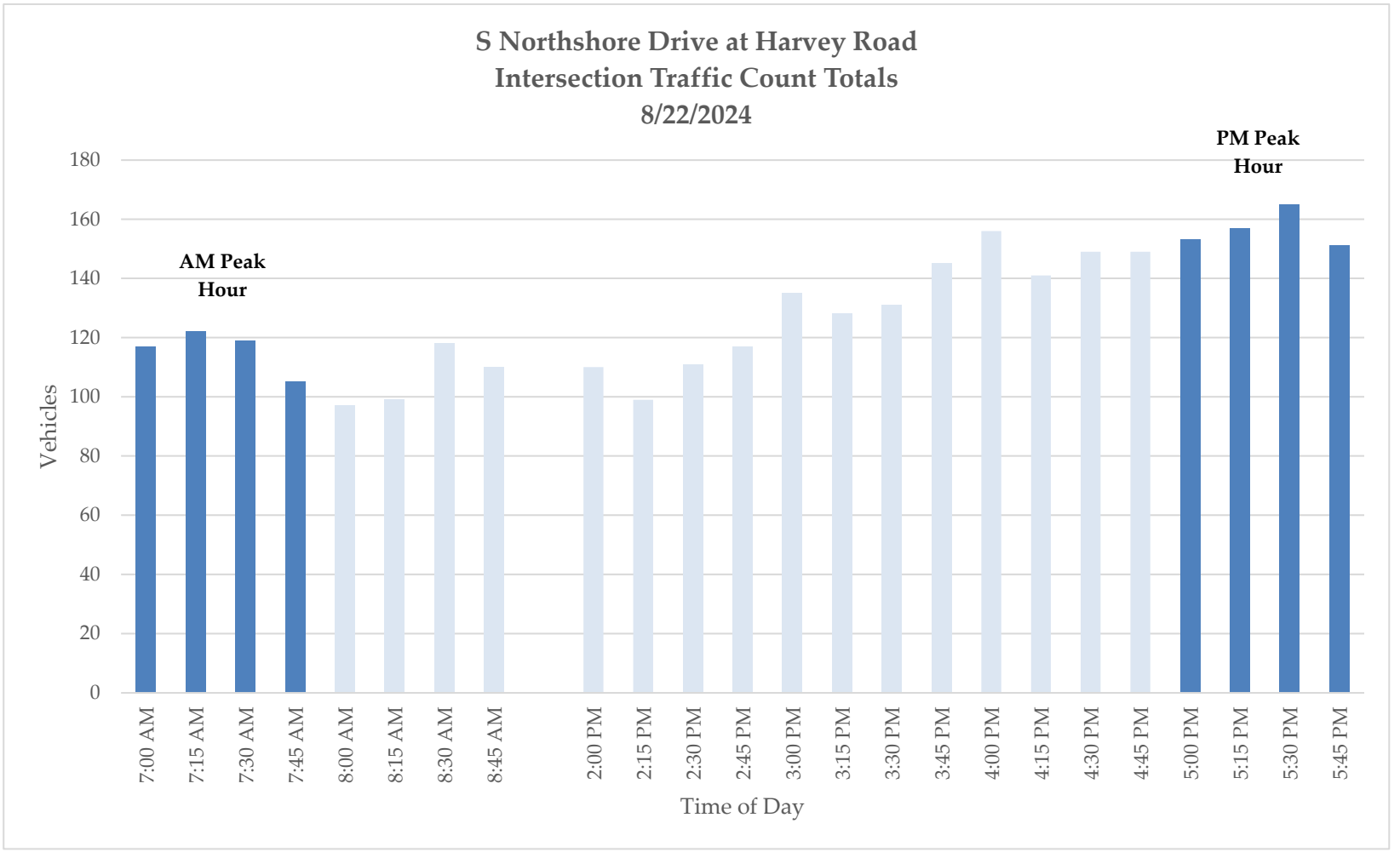
	Harvey Road			S Northshore Drive			Harvey Road			S Northshore Drive				
TIME	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND			VEHICLE	PEAK
BEGIN	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT	TOTAL	HOUR
7:00 AM	13	1	2	5	5	0	3	8	42	2	36	0	117	**7:00 AM - 8:00 AM**
7:15 AM	10	4	1	10	11	1	3	12	39	3	27	1	122	
7:30 AM	6	2	1	8	9	1	4	13	42	5	28	0	119	
7:45 AM	6	1	1	14	15	3	1	11	34	7	11	1	105	
8:00 AM	4	6	3	19	13	5	1	0	18	2	24	2	97	
8:15 AM	8	4	1	12	11	1	1	5	27	1	26	2	99	
8:30 AM	4	2	1	20	17	3	1	4	32	4	29	1	118	
8:45 AM	6	1	2	16	13	1	2	8	27	4	26	4	110	
TOTAL	57	21	12	104	94	15	16	61	261	28	207	11	887	
2:00 PM	6	5	3	23	22	3	3	2	20	2	19	2	110	
2:15 PM	1	7	4	17	14	4	2	1	23	4	19	3	99	
2:30 PM	3	7	0	25	23	4	2	2	21	1	19	4	111	
2:45 PM	4	1	4	20	26	6	3	5	23	3	20	2	117	
3:00 PM	8	8	5	28	32	5	1	6	20	3	19	0	135	
3:15 PM	6	7	3	25	20	9	2	4	18	4	26	4	128	
3:30 PM	7	6	1	28	23	4	0	2	31	1	26	2	131	
3:45 PM	3	8	6	39	26	4	4	3	20	6	24	2	145	
4:00 PM	2	8	4	25	44	5	1	5	21	4	34	3	156	
4:15 PM	3	5	8	34	25	8	4	8	19	4	18	5	141	
4:30 PM	7	9	5	25	33	5	2	4	26	5	25	3	149	
4:45 PM	6	13	5	22	33	9	4	5	28	4	14	6	149	
5:00 PM	5	6	12	31	36	8	2	6	24	4	19	0	153	**5:00 PM - 6:00 PM**
5:15 PM	10	4	3	32	30	11	1	4	24	4	30	4	157	
5:30 PM	7	9	10	29	38	5	5	7	21	7	25	2	165	
5:45 PM	5	6	2	38	40	5	3	4	24	2	15	7	151	
TOTAL	83	109	75	441	465	95	39	68	363	58	352	49	2197	

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

	Harvey Road			S Northshore Drive			Harvey Road			S Northshore Drive		
TIME	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND		
BEGIN	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT
7:00 AM	13	1	2	5	5	0	3	8	42	**2**	**36**	**0**
7:15 AM	10	4	1	10	11	1	3	12	39	**3**	**27**	**1**
7:30 AM	6	2	1	8	9	1	4	13	42	**5**	**28**	**0**
7:45 AM	6	1	1	14	15	3	1	11	34	**7**	**11**	**1**
TOTAL	**35**	**8**	**5**	**37**	**40**	**5**	**11**	**44**	**157**	**17**	**102**	**2**
TRUCK %	**0.0%**	**0.0%**	**20.0%**	**2.7%**	**0.0%**	**0.0%**	**0.0%**	**2.3%**	**0.6%**	**0.0%**	**1.0%**	**0.0%**
PHF $_{mvmt}$	**0.67**	**0.50**	**0.63**	**0.66**	**0.67**	**0.42**	**0.69**	**0.85**	**0.93**	**0.61**	**0.71**	**0.50**
PHF $_{app}$	**0.75**			**0.64**			**0.90**			**0.80**		
PHF $_{int}$	**0.95**											

2024 PM Peak Hour **5:00 PM - 6:00 PM**

	Harvey Road			S Northshore Drive			Harvey Road			S Northshore Drive		
TIME	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND		
BEGIN	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT
5:00 PM	5	6	12	31	36	8	2	6	24	4	19	0
5:15 PM	10	4	3	32	30	11	1	4	24	4	30	4
5:30 PM	7	9	10	29	38	5	5	7	21	7	25	2
5:45 PM	5	6	2	38	40	5	3	4	24	2	15	7
TOTAL	**27**	**25**	**27**	**130**	**144**	**29**	**11**	**21**	**93**	**17**	**89**	**13**
TRUCK %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.7%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
PHF $_{mvmt}$	**0.68**	**0.69**	**0.56**	**0.86**	**0.90**	**0.66**	**0.55**	**0.75**	**0.97**	**0.61**	**0.74**	**0.46**
PHF $_{app}$	**0.76**			**0.91**			**0.95**			**0.78**		
PHF $_{int}$	**0.95**											


