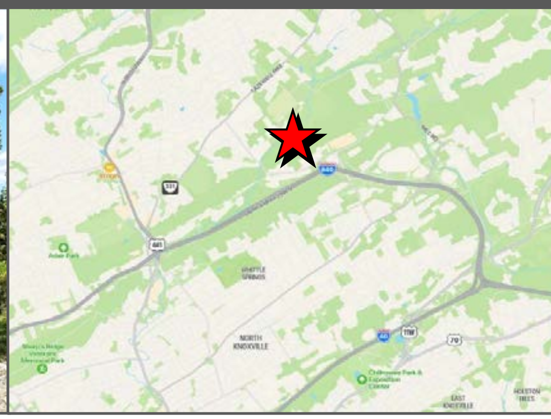
AJAX ENGINEERING

CIVIL ENGINEERING / TRAFFIC ENGINEERING

Transportation Impact Study
The Preserve at Whites Creek
Knox County, Tennessee



Revised November 2022

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EXECUTIVE SUMMARY

Preface:

Café International, LLC is proposing a residential development off Beverly Road just outside the City of Knoxville limits in Northeast Knox County, TN. The proposed development will include 120 single-family detached houses and 75 multi-family attached townhouses on 84.56 +/- acres and is referenced in this study as "The Preserve at Whites Creek". The development is anticipated to be fully built and occupied by 2027. The development proposes one entrance on Beverly Road, between Oakland Drive and Greenway Drive.

This study's primary purpose is to determine and evaluate the potential impacts of the development on the adjacent transportation system. The study includes a review of the primary access roads and intersections and is a Level 1 study established by Knoxville/Knox County Planning. Recommendations and mitigation measures are offered if transportation operations are projected to be below recognized engineering standards.

Study Results:

The significant findings of this study include the following:

- The Preserve at Whites Creek development, with a total of 120 single-family detached houses and 75 multi-family attached townhouses, is estimated to generate 1,930 trips at full build-out and occupancy on an average weekday. Of these daily trips, 129 are estimated to occur during the AM peak hour and 178 in the PM peak hour in 2027.
- The existing intersection of Tazewell Pike at Beverly Road currently operates with very high vehicle delays and long queues in the peak hours. The Beverly Road approach at this intersection currently experiences vehicle queue lengths in excess of 1,000 feet, encouraging cut-thru traffic on adjacent roadways.
- The intersection of the development's Proposed Entrance at Beverly Road is expected to operate with very reasonable vehicle delays in the projected AM and PM peak hours. The addition of the Proposed Entrance approach on Beverly Road will operate well in 2027 with respect to vehicle capacity.
- The projected 2027 traffic volumes do not warrant the construction of separate entering left and right-turn lanes on Beverly Road at the Proposed Entrance. A single exiting lane for the development entrance at Beverly Road will be sufficient.

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 transportation need and are not explicitly associated with the development's impacts in the projected conditions. More details regarding the recommendations are discussed at the end of the report.

- * It is highly recommended that the intersection of Tazewell Pike at Beverly Road be converted to a traffic signal as soon as feasible. In addition to installing a traffic signal, turn lanes on the approaches at the t-intersection will need to be constructed to remediate the vehicle delays and queues fully. Overall, the existing vehicle delays and queues are not acceptable and are projected to worsen in the future, even without The Preserve at Whites Creek development being constructed.
- * In the interim, before a traffic signal is installed at the intersection of Tazewell Pike at Beverly Road, to reduce the possibility of vehicles clipping each other at the intersection, it is recommended that a 24" white stop bar be installed on Beverly Road and the yellow double centerline on the westbound approach of Tazewell Pike be extended further west. It is believed that these pavement markings would provide a better visual target to designate the appropriate location and turning path for westbound left-turn motorists turning onto Beverly Road and reduce the number of "short-turns".
- It is recommended that a Stop Sign (R1-1) be installed, and a 24" white stop bar be applied to the Proposed Entrance approach at Beverly Road. The stop bar should be applied a minimum of 4 feet away from the edge of Beverly Road and placed at the desired stopping point that maximizes the sight distance.
- Sight distances at the Proposed Entrance approach at Beverly Road must not be impacted by future landscaping, signage, or existing vegetation. Based on a posted speed limit of 30-mph on Beverly Road, the required intersection sight distance is 335 feet looking in each direction at the entrance. The required stopping sight distance is 200 feet looking to the north and 220 feet to the south at the Proposed Entrance location on Beverly Road. A visual inspection determined that the intersection and stopping sight distances are available at the Proposed Entrance location. The site designer must ensure that these sight distances are accounted for and provided in the design plans. It is recommended that a licensed

land surveyor measure the available sight distances at the Proposed Entrance location to the north and south on Beverly Road.

- A 25-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the development entrance off Beverly Road. It is recommended that a "No Outlet" Sign (W14-2a) be installed at the front of the development at Beverly Road. This sign can be installed above or below the street name sign.
- As shown in the report, Stop Signs (R1-1) and 24" white stop bars are recommended on the new internal roadways. End of roadway signage (OM4-1) should be installed at the eastern end of Road "A" if a stub road is constructed.
- Sight distance at the new internal road intersections must not be impacted by new signage, parked cars, or future landscaping. With a proposed speed limit of 25-mph in the development, the internal intersection sight distance is 250 feet. The required stopping sight distance is 155 feet for a level road grade. The site designer should ensure that these internal sight distance lengths are met.
- All drainage grates and covers for the residential development must be pedestrian and bicycle safe.
- The site designer should include a parking area and a centralized mail delivery center within the development if directed by the local post office.
- The subdivision entrance is recommended to be designed and constructed with a boulevard roadway section. Typically, a boulevard road section is designed and constructed to the first intersecting street within the development, which would be Road "B" in this case. At a minimum, the boulevard section should have a 10-foot median with 2 – 18-foot lanes within 60 feet of right-of-way.
- All road grade and intersection elements should be designed to AASHTO, TDOT, the City of Knoxville, and Knox County specifications and guidelines to ensure proper operation.
- It is recommended that a "Do Not Stop on Tracks" (R8-8) sign be installed on the right-hand side of Beverly Road on the near side (north side) of the railroad grade crossing facing southbound traffic.
- * According to Google Street Maps, as recently as February 2019, a "Narrow Bridge" (W5-2) sign was installed for southbound traffic on Beverly Road just north of the railroad crossing and south of the intersection with Oakland Drive. This sign is no longer installed. To match the existing warning sign for northbound traffic on Beverly Road before the bridge and to provide advanced warning, this signage should be reinstalled.

DESCRIPTION OF EXISTING CONDITIONS

- **STUDY AREA:**

The proposed location of this new residential development is shown on a map in Figure 1. This proposed development will be located off Beverly Road, between Oakland Drive and Greenway Drive in Northeast Knox County, TN. The development site is 0.6 miles southeast of Tazewell Pike and just under a mile from Washington Pike on the northern side of Interstate 640. The proposed access point for the development is also just southeast of a railroad and bridge creek crossing on Beverly Road. The development will have a single entrance on Beverly Road. The development property is in Knox County; however, Beverly Road and the adjoining right-of-way are in the City of Knoxville.

As Knoxville/Knox County Planning requested, transportation impacts associated with the proposed development were analyzed at the future intersection of Beverly Road at the Proposed Entrance, where the proposed development will have singular road access to and from outside destinations. The scope of work also requested a before and after analysis of the existing unsignalized t-intersection of Tazewell Pike at Beverly Road. In the past, this intersection has been reviewed and determined to meet traffic signal warrants.

View of Development Site at Proposed Entrance Location on Beverly Road (Looking East from Beverly Road)

The proposed development property is in a suburbanized area with highly variable land uses. In the immediate vicinity, the land uses include residential, industrial, agricultural, and commercial uses. The development property is currently undeveloped and completely forested. The development property has just over 400 feet of road frontage along the property's western edge and the eastern side of Beverly Road. The City of Knoxville limit lines the eastern edge of Beverly Road. Whites Creek runs along the property's northern edge and is in a flood zone.

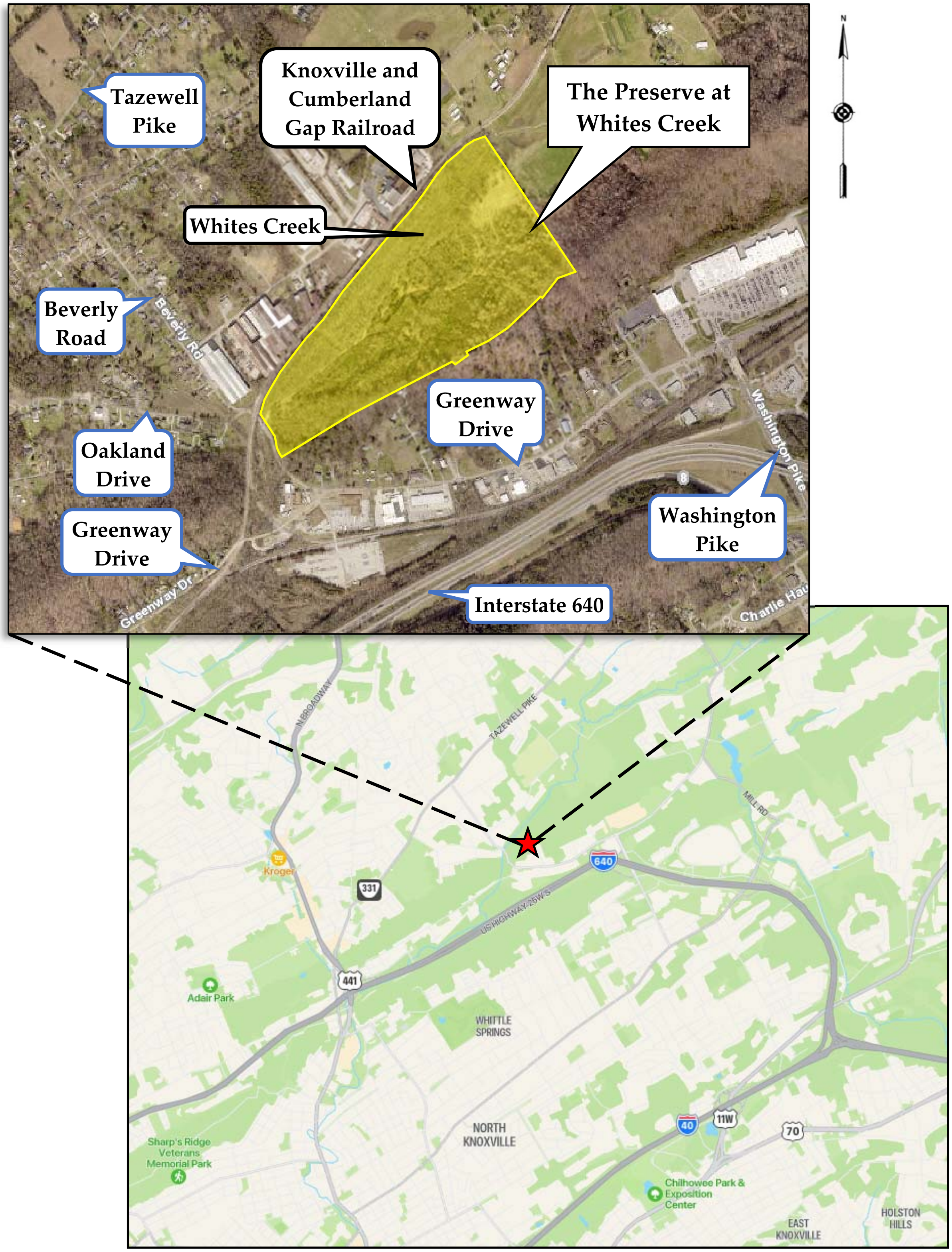


Figure 1
Location Map

- **EXISTING ROADWAYS:**

Table 1 lists the characteristics of the existing primary access 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
Tazewell Pike (SR 331)	Minor Arterial	40 mph	2 undivided	24 feet	None	No sidewalks along roadway	No bike lanes
Beverly Road	Major Collector	30 mph	2 undivided	20-26 feet	None	No sidewalks along roadway	No bike lanes

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

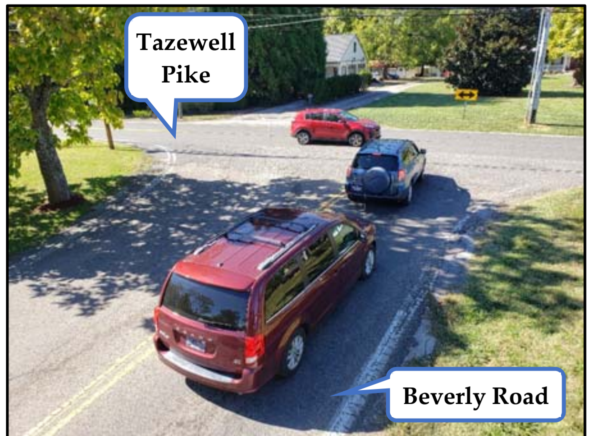
Tazewell Pike (State Route 331) is classified as a Minor Arterial from Old Broadway to the Union County, TN line. The Tennessee Department of Transportation (TDOT) maintains this roadway, traversing in a generally southwest-northeast direction over its entire length. On the southwest end, Tazewell Pike begins at a signalized intersection in the Fountain City area of Knoxville and continues to Luttrel, TN, for a total length of 17.6 miles. Several miles to the northeast of Beverly Road, in the Gibbs community, Tazewell Pike and East Emory Road intersect at a signalized intersection. SR 331 continues east on East Emory Road, and Tazewell Pike continues to the northeast as SR 131 to Luttrel, TN.

In the vicinity of Beverly Road, Tazewell Pike is primarily occupied by single-family houses with individual driveways, churches, and a large cemetery. To the southwest and closer to Knoxville, Tazewell Pike is more developed with commercial developments as it approaches the Fountain City and Broadway area. Several single-family subdivisions are off Tazewell Pike to the northeast of Beverly Road.

Intersection of Tazewell Pike at Beverly Road

At the unsignalized t-intersection of Tazewell Pike at Beverly Road, each approach has a single lane, the Beverly Road approach is controlled by a Stop Sign (R1-1), and the Tazewell Pike approaches operate freely. This intersection is located in the City of Knoxville.

Tazewell Pike, near Beverly Road, currently consists of a 2-lane pavement section with 11.5-foot lanes and a total pavement width of 24 feet. The roadway is striped with white edge lines and a double yellow center line. Outside the white edge lines, the pavement edge extends only a few inches on each side. The posted speed limit on Tazewell Pike is 40-mph, and sidewalks are not provided along the roadway. A utility streetlight is located on the north side of Tazewell Pike at the intersection with Beverly Road.



Tazewell Pike at Beverly Road (Looking Northwest)

<u>Beverly Road</u> is classified as a Major Collector and traverses from Tazewell Pike on the north side to Greenway Drive on the south side with a total length of 0.8 miles. Beverly Road transitions to Greenway Drive at a three-way forked intersection on its south side. Beverly Road is occupied with residential homes on a majority of its length, but on its southern side is occupied by the Triple-S Steel Supply Company, a structural steel supplier, and undeveloped property, including the proposed development property.

Adjacent to the development property, Beverly Road has an s-curve horizontal road alignment crossed by a railroad track and a bridge creek crossing. Just north of the proposed development property, Beverly Road crosses the single railroad line owned by R.J. Corman Railroad.