S Northshore Drive at Harvey Road
Intersection Traffic Count Totals
8/22/2024
PM Peak Hour
AM Peak Hour
180
160
140
120
100
80
60
40
20
0
Vehicles
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
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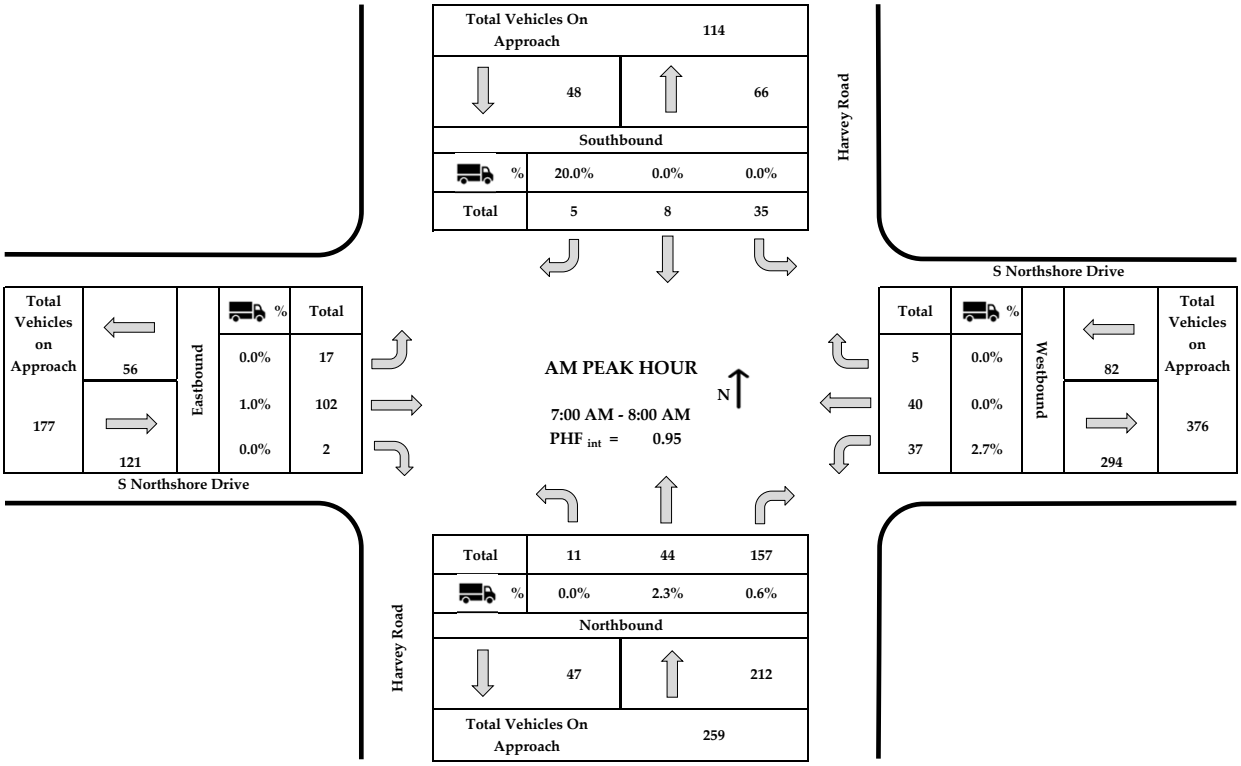
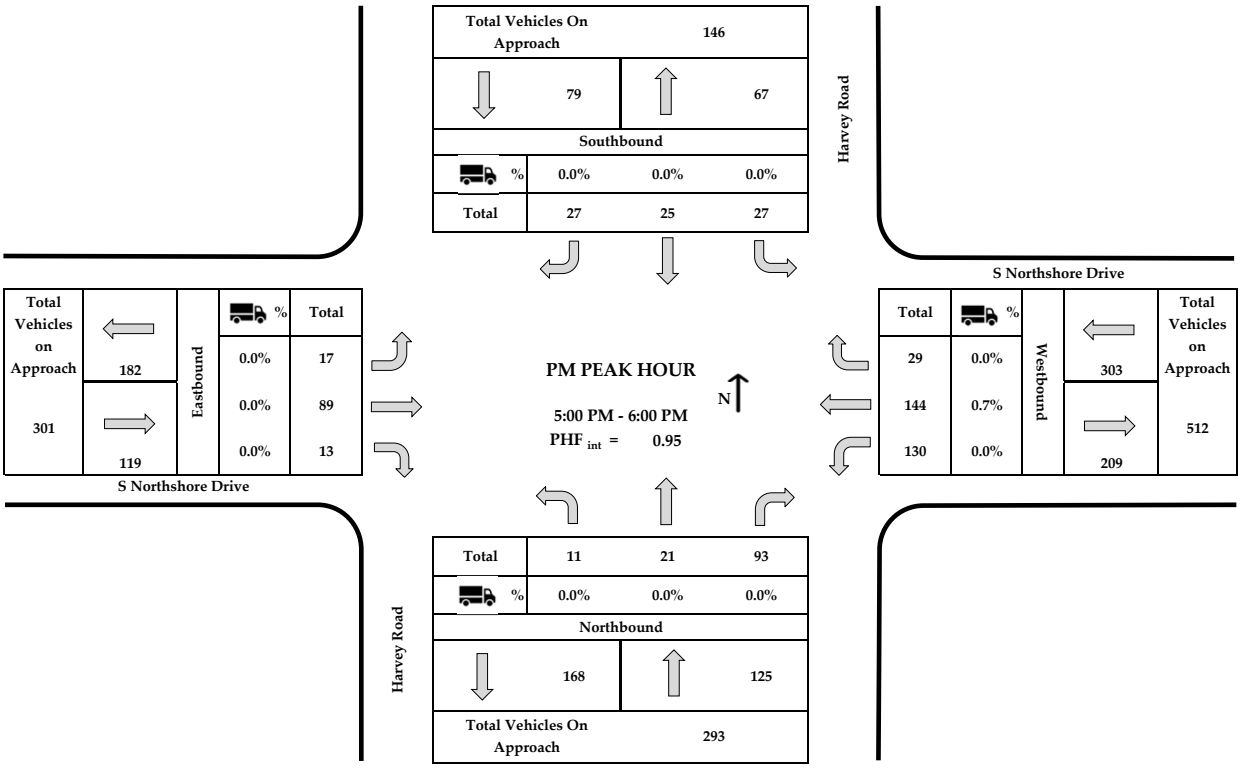
3:30 PM
3:45 PM
4:00 PM
4:15 PM
4:30 PM
4:45 PM
5:00 PM
5:15 PM
5:30 PM
5:45 PM
Time of Day

PEAK HOUR DATA

Major Street: S Northshore Drive (WB and EB)
Minor Street: Harvey Road (SB and NB)
Traffic Control: 4-Way Stop

8/22/2024 (Thursday)
Mostly Sunny and Warm
Conducted by: Ajax Engineering





TRAFFIC COUNT DATA

Major Street: S Northshore Drive (EB and WB)
Minor Street: Falcon Pointe Drive (NB)
Traffic Control: Stop Sign on Falcon Pointe Drive

8/22/2024 (Thursday)
Mostly Sunny and Warm
Conducted by: Ajax Engineering

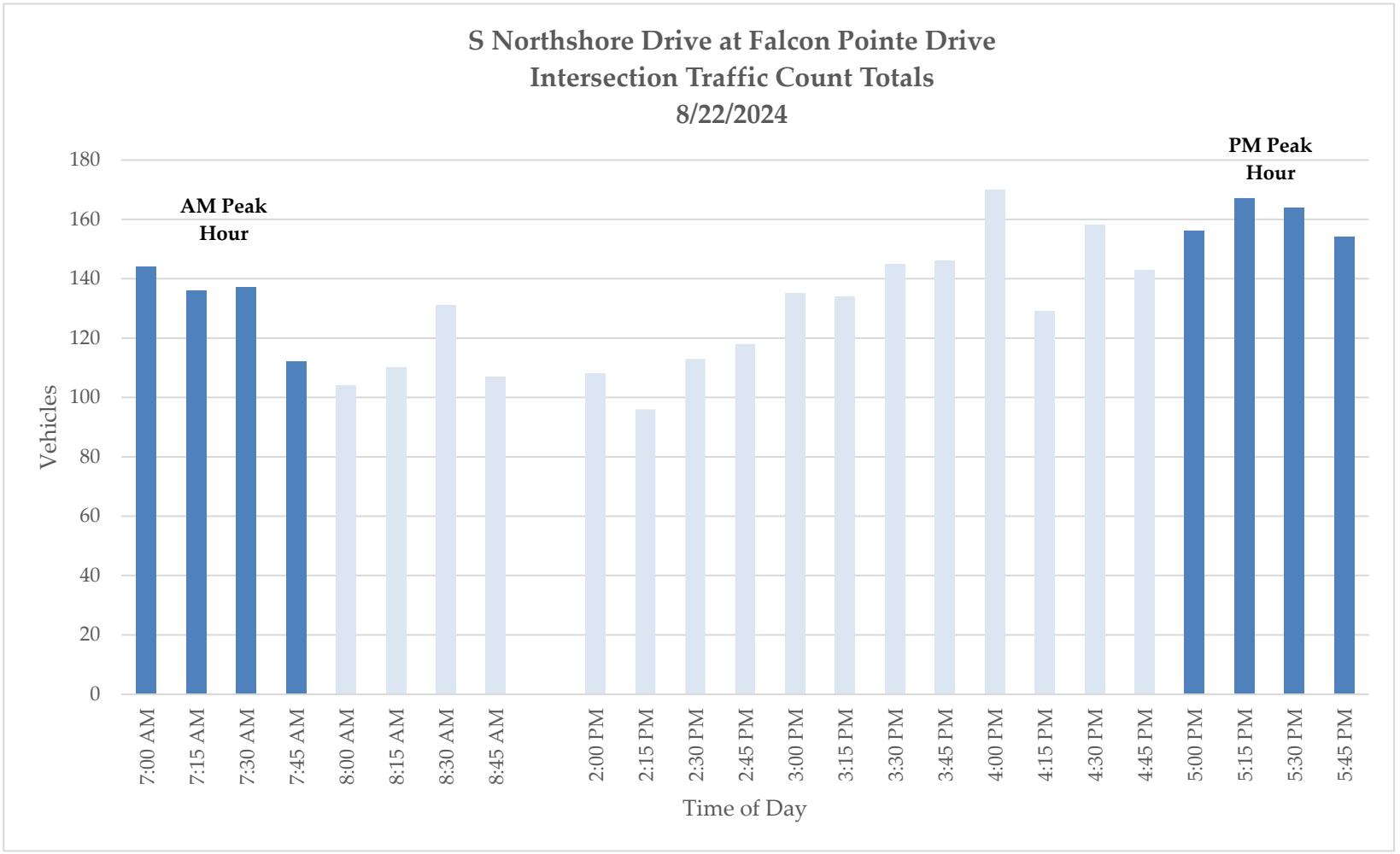
	S Northshore Drive		Falcon Pointe Drive		S Northshore Drive			
TIME	WESTBOUND		NORTHBOUND		EASTBOUND		VEHICLE	PEAK
BEGIN	LT	THRU	LT	RT	THRU	RT	TOTAL	HOUR
7:00 AM	1	11	0	41	91	0	144	**7:00 AM - 8:00 AM**
7:15 AM	5	17	4	33	77	0	136	
7:30 AM	4	18	0	36	79	0	137	
7:45 AM	11	32	0	17	51	1	112	
8:00 AM	11	35	1	13	44	0	104	
8:15 AM	16	23	2	11	58	0	110	
8:30 AM	12	36	1	14	68	0	131	
8:45 AM	7	31	0	11	57	1	107	
TOTAL	67	203	8	176	525	2	981	
2:00 PM	8	46	0	9	45	0	108	
2:15 PM	9	33	1	8	45	0	96	
2:30 PM	10	53	1	8	40	1	113	
2:45 PM	10	48	1	13	46	0	118	
3:00 PM	11	65	1	11	45	2	135	
3:15 PM	16	56	0	11	51	0	134	
3:30 PM	13	55	1	9	65	2	145	
3:45 PM	24	69	0	10	42	1	146	
4:00 PM	23	73	1	17	55	1	170	
4:15 PM	14	66	0	8	37	4	129	
4:30 PM	13	64	3	19	56	3	158	
4:45 PM	18	64	0	16	44	1	143	
5:00 PM	20	71	4	13	47	1	156	**5:00 PM - 6:00 PM**
5:15 PM	16	71	0	15	64	1	167	
5:30 PM	23	70	2	16	50	3	164	
5:45 PM	11	85	0	12	45	1	154	
TOTAL	239	989	15	195	777	21	2236	