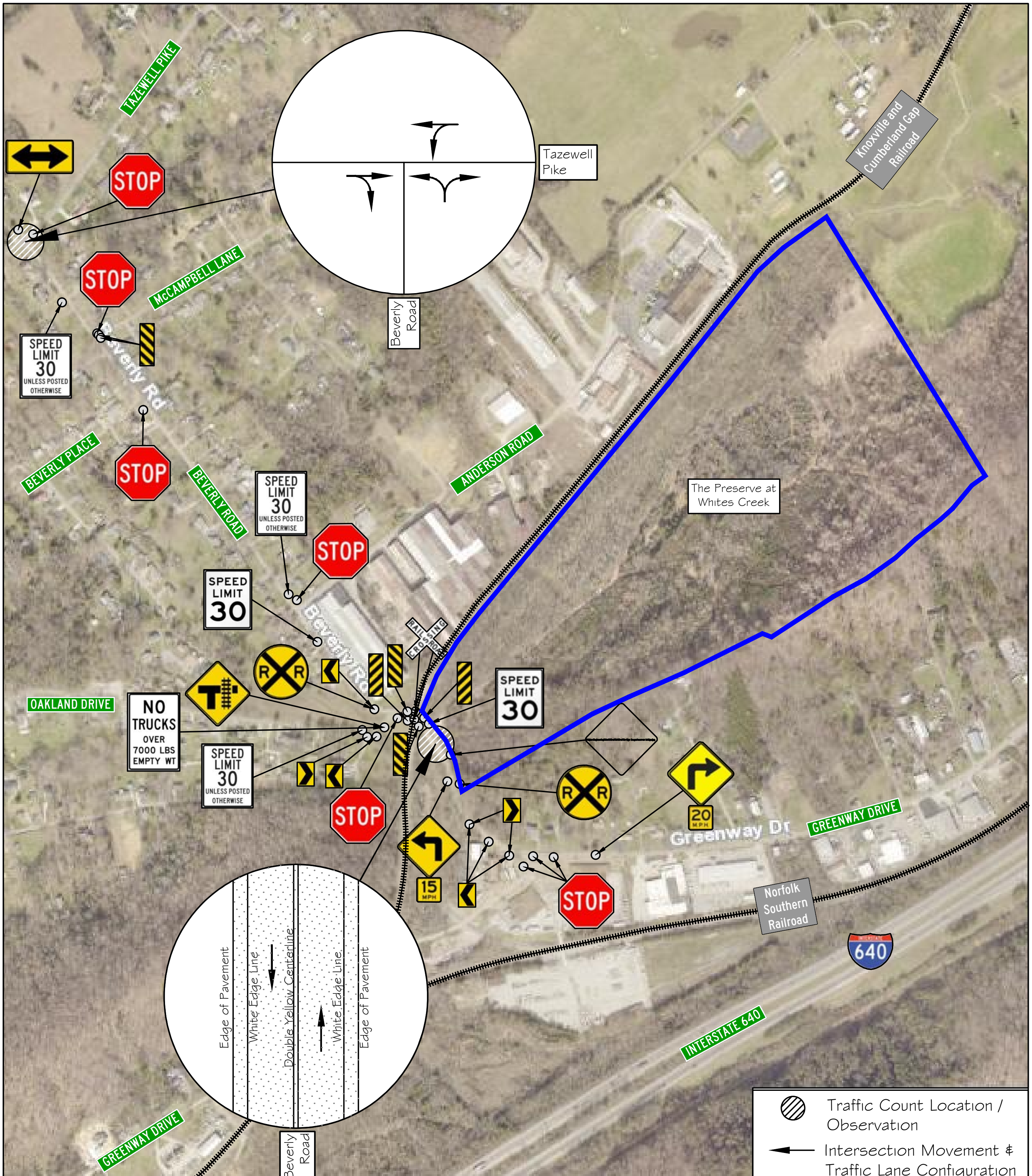
Beverly Road at Railroad Crossing and Whites Creek Bridge (Looking Southeast)

A bridge is provided to cross Whites Creek just south of the railroad crossing on Beverly Road. In addition to vehicles, the bridge also cradles a water line on the concrete barrier on its western side. The total pavement width of the road between the concrete barriers on the bridge was measured to be 20.3 feet. On the north side of the railroad crossing and stream crossing on Beverly Road, the pavement width was measured to be 26 feet. The pavement width of Beverly Road was measured to be just under 24 feet to the south side and adjacent to where the Proposed Entrance will be located.

Whites Creek Bridge on Beverly Road (Looking Northeast)

Beverly Road has several intersecting roadways that provide alternate routes to Tazewell Pike to the north. These roads include Beverly Place, Oakland Drive, and Anderson Road. These roadways do not provide as direct access as Beverly Road does, but they do provide alternative road access to Tazewell Pike east and west of the intersection of Tazewell Pike at Beverly Road. Due to the vehicle delays on Beverly Road at Tazewell Pike, Beverly Place is used as a cut-thru route. As a result of this cut-thru activity and vehicle speeds, the City of Knoxville recently installed speed humps along Beverly Place.

Figure 2 shows the existing lane configurations of the intersection and location where traffic counts were conducted for the study and the current traffic road signage in the study area. The road 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