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

	S Northshore Drive		Falcon Pointe Drive		S Northshore Drive	
TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
7:00 AM	1	11	0	41	91	0
7:15 AM	5	17	4	33	77	0
7:30 AM	4	18	0	36	79	0
7:45 AM	11	32	0	17	51	1
TOTAL	**21**	**78**	**4**	**127**	**298**	**1**
Truck %	**4.8%**	**3.8%**	**0.0%**	**0.8%**	**0.7%**	**0.0%**
PHF $_{mvmt}$	**0.48**	**0.61**	**0.25**	**0.77**	**0.82**	**0.25**
PHF $_{app}$	**0.58**		**0.80**		**0.82**	
PHF $_{int}$	**0.92**					

2024 PM Peak Hour **5:00 PM - 6:00 PM**

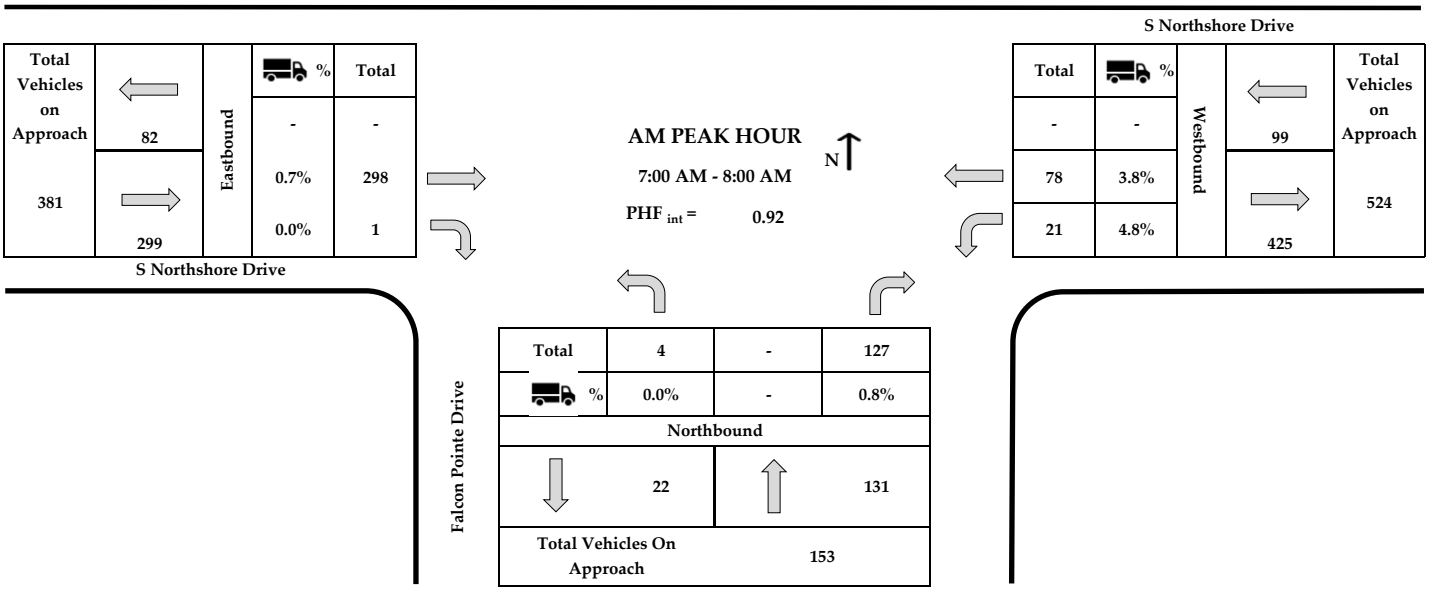
	S Northshore Drive		Falcon Pointe Drive		S Northshore Drive	
TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
5:00 PM	20	71	4	13	47	1
5:15 PM	16	71	0	15	64	1
5:30 PM	23	70	2	16	50	3
5:45 PM	11	85	0	12	45	1
TOTAL	**70**	**297**	**6**	**56**	**206**	**6**
Truck %	**0.0%**	**0.3%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
PHF $_{mvmt}$	**0.76**	**0.87**	**0.38**	**0.88**	**0.80**	**0.50**
PHF $_{app}$	**0.96**		**0.86**		**0.82**	
PHF $_{int}$	**0.96**					

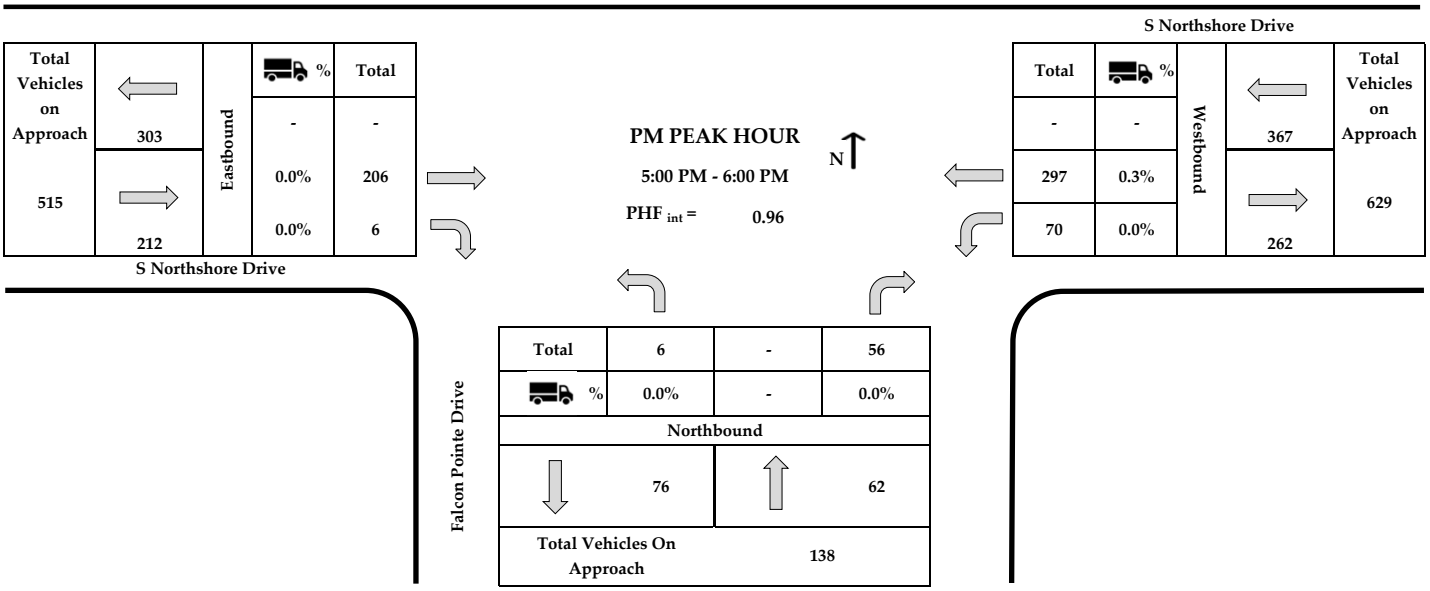

S Northshore Drive at Falcon Pointe Drive
Intersection Traffic Count Totals
8/22/2024
AM Peak Hour
PM Peak Hour
Vehicles
180
160
140
120
100
80
60
40
20
0
7:00 AM
7:15 AM
7:30 AM
7:45 AM
8:00 AM
8:15 AM
8:30 AM
8:45 AM
2:00 PM
2:15 PM
2:30 PM
2:45 PM
3:00 PM
3:15 PM
3:30 PM
3:45 PM
4:00 PM
4:15 PM
4:30 PM
4:45 PM
5:00 PM
5:15 PM
5:30 PM
5:45 PM
Time of Day

PEAK HOUR DATA

Major Street: S Northshore Drive (EB and WB)
Minor Street: Falcon Pointe Drive (NB)
Traffic Control: Stop Sign on Falcon Pointe Drive

8/22/2024 (Thursday)
Mostly Sunny and Warm
Conducted by: Ajax Engineering





APPENDIX E

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 12)

EXISTING CONDITIONS

Intersection	
Int Delay, s/veh	3.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	298	1	21	78	4	127
Future Vol, veh/h	298	1	21	78	4	127
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, %	0	-	-	0	0	-
Peak Hour Factor	82	82	58	58	80	80
Heavy Vehicles, %	1	0	5	4	0	1
Mvmt Flow	363	1	36	134	5	159

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	365	0	571	364
Stage 1	-	-	-	-	364	-
Stage 2	-	-	-	-	207	-
Critical Hdwy	-	-	4.15	-	6.4	6.21
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.245	-	3.5	3.309
Pot Cap-1 Maneuver	-	-	1178	-	486	683
Stage 1	-	-	-	-	707	-
Stage 2	-	-	-	-	833	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1178	-	470	683
Mov Cap-2 Maneuver	-	-	-	-	470	-
Stage 1	-	-	-	-	707	-
Stage 2	-	-	-	-	805	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.73	12.05
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	674	-	-	382	-
HCM Lane V/C Ratio	0.243	-	-	0.031	-
HCM Control Delay (s/veh)	12	-	-	8.2	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.9	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	8.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	17	102	2	37	40	5	11	44	157	35	8	5
Future Vol, veh/h	17	102	2	37	40	5	11	44	157	35	8	5
Peak Hour Factor	0.80	0.80	0.80	0.64	0.64	0.64	0.90	0.90	0.90	0.75	0.75	0.75
Heavy Vehicles, %	0	1	0	3	0	0	0	2	1	0	0	20
Mvmt Flow	21	128	3	58	63	8	12	49	174	47	11	7
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	9	8.9	8.9	8.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	5%	14%	45%	73%
Vol Thru, %	21%	84%	49%	17%
Vol Right, %	74%	2%	6%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	212	121	82	48
LT Vol	11	17	37	35
Through Vol	44	102	40	8
RT Vol	157	2	5	5
Lane Flow Rate	236	151	128	64
Geometry Grp	1	1	1	1
Degree of Util (X)	0.276	0.199	0.173	0.088
Departure Headway (Hd)	4.224	4.743	4.856	4.926
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	848	753	735	725
Service Time	2.259	2.791	2.904	2.973
HCM Lane V/C Ratio	0.278	0.201	0.174	0.088
HCM Control Delay, s/veh	8.9	9	8.9	8.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.1	0.7	0.6	0.3

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	206	6	70	297	6	56
Future Vol, veh/h	206	6	70	297	6	56
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, %	0	-	-	0	0	-
Peak Hour Factor	82	82	96	96	86	86
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	251	7	73	309	7	65

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	259	0	710	255
Stage 1	-	-	-	-	255	-
Stage 2	-	-	-	-	455	-
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	-	-	1318	-	403	789
Stage 1	-	-	-	-	792	-
Stage 2	-	-	-	-	643	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1318	-	376	789
Mov Cap-2 Maneuver	-	-	-	-	376	-
Stage 1	-	-	-	-	792	-
Stage 2	-	-	-	-	600	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.51	10.62
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	713	-	-	343	-
HCM Lane V/C Ratio	0.101	-	-	0.055	-
HCM Control Delay (s/veh)	10.6	-	-	7.9	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.2	-

Intersection	
Intersection Delay, s/veh	10.1
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	17	89	13	130	144	29	11	21	93	27	25	27
Future Vol, veh/h	17	89	13	130	144	29	11	21	93	27	25	27
Peak Hour Factor	0.78	0.78	0.78	0.91	0.91	0.91	0.95	0.95	0.95	0.76	0.76	0.76
Heavy Vehicles, %	0	0	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	22	114	17	143	158	32	12	22	98	36	33	36
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	9.2	11.3	8.8	9
HCM LOS	A	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	9%	14%	43%	34%
Vol Thru, %	17%	75%	48%	32%
Vol Right, %	74%	11%	10%	34%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	125	119	303	79
LT Vol	11	17	130	27
Through Vol	21	89	144	25
RT Vol	93	13	29	27
Lane Flow Rate	132	153	333	104
Geometry Grp	1	1	1	1
Degree of Util (X)	0.174	0.205	0.433	0.147
Departure Headway (Hd)	4.755	4.833	4.682	5.078
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	747	735	762	700
Service Time	2.831	2.906	2.745	3.159
HCM Lane V/C Ratio	0.177	0.208	0.437	0.149
HCM Control Delay, s/veh	8.8	9.2	11.3	9
HCM Lane LOS	A	A	B	A
HCM 95th-tile Q	0.6	0.8	2.2	0.5

PROJECTED CONDITIONS WITHOUT THE PROJECT

Intersection	
Int Delay, s/veh	3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	358	1	21	94	4	127
Future Vol, veh/h	358	1	21	94	4	127
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, %	0	-	-	0	0	-
Peak Hour Factor	82	82	58	58	80	80
Heavy Vehicles, %	1	0	5	4	0	1
Mvmt Flow	437	1	36	162	5	159

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	438	0	672	437
Stage 1	-	-	-	-	437	-
Stage 2	-	-	-	-	234	-
Critical Hdwy	-	-	4.15	-	6.4	6.21
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.245	-	3.5	3.309
Pot Cap-1 Maneuver	-	-	1106	-	424	621
Stage 1	-	-	-	-	655	-
Stage 2	-	-	-	-	809	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1106	-	409	621
Mov Cap-2 Maneuver	-	-	-	-	409	-
Stage 1	-	-	-	-	655	-
Stage 2	-	-	-	-	780	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.53	13.02
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	612	-	-	329	-
HCM Lane V/C Ratio	0.268	-	-	0.033	-
HCM Control Delay (s/veh)	13	-	-	8.4	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	1.1	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	122	2	44	48	6	13	53	188	42	10	6
Future Vol, veh/h	20	122	2	44	48	6	13	53	188	42	10	6
Peak Hour Factor	0.80	0.80	0.80	0.64	0.64	0.64	0.90	0.90	0.90	0.75	0.75	0.75
Heavy Vehicles, %	0	1	0	3	0	0	0	2	1	0	0	20
Mvmt Flow	25	153	3	69	75	9	14	59	209	56	13	8
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	9.7	9.5	9.8	8.9
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	5%	14%	45%	72%
Vol Thru, %	21%	85%	49%	17%
Vol Right, %	74%	1%	6%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	254	144	98	58
LT Vol	13	20	44	42
Through Vol	53	122	48	10
RT Vol	188	2	6	6
Lane Flow Rate	282	180	153	77
Geometry Grp	1	1	1	1
Degree of Util (X)	0.344	0.247	0.215	0.111
Departure Headway (Hd)	4.394	4.941	5.058	5.148
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	813	720	703	690
Service Time	2.451	3.015	3.134	3.226
HCM Lane V/C Ratio	0.347	0.25	0.218	0.112
HCM Control Delay, s/veh	9.8	9.7	9.5	8.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.5	1	0.8	0.4

Intersection	
Int Delay, s/veh	1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	247	6	70	356	6	56
Future Vol, veh/h	247	6	70	356	6	56
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, %	0	-	-	0	0	-
Peak Hour Factor	82	82	96	96	86	86
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	301	7	73	371	7	65

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	309	0	822	305
Stage 1	-	-	-	-	305	-
Stage 2	-	-	-	-	517	-
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	-	-	1263	-	347	740
Stage 1	-	-	-	-	752	-
Stage 2	-	-	-	-	603	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1263	-	321	740
Mov Cap-2 Maneuver	-	-	-	-	321	-
Stage 1	-	-	-	-	752	-
Stage 2	-	-	-	-	559	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.32	11.15
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	657	-	-	296	-
HCM Lane V/C Ratio	0.11	-	-	0.058	-
HCM Control Delay (s/veh)	11.2	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0.2	-

Intersection	
Intersection Delay, s/veh	11.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	107	16	156	173	35	13	25	112	32	30	32
Future Vol, veh/h	20	107	16	156	173	35	13	25	112	32	30	32
Peak Hour Factor	0.78	0.78	0.78	0.91	0.91	0.91	0.95	0.95	0.95	0.76	0.76	0.76
Heavy Vehicles, %	0	0	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	26	137	21	171	190	38	14	26	118	42	39	42
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.1	14	9.7	9.9
HCM LOS	B	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	9%	14%	43%	34%
Vol Thru, %	17%	75%	48%	32%
Vol Right, %	75%	11%	10%	34%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	150	143	364	94
LT Vol	13	20	156	32
Through Vol	25	107	173	30
RT Vol	112	16	35	32
Lane Flow Rate	158	183	400	124
Geometry Grp	1	1	1	1
Degree of Util (X)	0.227	0.265	0.555	0.19
Departure Headway (Hd)	5.177	5.198	4.996	5.525
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	692	691	728	648
Service Time	3.221	3.234	2.996	3.569
HCM Lane V/C Ratio	0.228	0.265	0.549	0.191
HCM Control Delay, s/veh	9.7	10.1	14	9.9
HCM Lane LOS	A	B	B	A
HCM 95th-tile Q	0.9	1.1	3.4	0.7

PROJECTED CONDITIONS WITH THE PROJECT

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	1	380	1	21	102	18	4	0	127	54	0	3
Future Vol, veh/h	1	380	1	21	102	18	4	0	127	54	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	58	58	58	80	80	80	90	90	90
Heavy Vehicles, %	0	1	0	5	4	0	0	0	1	0	0	0
Mvmt Flow	1	463	1	36	176	31	5	0	159	60	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	207	0	0	465	0	0	715	746	464	730	731	191
Stage 1	-	-	-	-	-	-	466	466	-	264	264	-
Stage 2	-	-	-	-	-	-	248	279	-	466	467	-
Critical Hdwy	4.1	-	-	4.15	-	-	7.1	6.5	6.21	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.245	-	-	3.5	4	3.309	3.5	4	3.3
Pot Cap-1 Maneuver	1376	-	-	1081	-	-	349	344	600	341	351	855
Stage 1	-	-	-	-	-	-	580	566	-	746	694	-
Stage 2	-	-	-	-	-	-	760	683	-	581	565	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1376	-	-	1081	-	-	334	331	600	241	337	855
Mov Cap-2 Maneuver	-	-	-	-	-	-	334	331	-	241	337	-
Stage 1	-	-	-	-	-	-	580	565	-	717	668	-
Stage 2	-	-	-	-	-	-	728	657	-	427	564	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.02	1.26	13.51	24.2
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	586	5	-	-	260	-	-	250
HCM Lane V/C Ratio	0.279	0.001	-	-	0.033	-	-	0.253
HCM Control Delay (s/veh)	13.5	7.6	0	-	8.4	0	-	24.2
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	1.1	0	-	-	0.1	-	-	1