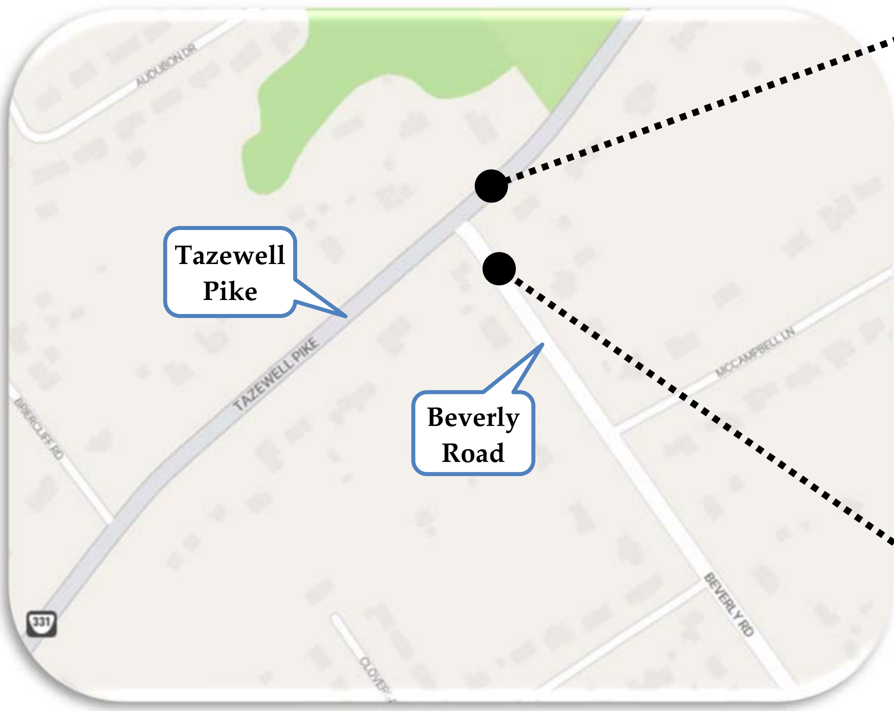
NORTH

FIGURE 2

The Preserve at Whites Creek

Traffic Count Locations, Traffic Signage & Existing Lane Configurations

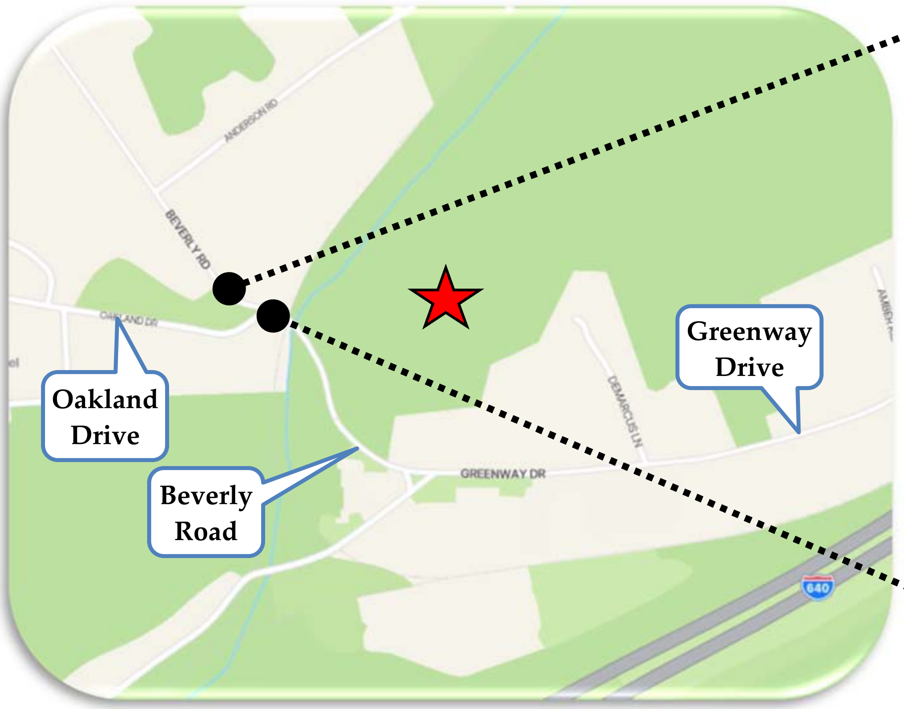
PHOTO EXHIBITS



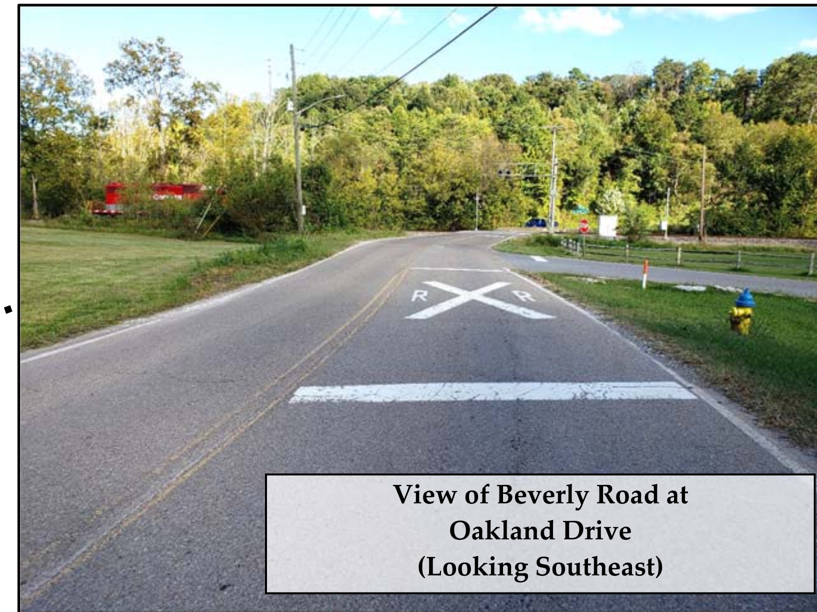
Tazewell Pike at Beverly Road

View of Tazewell Pike at Beverly Road (Looking Southwest)

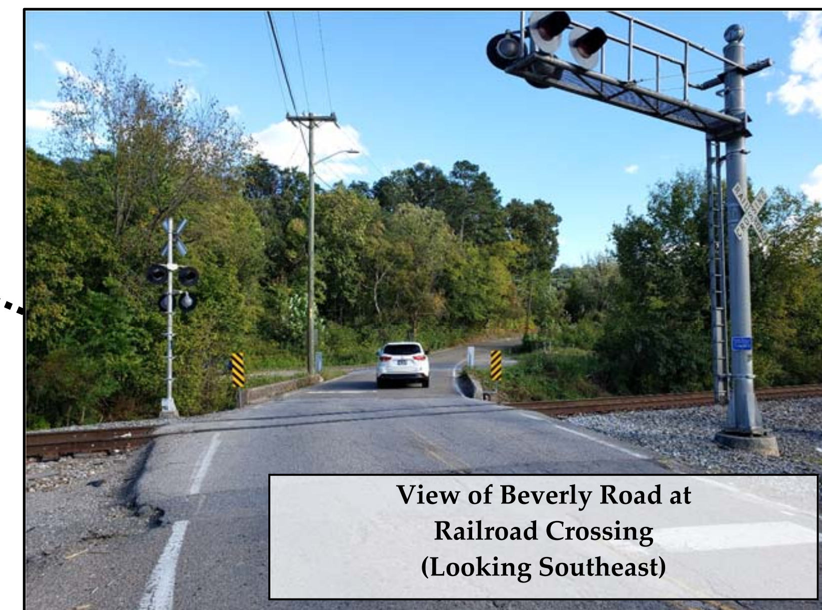
View of Beverly Road at Tazewell Pike (Looking Northwest)



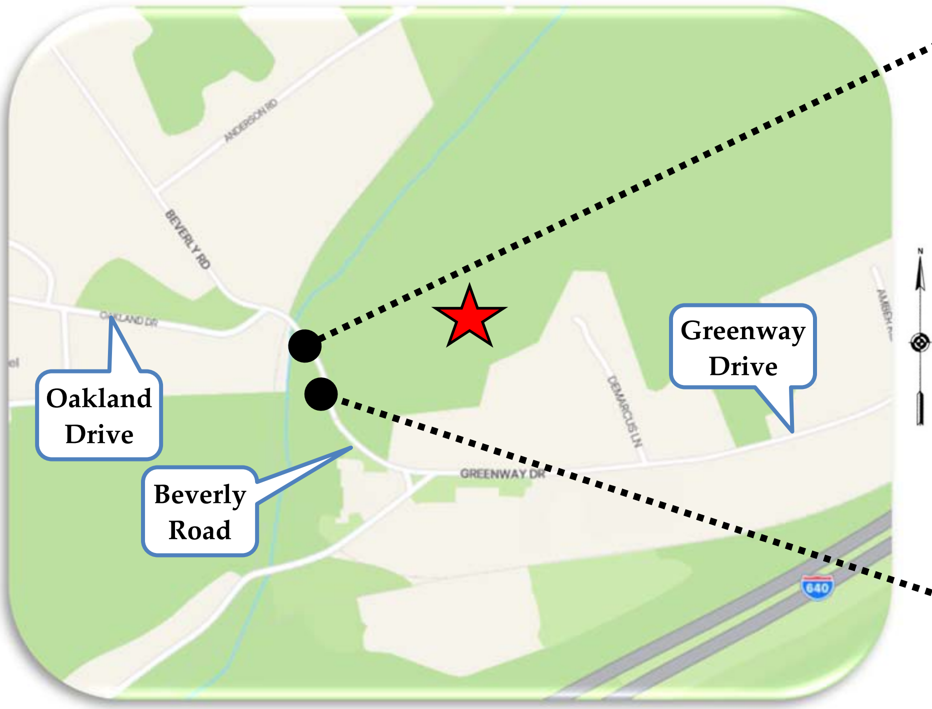
Beverly Road near Development Site



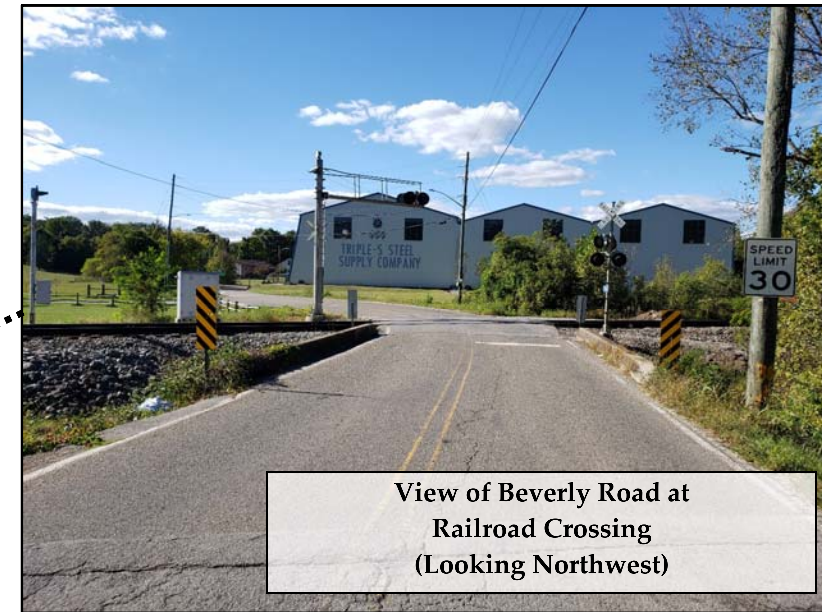
View of Beverly Road at
Oakland Drive
(Looking Southeast)



View of Beverly Road at
Railroad Crossing
(Looking Southeast)