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	129	2	44	53	12	13	53	190	56	10	8
Future Vol, veh/h	21	129	2	44	53	12	13	53	190	56	10	8
Peak Hour Factor	0.80	0.80	0.80	0.64	0.64	0.64	0.90	0.90	0.90	0.75	0.75	0.75
Heavy Vehicles, %	0	1	0	3	0	0	0	2	1	0	0	20
Mvmt Flow	26	161	3	69	83	19	14	59	211	75	13	11
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10	9.9	10.1	9.2
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	5%	14%	40%	76%
Vol Thru, %	21%	85%	49%	14%
Vol Right, %	74%	1%	11%	11%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	256	152	109	74
LT Vol	13	21	44	56
Through Vol	53	129	53	10
RT Vol	190	2	12	8
Lane Flow Rate	284	190	170	99
Geometry Grp	1	1	1	1
Degree of Util (X)	0.356	0.266	0.242	0.144
Departure Headway (Hd)	4.5	5.04	5.11	5.242
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	791	705	695	676
Service Time	2.572	3.131	3.204	3.336
HCM Lane V/C Ratio	0.359	0.27	0.245	0.146
HCM Control Delay, s/veh	10.1	10	9.9	9.2
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	1.6	1.1	0.9	0.5

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	5	83	0	2	59
Future Vol, veh/h	2	5	83	0	2	59
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	2	6	92	0	2	66

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	162	92	0	0	92	0
Stage 1	92	-	-	-	-	-
Stage 2	70	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	833	971	-	-	1515	-
Stage 1	936	-	-	-	-	-
Stage 2	958	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	832	971	-	-	1515	-
Mov Cap-2 Maneuver	832	-	-	-	-	-
Stage 1	936	-	-	-	-	-
Stage 2	956	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	8.92	0	0.24
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	926	59	-
HCM Lane V/C Ratio	-	-	0.008	0.001	-
HCM Control Delay (s/veh)	-	-	8.9	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	263	6	70	380	61	6	0	56	36	0	2
Future Vol, veh/h	2	263	6	70	380	61	6	0	56	36	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	96	96	96	86	86	86	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	2	321	7	73	396	64	7	0	65	40	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	459	0	0	328	0	0	871	934	324	899	906	428
Stage 1	-	-	-	-	-	-	329	329	-	573	573	-
Stage 2	-	-	-	-	-	-	542	605	-	326	333	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1112	-	-	1243	-	-	274	268	721	262	278	631
Stage 1	-	-	-	-	-	-	688	650	-	508	507	-
Stage 2	-	-	-	-	-	-	528	490	-	691	647	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1112	-	-	1243	-	-	250	246	721	219	255	631
Mov Cap-2 Maneuver	-	-	-	-	-	-	250	246	-	219	255	-
Stage 1	-	-	-	-	-	-	686	648	-	467	466	-
Stage 2	-	-	-	-	-	-	485	451	-	627	646	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.06	1.11	11.69	24.49
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	610	13	-	-	240	-	-	227
HCM Lane V/C Ratio	0.118	0.002	-	-	0.059	-	-	0.186
HCM Control Delay (s/veh)	11.7	8.2	0	-	8.1	0	-	24.5
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.4	0	-	-	0.2	-	-	0.7

Intersection	
Intersection Delay, s/veh	12.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	23	114	16	158	181	51	13	25	113	42	30	34
Future Vol, veh/h	23	114	16	158	181	51	13	25	113	42	30	34
Peak Hour Factor	0.78	0.78	0.78	0.91	0.91	0.91	0.95	0.95	0.95	0.76	0.76	0.76
Heavy Vehicles, %	0	0	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	29	146	21	174	199	56	14	26	119	55	39	45
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.6	15.4	10	10.3
HCM LOS	B	C	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	9%	15%	41%	40%
Vol Thru, %	17%	75%	46%	28%
Vol Right, %	75%	10%	13%	32%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	151	153	390	106
LT Vol	13	23	158	42
Through Vol	25	114	181	30
RT Vol	113	16	51	34
Lane Flow Rate	159	196	429	139
Geometry Grp	1	1	1	1
Degree of Util (X)	0.236	0.29	0.6	0.22
Departure Headway (Hd)	5.343	5.33	5.041	5.687
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	671	673	716	629
Service Time	3.39	3.374	3.074	3.737
HCM Lane V/C Ratio	0.237	0.291	0.599	0.221
HCM Control Delay, s/veh	10	10.6	15.4	10.3
HCM Lane LOS	A	B	C	B
HCM 95th-tile Q	0.9	1.2	4	0.8

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	3	82	2	7	97
Future Vol, veh/h	1	3	82	2	7	97
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	1	3	91	2	8	108

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	216	92	0	0	93	0
Stage 1	92	-	-	-	-	-
Stage 2	123	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	777	971	-	-	1514	-
Stage 1	936	-	-	-	-	-
Stage 2	907	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	773	971	-	-	1514	-
Mov Cap-2 Maneuver	773	-	-	-	-	-
Stage 1	936	-	-	-	-	-
Stage 2	902	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	8.97	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	912	121	-
HCM Lane V/C Ratio	-	-	0.005	0.005	-
HCM Control Delay (s/veh)	-	-	9	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

APPENDIX F

ITE TRIP GENERATION DATA

Land Use: 210
Single-Family Detached Housing

Description

A single-family detached housing site includes any single-family detached home on an individual lot. A typical site surveyed is a suburban subdivision.

Specialized Land Use

Data have been submitted for several single-family detached housing developments with homes that are commonly referred to as patio homes. A patio home is a detached housing unit that is located on a small lot with little (or no) front or back yard. In some subdivisions, communal maintenance of outside grounds is provided for the patio homes. The three patio home sites total 299 dwelling units with overall weighted average trip generation rates of 5.35 vehicle trips per dwelling unit for weekday, 0.26 for the AM adjacent street peak hour, and 0.47 for the PM adjacent street peak hour. These patio home rates based on a small sample of sites are lower than those for single-family detached housing (Land Use 210), lower than those for single-family attached housing (Land Use 251), and higher than those for senior adult housing -- single-family (Land Use 251). Further analysis of this housing type will be conducted in a future edition of *Trip Generation Manual*.

Additional Data

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website (https://www.ite.org/technical-resources/topics/trip-and-parking-generation/).

For 30 of the study sites, data on the number of residents and number of household vehicles are available. The overall averages for the 30 sites are 3.6 residents per dwelling unit and 1.5 vehicles per dwelling unit.

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

Source Numbers

100, 105, 114, 126, 157, 167, 177, 197, 207, 211, 217, 267, 275, 293, 300, 319, 320, 356, 357, 367, 384, 387, 407, 435, 522, 550, 552, 579, 598, 601, 603, 614, 637, 711, 716, 720, 728, 735, 868, 869, 903, 925, 936, 1005, 1007, 1008, 1010, 1033, 1066, 1077,1078, 1079

Single-Family Detached Housing
(210)

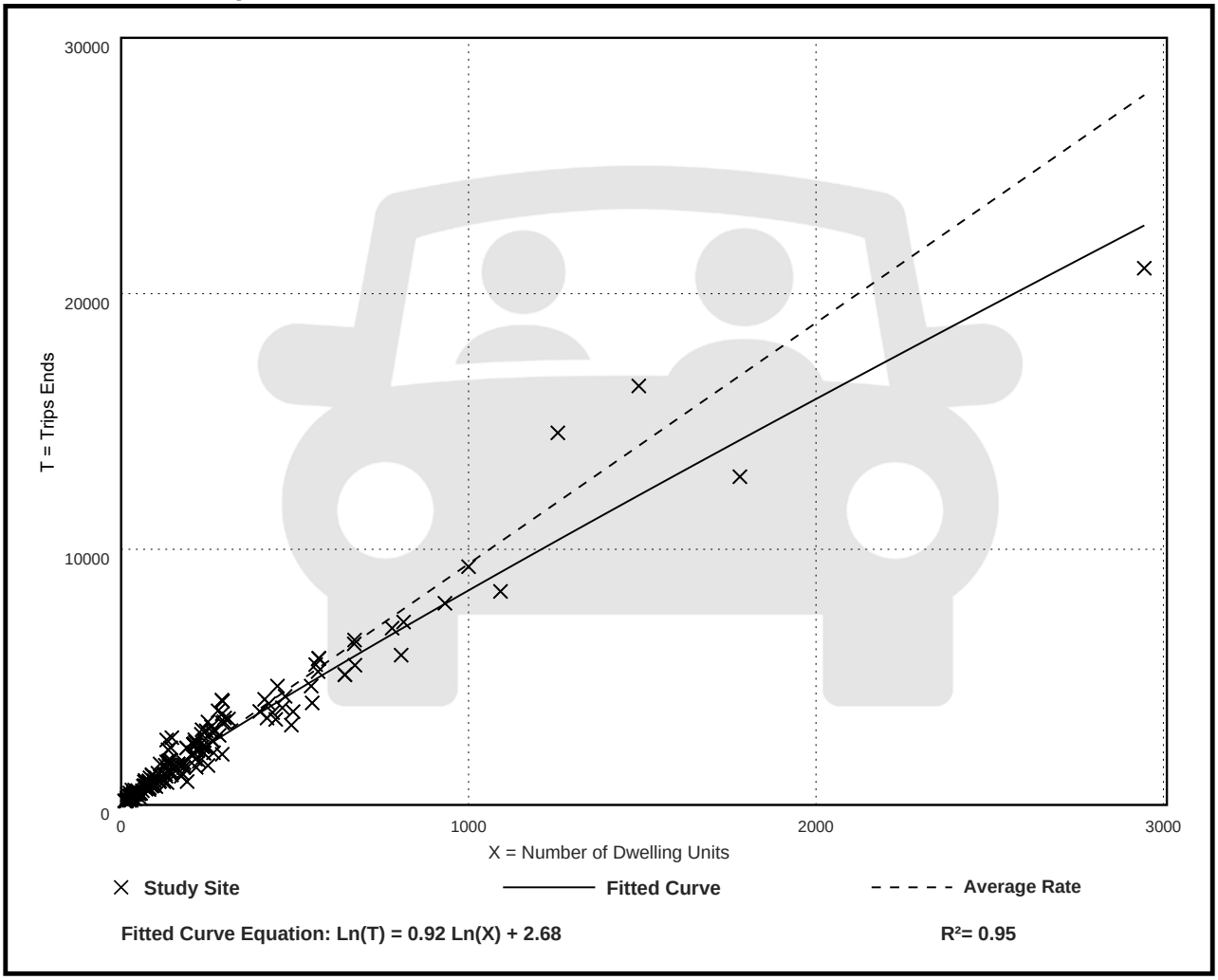
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 174
Avg. Num. of Dwelling Units: 246
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.43	4.45 - 22.61	2.13

Data Plot and Equation



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

R^2= 0.95

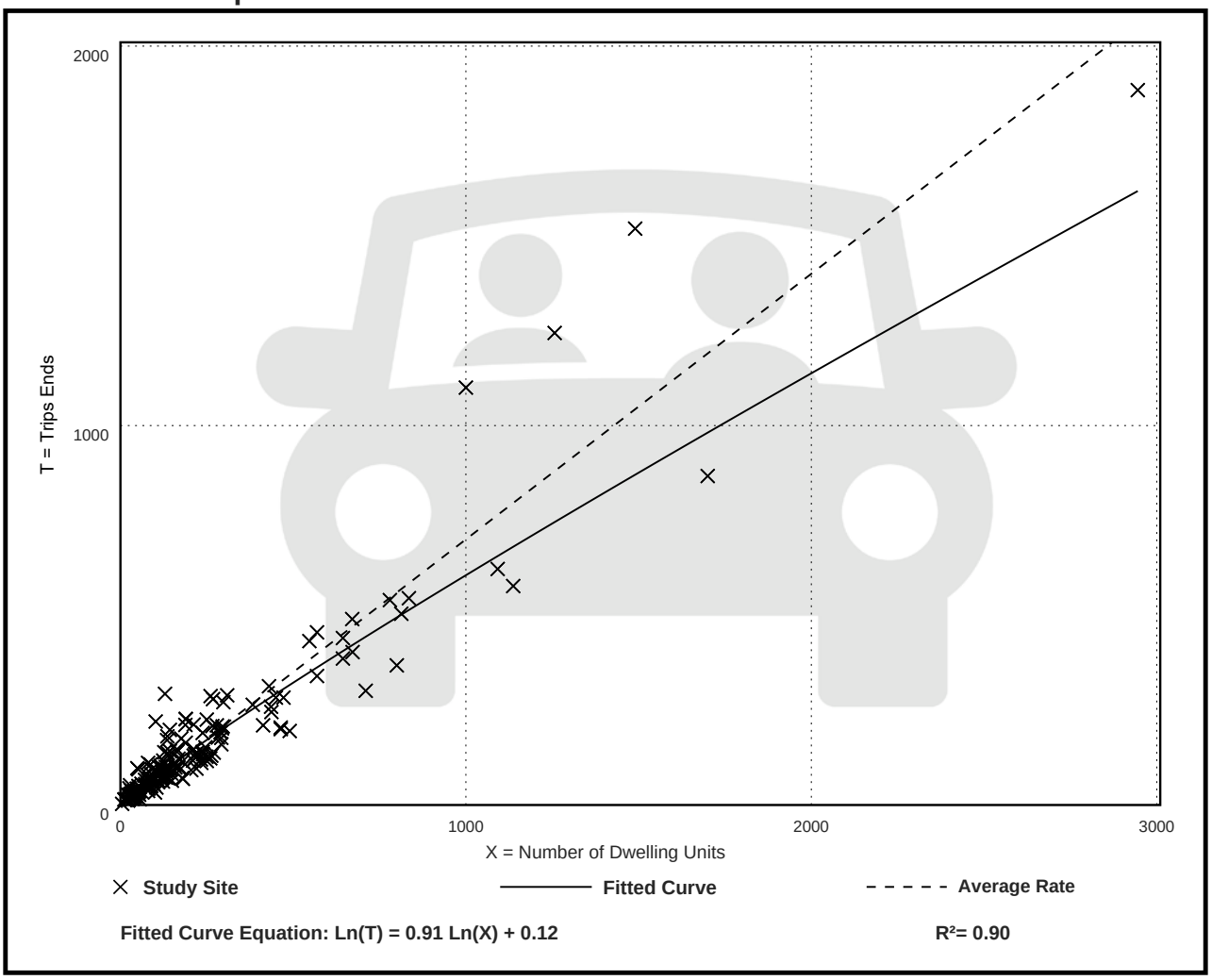
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
Number of Studies: 192
Avg. Num. of Dwelling Units: 226
Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.70	0.27 - 2.27	0.24

Data Plot and Equation



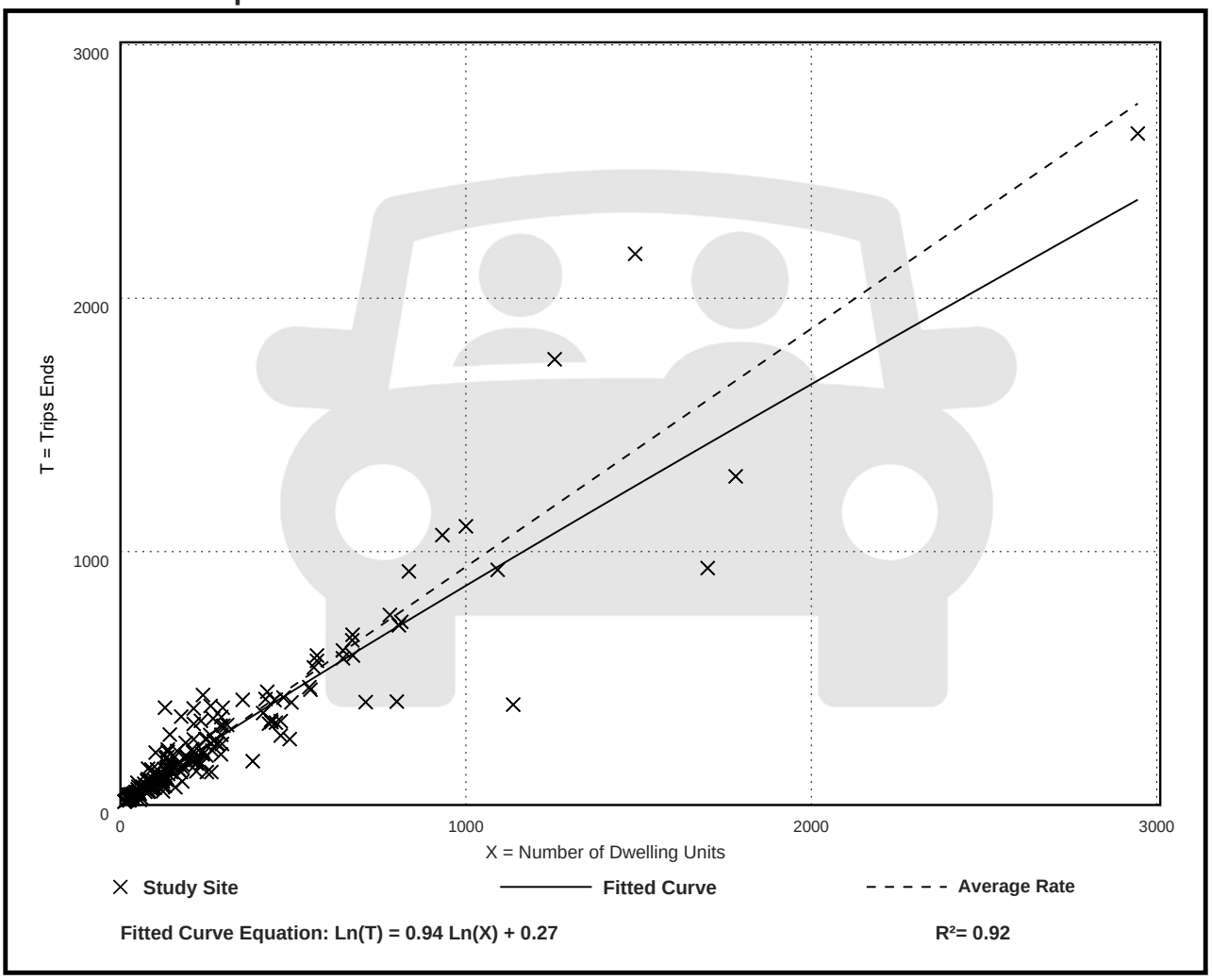
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
Number of Studies: 208
Avg. Num. of Dwelling Units: 248
Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.94	0.35 - 2.98	0.31

Data Plot and Equation



TRIP GENERATION FOR THE ENCLAVE AT HARVEY ROAD

Maximum of 116 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	116 Houses	1,157	25%	75%		63%	37%	
				21	64	85	72	42	114
Total New Volume Site Trips			**1,157**	**21**	**64**	**85**	**72**	**42**	**114**

ITE Trip Generation Manual, 11th Edition

Trips calculated by using Fitted Curve Equation

TRIP GENERATION FOR THE ENCLAVE AT HARVEY ROAD

Maximum of 116 Single-Family Detached Houses

116 Residential Houses = X

Weekday:

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

Ln(T) =	0.92	*	4.75	+	2.68
Ln(T) =	7.05				
T =	**1,157 trips**				

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T =	0.91	*	5	+	0.12
Ln(T) =	4.45				
T =	**85 trips**				

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

Ln(T) =	0.94	*	4.75	+	0.27
Ln(T) =	4.74				
T =	**114 trips**				

TRIP GENERATION FOR BODAK LLC ON NORTHSHORE DRIVE

14 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	14 Houses	165	25%	75%		63%	37%	
				3	9	12	10	6	16
Total New Volume Site Trips			**165**	**3**	**9**	**12**	**10**	**6**	**16**

ITE Trip Generation Manual, 11th Edition

Trips calculated by using Fitted Curve Equation

TRIP GENERATION FOR BODAK LLC ON NORTHSHORE DRIVE

14 Single-Family Detached Houses

14 Residential Houses = X

Weekday:

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

Ln(T) =	0.92	*	2.64	+	2.68
Ln(T) =	5.11				
T =	**165 trips**				

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T =	0.91	*	3	+	0.12
Ln(T) =	2.52				
T =	**12 trips**				

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

Ln(T) =	0.94	*	2.64	+	0.27
Ln(T) =	2.75				
T =	**16 trips**				

TRIP GENERATION FOR MESANA INVESTMENTS

27 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	27 Houses	303	25%	75%		63%	37%	
				6	17	23	18	11	29
Total New Volume Site Trips			**303**	**6**	**17**	**23**	**18**	**11**	**29**

ITE Trip Generation Manual, 11th Edition

Trips calculated by using Fitted Curve Equation

TRIP GENERATION FOR MESANA INVESTMENTS

27 Single-Family Detached Houses

27 Residential Houses = X

Weekday:

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

Ln(T) =	0.92	*	3.30	+	2.68
Ln(T) =	5.71				
T =	**303 trips**				

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T =	0.91	*	3	+	0.12
Ln(T) =	3.12				
T =	**23 trips**				

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

Ln(T) =	0.94	*	3.30	+	0.27
Ln(T) =	3.37				
T =	**29 trips**				

APPENDIX G

2021 CENSUS BUREAU DATA

United States Census Bureau OnTheMap

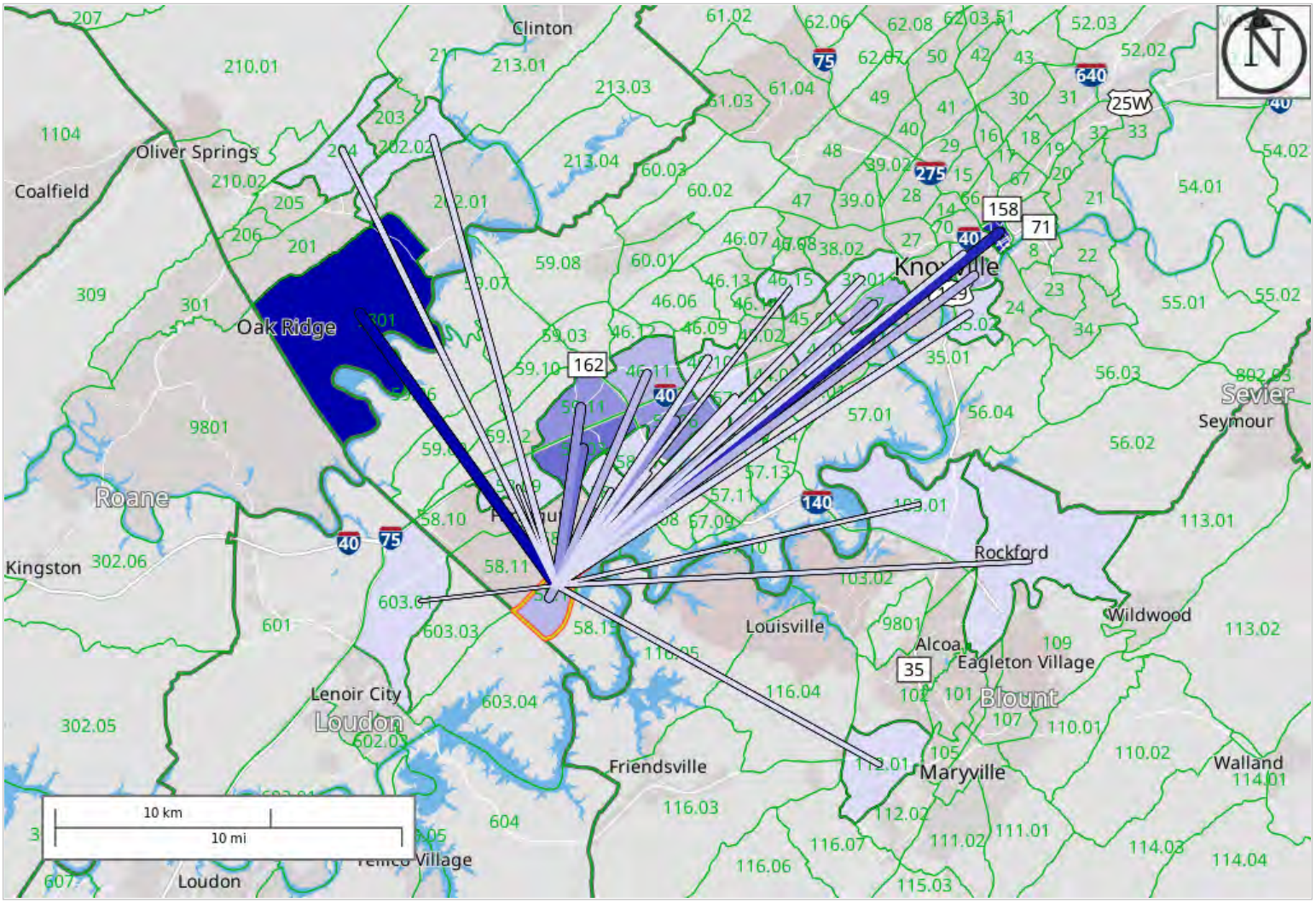
Destination Analysis

Workers: *Living in 58.14 (Knox, TN)*
Showing: *Employment locations grouped by Census Tracts*

Created by the U.S. Census Bureau's OnTheMap `https://onthemap.ces.census.gov` on 08/22/2024

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

All Workers



Map Legend

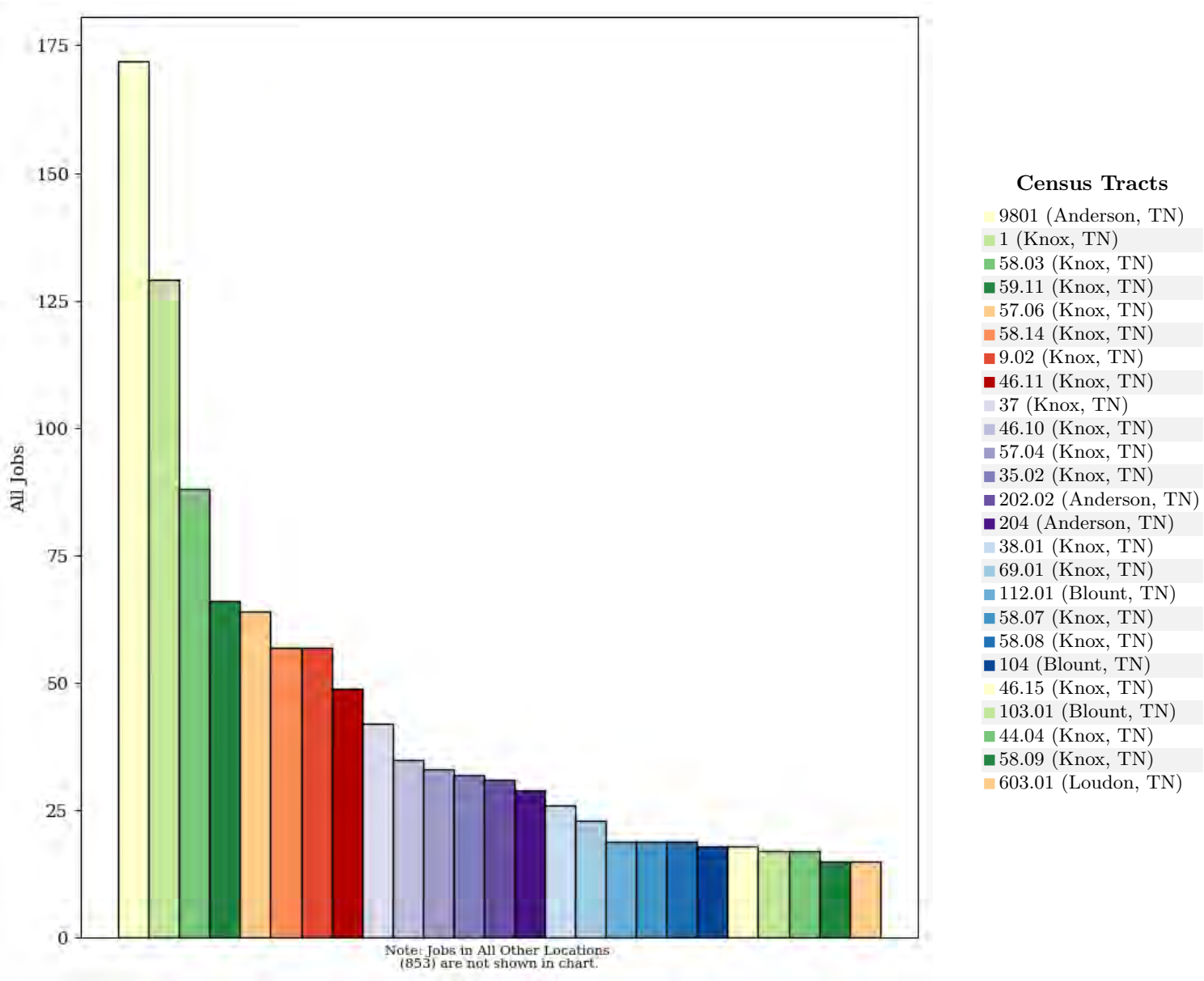
Job Count
- 150 - 172
- 128 - 149
- 105 - 127
- 83 - 104
- 60 - 82
- 38 - 59
- 15 - 37