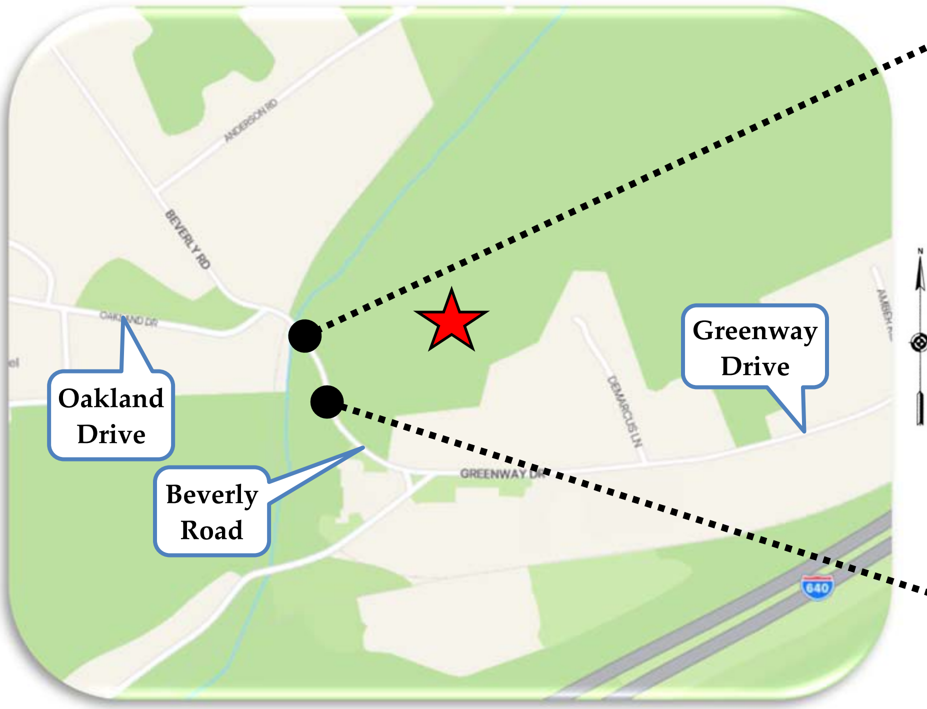


Beverly Road near Development Site



View of Beverly Road at Railroad Crossing (Looking Northwest)

View of Beverly Road near Proposed Entrance Location (Looking Northwest)



Beverly Road near Development Site

View of Existing Development Site near Proposed Entrance Location (Looking East)

View of Beverly Road near Proposed Entrance Location (Looking Southeast)

- **<u>EXISTING TRANSPORTATION VOLUMES PER MODE</u>**:

Two annual vehicular traffic count locations exist near the study area, and the Tennessee Department of Transportation (TDOT) conducts these counts. 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 Greenway Drive, just east of the intersection with Beverly Road and the development site, at 6,191 vehicles per day in 2021. From 2011 to 2021, this count station has indicated a +1.7% average annual traffic growth rate.
  - TDOT reported an Average Daily Traffic (ADT) on Tazewell Pike, northeast of Jacksboro Pike and west of the development site, at 15,302 vehicles per day in 2021. From 2011 to 2021, this count station has indicated a +0.1% average annual traffic growth rate.

- Existing bicycle and pedestrian volumes:
  The average daily pedestrian and bicycle traffic is unknown along the studied roadways. Due to the lack of facilities and nearby amenities, there is assumed to be minimal pedestrian and bicyclist activity on these roads in the study area. During the traffic counts for this project, only one pedestrian was observed over 6 hours.

  An online website, <u>strava.com</u>, provides "heat" maps detailing exercise routes taken by pedestrians, joggers, and bicyclists. The provided heat maps show the last two years of data, are updated monthly, and are gathered from individuals allowing their smart devices to track and compile their routes (millions of users). The activities in the maps are shown on the roads with color intensities with lighter colors signifying higher activity. The Strava heat maps show some bicycle and pedestrian activity in the study area. Higher pedestrian activity is shown on Oakland Drive and Anderson Road and in the existing adjacent residential subdivisions. Overall, lower bicycle traffic is shown on the surrounding roadways, but bicyclists have a more significant presence than pedestrians on Beverly Road adjacent to the development site, according to the heat maps.

Strava Heat Map for Pedestrian and Joggers

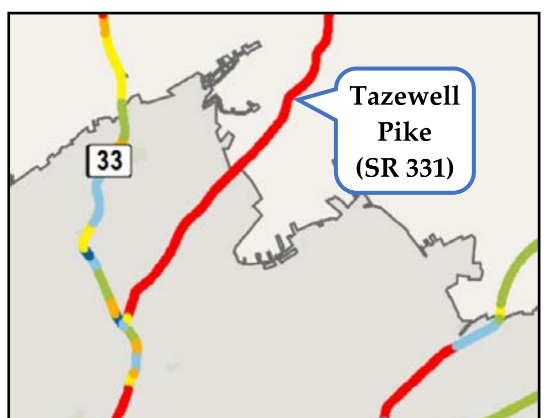
Strava Heat Map for Bicyclists

- **<u>ON-STREET PARKING</u>:**

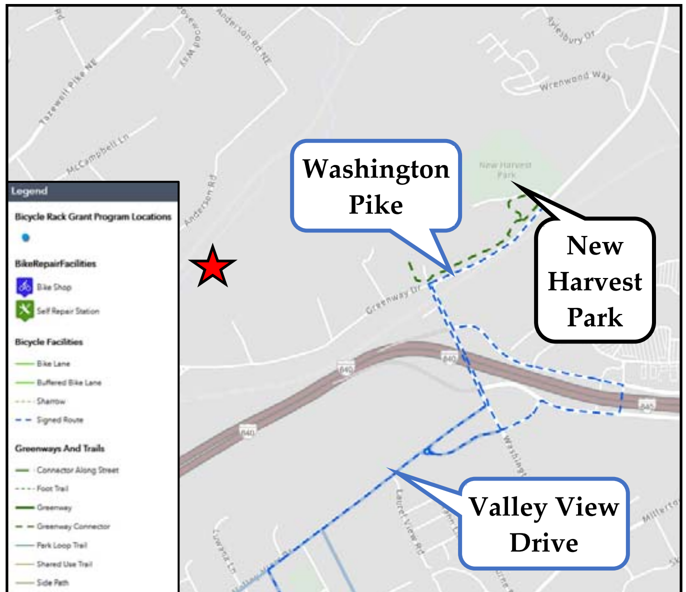
On-street parking was not observed during the site review and is not allowed on Tazewell Pike or Beverly Road adjacent to the project site. Off-street parking was observed along Beverly Road at Triple-S Steel Supply Company. The vehicles at this company directly pull in and back onto Beverly Road from a parking lot. These parking spaces are along Beverly Road and line the company's building.

- **<u>PEDESTRIAN AND BICYCLE FACILITIES</u>:**

Bicycle facilities (lanes) are not available within the project site study area. Sidewalks are not provided either. Even though bicycle facilities are not provided on Tazewell Pike (SR 331), TDOT has published mapping illustrating the Bicycle Level of Service (BLOS) for state routes in Knox County. BLOS is a nationally used measure of bicyclist comfort based on a roadway's geometry and traffic conditions. BLOS A designates the route as most suitable for bicyclists and BLOS F as the least suitable. The BLOS for Tazewell Pike (SR 331) at Beverly Road shows F grades.

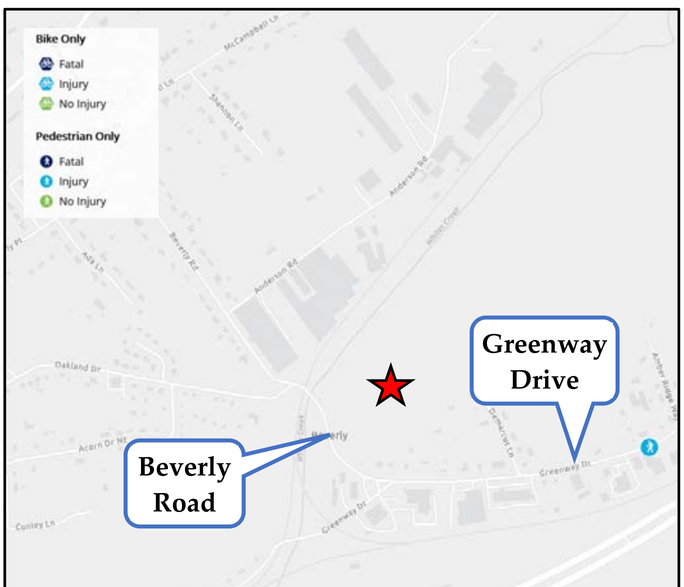


Mapping of Bicycle Level of Service (BLOS) - TDOT



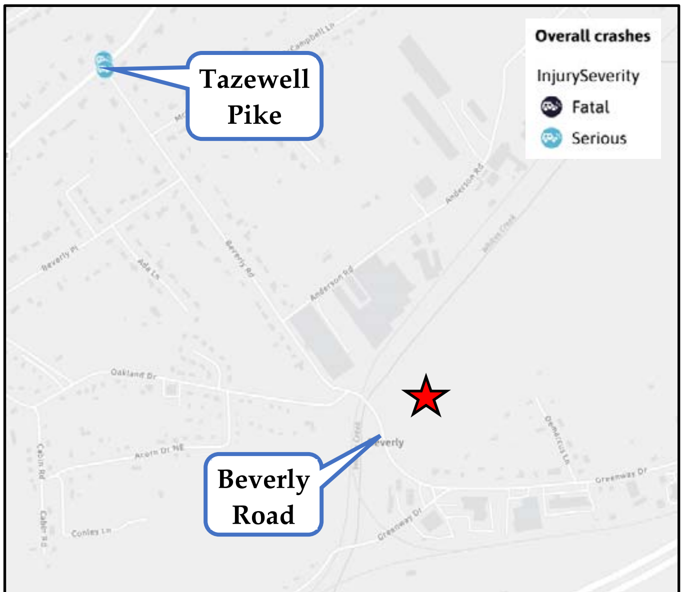
Designated Bicycle Routes in Study Area

Bicycle lanes are not provided on Beverly Road or other roadways adjacent to the development site, but a designated bicycle route is located just east of the development site along Washington Pike and Valley View Drive. This route along Washington Pike and Valley View Drive is designated as a "Comfortable Route" in the KGIS mapping. A "Comfortable Route" is defined as a route "based on low to medium traffic speeds and volumes along with other criteria". In addition to a nearby designated bicycle route, a paved greenway path is provided in front of the Target shopping center and New Harvest Park, north of Washington Pike. New Harvest Park has a new community building, a picnic pavilion/amphitheater, a splash pad, a playground, and a 0.25-mile trail. In addition to these amenities, the park also hosts a Farmer's Market from April to September.



Pedestrian/Bicycle Crash Data in Study Area

The Knoxville Transportation Planning Organization (TPO) provided a 2020 update to bicycle and pedestrian crash data for Knox County and other surrounding counties. According to the data, none of these incidents occurred near the development site in the past couple of years. The closest incident occurred on Greenway Drive, south and east of the development site, on March 5th, 2008. Details regarding the cause of the crash were not provided other than that an injury occurred.

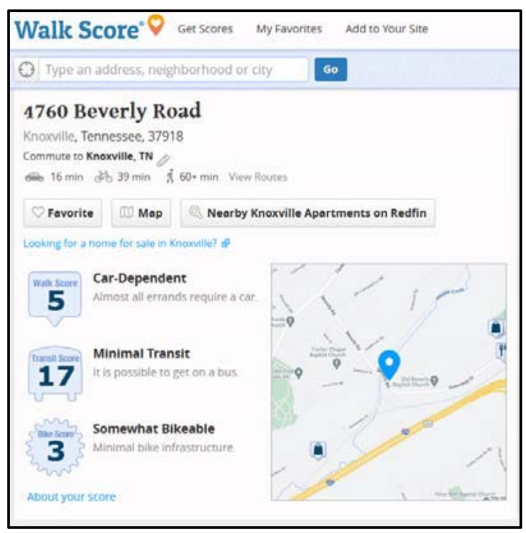


Vehicular Crash Data in Study Area

The Knoxville TPO also provides data related to "Life-Altering Traffic Crashes". This data lists "the location of 2,326 traffic crashes in the Knoxville region that resulted in a fatality or serious injury between January 2016 and June 2019." According to the data, none of these incidents occurred near the development site in the past couple of years. However, two crashes occurred at the intersection of Tazewell Pike at Beverly Road. Of these incidents, one is listed as involving a senior driver, the other as a teen driver, and both are listed as "Serious".

- <u>**WALK SCORE**</u>:

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

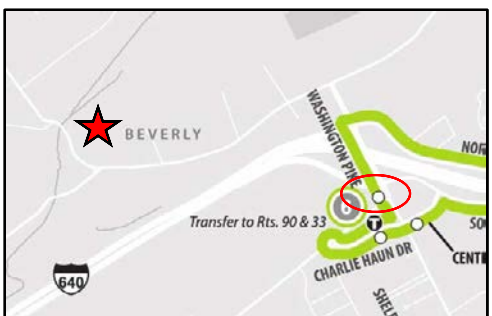


Appendix B shows maps and other information for the Walk Score, Bike Score, and Transit Score at the development property at 4760 Beverly Road (development property address). The project site location is graded with a Walk Score of 5. This Walk Score indicates that the site is car-dependent and that almost all errands currently require a vehicle for travel to and from the development property. The site is graded with a Bike Score of 3, which means there is minimal bike infrastructure. The site is given a Transit Score of 17 since public transportation is near the development site.

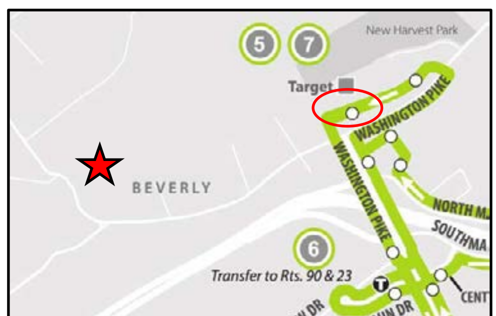
- **<u>TRANSIT SERVICES</u>:**

The City of Knoxville has a network of public transit opportunities offered by Knoxville Area Transit (KAT). Bus service is nearby in the study area, and the overall KAT bus system map is provided in Appendix C.

The closest public transit bus stops are over a mile away by roadway from the development's Proposed Entrance. These bus stops are located on Washington Pike near Valley View Drive and in the Target parking lot off Washington Pike. The bus stop on Washington Pike near Valley View Drive is on KAT Bus Route 23. Route 23 is designated as "Millertown Pike". The bus stop in the Target parking lot off Washington Pike is on KAT Bus Route 33. Route 33 is designated as "MLK Jr. Avenue". These routes operate on weekdays and weekends. Recently, KAT had to reduce its service schedule due to workforce shortages. These changes took place on August 29th, 2022, and the reduced schedules for these routes are included in Appendix C. The route maps are also included in Appendix C. Other transit services in the area include the East Tennessee Human Resource Agency (ETHRA) and the Community Action Committee (CAC), which provides transportation services when requested.



KAT Route 23



KAT Route 33

- **<u>ADJACENT RAILROAD SYSTEM</u>:**

R.J. Corman Railroad Company recently acquired the single railroad track just northwest of the Proposed Entrance location for the development on Beverly Road. This railroad line is named the Knoxville and Cumberland Gap Railroad (KXCG). Their recent online press release states, "The newly established KXCG is comprised of two branches. First, a 59-mile branch runs between Clinton, TN, and Clairfield, TN. Secondly, a branch of 72 miles operates between Beverly, TN, crossing the iconic Cumberland Gap and connecting to Middlesboro, KY. The branches, previously owned by Norfolk Southern, were historically part of the Southern

Railway."

The railroad crossing is marked and signed as #730476N. During the traffic count observations, no train crossing events were recorded. The centerline of the rail track to the center of the Proposed Entrance location for the residential development on Beverly Road is approximately 250 feet. The railroad crossing has Grade Crossing Advance Warning signs (W10-1) and railroad crossing signals for southbound and northbound traffic at the track but does not have crossing gates. The advance railroad pavement markings are fading at both approaches on Beverly Road to the railroad crossing.

Appendix D includes the U.S. DOT Crossing Inventory Form from the Federal Railroad Administration for this railroad crossing. According to the railroad form dated February 28, 2022, the estimated number of daily train movements includes one "Total Day Thru Trains", zero "Total Night Thru Trains, and one "Total Switching Trains". According to the Bureau of Transportation Statistics dictionary, "A *switching* and terminal railroad is a freight railroad company whose primary purpose is to perform local switching services or to own and operate a terminal facility. Switching is a type of operation done within the limits of a yard. It generally consists of making up and breaking up trains, storing and classifying cars, serving industries within yard limits, and other related purposes. These movements are made at slow speed under special yard rules."