Selection Areas
- Home Area

Job Count
- 150 - 172
- 128 - 149
- 105 - 127
- 83 - 104
- 60 - 82
- 38 - 59
- 15 - 37

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

All Workers



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

All Workers

Census Tracts as Work Destination Area	2021 Count	2021 Share
All Census Tracts	1,943	100.0%
9801 (Anderson, TN)	172	8.9%
1 (Knox, TN)	129	6.6%
58.03 (Knox, TN)	88	4.5%
59.11 (Knox, TN)	66	3.4%
57.06 (Knox, TN)	64	3.3%
58.14 (Knox, TN)	57	2.9%
9.02 (Knox, TN)	57	2.9%
46.11 (Knox, TN)	49	2.5%
37 (Knox, TN)	42	2.2%
46.10 (Knox, TN)	35	1.8%

Census Tracts as Work Destination Area	2021 Count	2021 Share
57.04 (Knox, TN)	33	1.7%
35.02 (Knox, TN)	32	1.6%
202.02 (Anderson, TN)	31	1.6%
204 (Anderson, TN)	29	1.5%
38.01 (Knox, TN)	26	1.3%
69.01 (Knox, TN)	23	1.2%
112.01 (Blount, TN)	19	1.0%
58.07 (Knox, TN)	19	1.0%
58.08 (Knox, TN)	19	1.0%
104 (Blount, TN)	18	0.9%
46.15 (Knox, TN)	18	0.9%
103.01 (Blount, TN)	17	0.9%
44.04 (Knox, TN)	17	0.9%
58.09 (Knox, TN)	15	0.8%
603.01 (Loudon, TN)	15	0.8%
All Other Locations	853	43.9%

Additional Information

Analysis Settings

Analysis Type	Destination
Destination Type	Census Tracts
Selection area as	Home
Year(s)	2021
Job Type	All Jobs
Selection Area	58.14 (Knox, TN) from Census Tracts
Selected Census Blocks	27
Analysis Generation Date	08/22/2024 16:10 - OnTheMap 6.24.1
Code Revision	bc639735180b6b7ade65403c2bedfe53b70b1e56
LODES Data Vintage	20231016_1512

Data Sources

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

Notes

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

APPENDIX H

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)

380 +1 = 381

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			60	55	45
350 - 399	100			55	50	40
400 - 449	90			50	45	35
450 - 499	80			45	40	30
500 - 549	70			35	35	25
550 - 599	65			35	30	25
600 - 649	60			30	25	25
650 - 699	55			30	25	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25	25	20	20

S Northshore Drive at Proposed South Entrance

2028 Projected AM EB Left Turns = 1

Left Turn Lane NOT Warranted

18+102+21 = 141

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

102 + 21 = 123

18

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 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 Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

S Northshore Drive at Proposed South Entrance

2028 Projected AM WB Right Turns = 18

Right Turn Lane NOT Warranted

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

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

TABLE 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)

263 +6 = 269

61+380+70 = 511

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

S Northshore Drive at Proposed South Entrance

2028 Projected PM EB Left Turns = 2

Left Turn Lane NOT Warranted

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	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 Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

380 + 70 = 450

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 61 50 - 99				Yes	Yes Yes	Yes Yes
100 - 149 150 - 199		Yes	Yes Yes	Yes 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

S Northshore Drive at Proposed South Entrance

2028 Projected PM WB Right Turns = 61

Right 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)

59

59

83

83 + 0 = 83

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

Harvey Road at
Proposed West Entrance

2028 Projected AM
SB Left Turns = 2

Left Turn Lane NOT
Warranted

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

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

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

83

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
0 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

Harvey Road at
Proposed West Entrance

2028 Projected AM
NB Right Turns = 0

Right Turn Lane NOT
Warranted

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

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

TABLE 4A

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

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

97

97

84

82 + 2 = 84

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

Harvey Road at
Proposed West Entrance

2028 Projected PM
SB Left Turns = 7

Left Turn Lane NOT
Warranted

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

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

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

82

2

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

Harvey Road at
Proposed West Entrance

2028 Projected PM
NB Right Turns = 2

Right Turn Lane NOT
Warranted

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

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

APPENDIX I

SIMTRAFFIC VEHICLE QUEUE WORKSHEETS

Intersection: 3: Falcon Pointe Drive/Proposed South Entrance & Northshore Drive

Movement	WB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	45	85	60
Average Queue (ft)	7	43	29
95th Queue (ft)	31	70	52
Link Distance (ft)	705	497	280
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: Harvey Road & Northshore Drive

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	69	48	99	60
Average Queue (ft)	36	18	50	31
95th Queue (ft)	56	34	82	50
Link Distance (ft)	523	1256	592	694
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 10: Harvey Road & Proposed West Entrance

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	31	6
Average Queue (ft)	5	0
95th Queue (ft)	24	4
Link Distance (ft)	286	84
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

Intersection: 3: Falcon Pointe Drive/Proposed South Entrance & Northshore Drive

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	10	79	54	53
Average Queue (ft)	0	18	30	23
95th Queue (ft)	6	57	51	48
Link Distance (ft)	1256	705	497	310
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Harvey Road & Northshore Drive

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	61	121	61	56
Average Queue (ft)	36	49	36	33
95th Queue (ft)	55	89	57	52
Link Distance (ft)	523	1256	592	693
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 10: Harvey Road & Proposed West Entrance

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	31	12
Average Queue (ft)	3	1
95th Queue (ft)	19	7
Link Distance (ft)	241	85
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

APPENDIX J

RESPONSE LETTER TO ADDRESS COMMENTS

AJAX ENGINEERING
CIVIL ENGINEERING / TRAFFIC ENGINEERING

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

October 28, 2024

PROJECT NAME: The Enclave at Harvey (11-SB-24-C / 11-B-24-DP)
TO: Knoxville-Knox County Planning
SUBJECT: Response Document for The Enclave at Harvey TIS Review Comments

Knoxville-Knox County Planning and Knox County Engineering Staff:

The following response document addresses the comments in a memorandum from Mike Conger, PE, dated October 21, 2024. This letter is added to the end of the revised report in Appendix J.

1) **The TIS includes multiple references to there being no existing sidewalks along S Northshore Drive however there is a section of sidewalk to the east of the development as well as some near the commercial area at Choto Rd – please update sections as necessary to reflect this.**

   Response: The original intent of the statement regarding the lack of sidewalks was to infer the roadway section adjacent to the proposed development site. However, the statement in the report does not reflect this intent. Thus, the discussion regarding sidewalks on S Northshore Drive was revised on Page 9. A revision is posted in Table 1 on Page 8 for S Northshore Drive. Pages 17, 18, and 19 also include a brief revision about sidewalks during the Strava maps, Walk Score, and transit discussions.

2) **Additionally, the TIS notes that internal sidewalks are not proposed for this subdivision however Knox County EPW will be requiring sidewalks both along the Northshore Dr frontage as well as internally as required by the Knox County Sidewalk Ordinance including due to there being provision of a new connection between classified streets – please update the TIS accordingly.**

   Response: An additional recommendation regarding the proposed sidewalks is included on Pages 4 and 57, and a discussion has been added on Pages 20-21 and 24.

3) **It is understood that warrants were not met for a westbound right turn lane at the development access on Northshore Dr, however Knox County EPW has requested**

consideration of a larger intersection radius at this location due to the higher posted speed and classification of Northshore Dr. Please review and provide recommendation for a greater than the standard 25' intersection radius at this location.

Response: A recommendation to increase this corner intersection radius to 35 feet has been added on Pages 3 and 53-54.

4) **Please include a turn lane warrant evaluation for both directions along Northshore Dr at the proposed access point, i.e. to include turn lanes for the existing Falcon Point Dr. It appears that a westbound left turn lane may be warranted based on a cursory review of the volumes. If that is the case please provide recommendations for potential mitigation and if alternate location for the development access may be desired.**

Response: An evaluation was conducted for a separate westbound left turn lane on S Northshore Drive at the intersection with Falcon Pointe Drive and the Proposed South Entrance. The results determined that this lane would be warranted in the projected 2028 conditions in the PM peak hour. Pages 1-2, 3, and 54 include a discussion and recommendation for constructing this lane. In addition, a proposal for also constructing an eastbound left-turn lane on S Northshore Drive is included.

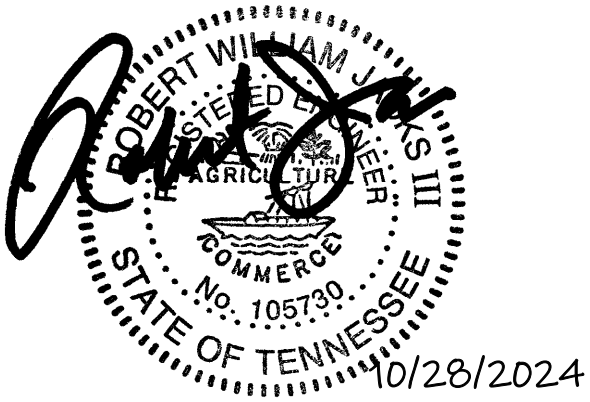
In addition to the revisions listed above, other changes in the report include the following:

- Updated Title Page
- Updated Table of Contents
- Updated Page Footers and Page Numbers
- General grammar and other improvements to the discussions
- Added additional left-turn lane warrant threshold sheets in Appendix H
- Added Appendix J to include this response letter

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

Sincerely,

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



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