The maximum track speed is 30 mph for freight trains on this track, but the typical speed is 5 to 15 mph, according to the inventory report. Accident reports were not available for this crossing, and it is assumed that this indicates that no reported accidents have occurred. A request was made to the railroad company to gather more details about the track, but there was no response from the company.

PROJECT DESCRIPTION

- **LOCATION AND SITE PLAN:**

The proposed plan layout with 120 single-family detached houses and 75 multi-family attached townhouses on 84.56 +/- acres is designed by W. Scott Williams and Associates and is shown in Figure 3. The design shows two new streets for the residential development, Road "A" and "B". Road "A" is the street that will intersect Beverly Road and provide access for the residents to and from outside destinations. The current site plan shows separate exiting lanes on Road "A" for left and right turns at Beverly Road.

The 84.56-acre residential development will include two extensive common areas on either side of the housing units with a combined size of 58.97 acres that will remain undeveloped. The proposed lot widths will vary from 22 to 60 feet, with depths between 80 and 100 feet. The single-family detached houses will be located to the property's rear (east side), with the townhouses closer to the front (west side). The single-family detached housing lots will be larger in area than the townhouse lots. Each housing unit will have a 2-car garage and driveway. Internal sidewalks are proposed for this development along one side of each road. Three detention ponds are proposed on the site to control stormwater discharges.

While not shown in Figure 3, the developer plans to construct a community building with pickleball courts and walking trails around the property's perimeter for the residents. The developer also plans to donate 16 acres of the development site to the Legacy Parks Foundation. Details regarding this donation and the timeframe are unknown at this time. However, the donated area would be the northern portion of the development property within the floodplain and adjacent to the railroad line.

The schedule for the completion of this new residential development is dependent on economic factors and construction timelines. This project is also contingent on permitting, design, and other regulatory approvals. Currently, the real estate market in the area is experiencing large amounts of activity and growth. This study assumed that the total construction build-out of the development and full occupancy would occur within the next five years (2027).

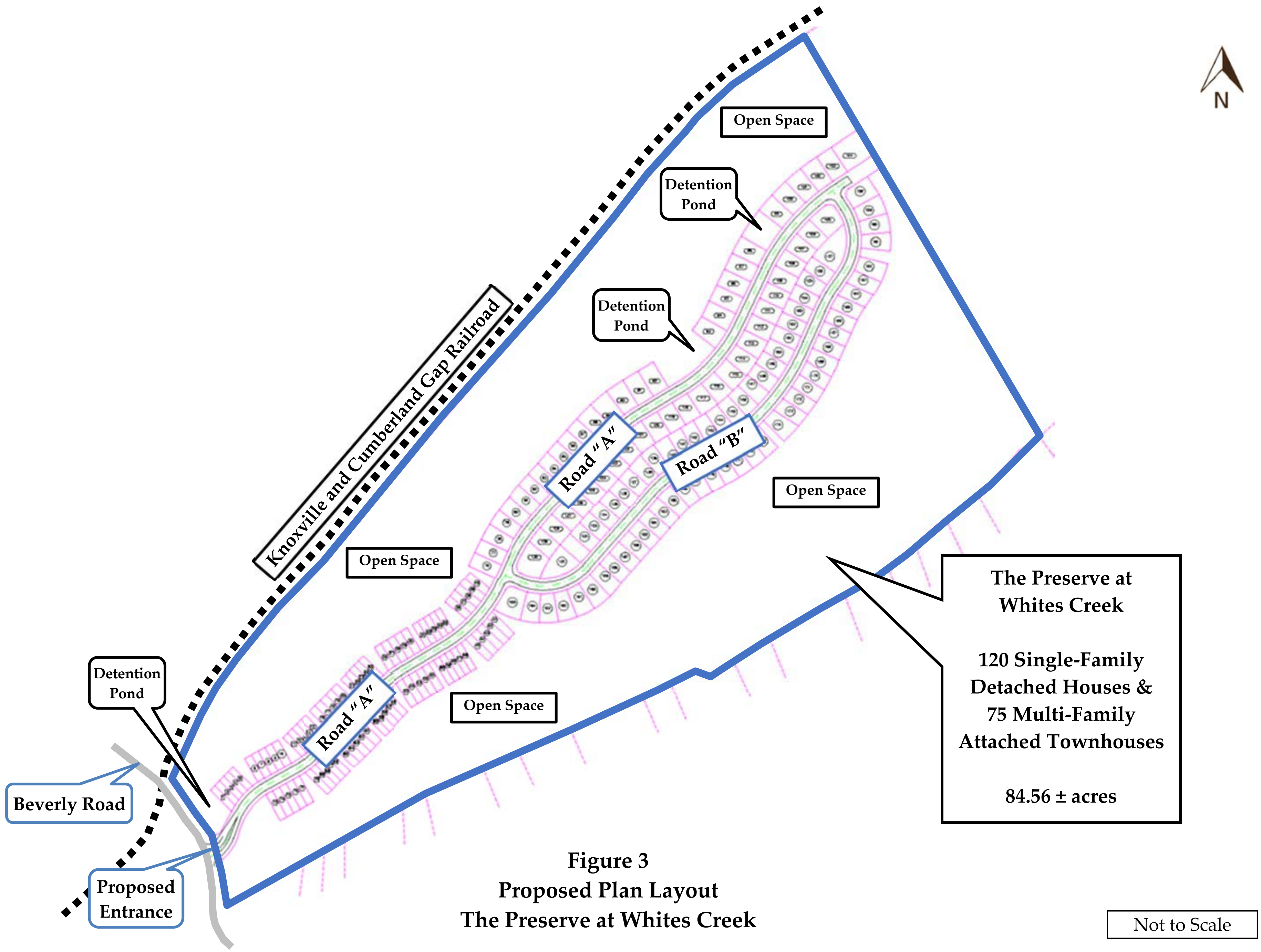


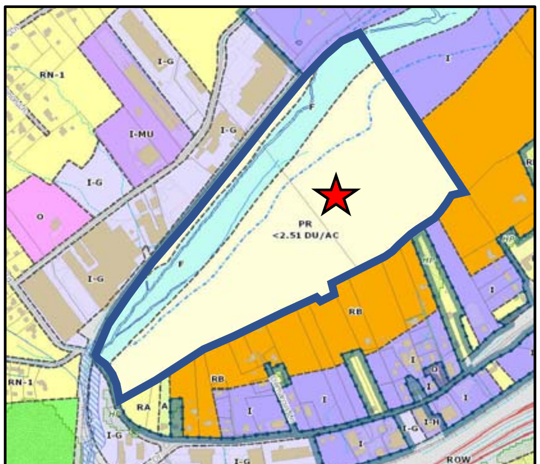
Figure 3
Proposed Plan Layout
The Preserve at Whites Creek

- **<u>PROPOSED USES AND ZONING REQUIREMENTS</u>:**

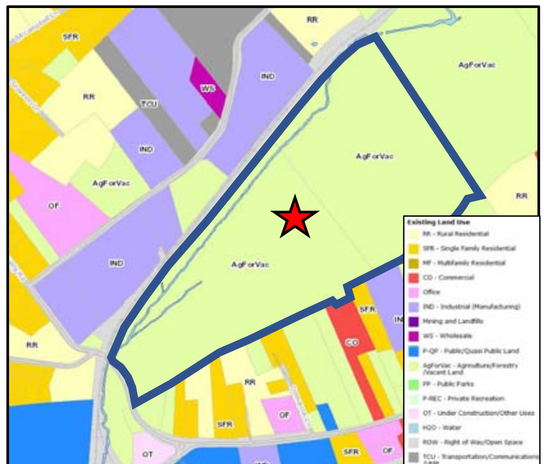
The two existing parcels comprising The Preserve at Whites Creek development property were recently rezoned to Planned Residential (PR) and Floodway (F) from Industrial (I), General Residential (RB), and Floodway (F) within Knox County, TN. The development property was requested to be rezoned to the Planned Residential (PR) zone with up to 2.51 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 E. While the development property is within Knox County - Beverly Road and the areas to the north, west, and south surrounding the development property are all located within the City of Knoxville. The existing adjacent surrounding zoning and land uses are the following:

- To the north and northwest of the development site and across the railroad and Whites Creek, seven parcels are zoned as General Industrial (I-G), and two parcels are zoned as Industrial (I) in the City of Knoxville. These parcels contain Triple-S Steel Supply, Beverly Steel, and other large industrial buildings and smaller buildings that abut the railroad. These parcels have access to Anderson Road, and Triple-S Steel Supply also has road access to Beverly Road.
- One large parcel to the northeast and east is zoned as Agricultural (A) and is occupied by farmland and forested areas. This property has access to Anderson Road and McCampbell Drive to the north.
- Eighteen parcels abut to the southeast and south of the proposed development property. One of these parcels is in the City of Knoxville; the rest are located outside the City and in Knox County. Most of these parcels are zoned as General Residential (RB). Two parcels are zoned as Low Density Residential (RA), one in the Agricultural (A) zone, one in the Industrial (I) zone, and the parcel in the City of Knoxville is zoned as Single-Family Residential Neighborhood (RN-1). Single-family detached houses occupy nearly all these parcels, with the rear of the parcels ending at the mountain ridge that borders the southern portion of the development property. One of the parcels near the top of the ridge contains a telecommunication tower. These parcels have road access to the south to Beverly Road or Greenway Drive. Some parcels have initial road access to Demarcus Lane, Amber Ridge Way, and New Beverly Baptist Church Road, with these roadways intersecting Greenway Drive to the south.

- o The property across Beverly Road to the southwest and west is in the City of Knoxville and zoned as General Industrial (I-G) and Floodway (F). Other property to the west includes the railroad property and is designated as Right-of-Way (ROW). The property immediately across Beverly Road from the development property is undeveloped with scrub brush and some trees. Some construction items (concrete barriers) are present along the Beverly Road frontage on this property. The immediate area on the other side of Beverly Road has a makeshift vehicle pull-over area: part pavement and part gravel. It is unknown how often this pull-over area is used, but it appears to be well used.



KGIS Existing Zoning Map



KGIS Existing Land Use Map

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

The Preserve at Whites Creek development's proposed density is based on a maximum of 195 dwelling units on 84.56 acres. One hundred ninety-five dwelling units on 84.56 acres compute to 2.31 dwelling units per acre, slightly less than allowed for this property with a density of 2.51 units per acre in the Planned Residential (PR) zone.

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

The total length of the two new streets within the development will be 4,885 feet (0.93 miles), designed and constructed to the Knox County, TN specifications. The development will have asphalt paved internal roadways and extruded concrete curbs. The lane widths internally will be 13 feet each for a total 26-foot pavement width. The public right-of-way within the development will be 50 feet. Sidewalks are proposed on one side of both internal roads. Knox

County will maintain the streets in the development after construction, and these will be dedicated public roads. A stub road is shown in the layout plan at the end of Road "A". According to the site designer, this stub may be required by Planning to be used for a further road extension into the adjacent property; however, this extension is estimated to have little chance of occurring.

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

Besides residential passenger vehicles, the internal roadways will provide access to service, delivery, maintenance, and fire protection/rescue vehicles. None of these vehicle types will impact roadway operations other than when they occasionally enter and exit the development. It is expected that curbside private garbage collection services will be available for this residential development.

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, school buses, trash collection trucks, and single-unit delivery trucks. The development's internal drives will accommodate the larger vehicle types and residents' standard passenger vehicles.

ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

▪ EXISTING TRAFFIC CONDITIONS:

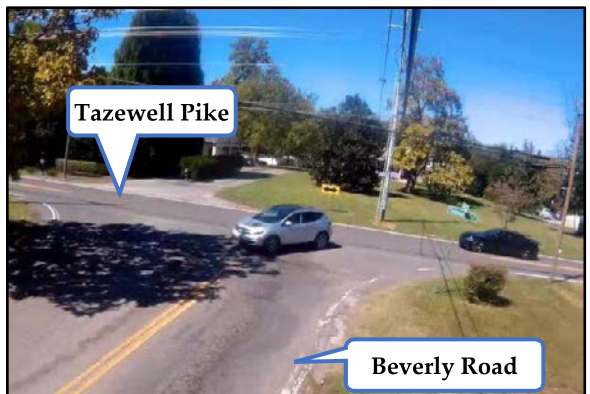
This study conducted a 6-hour traffic count at the unsignalized t-intersection of Tazewell Pike at Beverly Road and on Beverly Road adjacent to the development site on Thursday, September 29th, 2022. The manual traffic counts were conducted to tabulate the morning and afternoon peak period volumes and travel directions near the proposed development site. Based on the traffic volumes collected at the intersection of Tazewell Pike at Beverly Road, the AM and PM peak hours were observed at 7:15 – 8:15 am and 4:45 – 5:45 pm. Adjacent and closer to the development site on Beverly Road, the AM and PM peak hours were observed at 7:15 – 8:15 am and 4:15 – 5:15 pm.

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

- Only one pedestrian and no bicyclists were observed during the traffic counts. During the traffic count adjacent to the development site at Beverly Road, the lone observed pedestrian walked northbound on Beverly Road and continued onto Oakland Drive. School bus stops were observed just north of the development site at the intersection of Beverly Road at Oakland Drive. In the morning and afternoon, school buses stopped at this intersection and picked up and dropped off children that live further to the west along Oakland Drive. All the buses traveled on Beverly Road, and none were observed traveling on Oakland Drive.
- Most of the observed traffic was passenger vehicles, but the traffic stream on Beverly Road and Tazewell Pike included public school buses, dump trucks, and larger single-unit trucks. Several semi-tractor trailers were observed during the traffic count. At the railroad crossing adjacent to the development site, all the school buses and several larger trucks stopped at the track before proceeding. Some of these stops occurred due to laws and regulations - a few occurred due to the drivers' not feeling comfortable crossing the bridge over Whites Creek simultaneously with oncoming traffic. While the bridge width is adequate, the bridge structure combined with Beverly Road's s-curve horizontal alignment contributes to some drivers' unease of crossing simultaneously.
- Due to the high vehicle delays and queues experienced on the Beverly Road approach at Tazewell Pike, a lot of courteous activity was observed by fellow motorists allowing other motorists to turn at the intersection. The most often observed courteous activity involved

westbound left-turning motorists on Tazewell Pike allowing northbound left-turning motorists to turn in front of them onto Tazewell Pike. While helpful to motorists on Beverly Road, this increased vehicle delays on Tazewell Pike.

- The existing northbound approach of Beverly Road is a single lane for left and right turns onto Tazewell Pike. However, the travel lane and the grassed shoulder on Beverly Road provide just enough width to simultaneously allow compact, smaller vehicles to be side-by-side for both left and right turns. A few times, when a left-turning motorist on Beverly Road had significant delays due to heavy traffic on Tazewell Pike, a right-turning motorist in a compact vehicle was observed driving on the grassed shoulder alongside the stopped left-turning vehicle. This maneuver was taken to avoid the vehicle queue and to complete their turn to the right without further waiting. This maneuver occurred three times during the traffic counts. It is assumed that this would occur more often if more space were alongside the road's edge. Larger vehicles are restricted from doing this due to the adjacent street signpost location and lack of shoulder.
- One observed turning characteristic at the intersection of Tazewell Pike at Beverly Road was westbound left-turning vehicles on Tazewell Pike consistently "short-turning" onto Beverly Road. This maneuver typically occurred when vehicles were not present and stopped on Beverly Road. However, a few times, this occurred when a vehicle on Beverly Road was approaching the intersection and nearly clipped by this "short turning". This "short-turning" also occurred even when oncoming eastbound traffic on Tazewell Pike was not present.



"Short-Turning" at Intersection of Tazewell Pike at Beverly Road (Looking Northeast)

- Long vehicle queues were regularly observed on the northbound approach of Beverly Road at Tazewell Pike, even during off-peak hours. During the AM and PM peak hours, substantial queues formed on Beverly Road, some approaching 1,000 feet in length. The observed queues were most significant during the PM peak hour and backed up past McCampbell Lane and nearly to Beverly Place. While it cannot be stated for certain, observed increased turning activity onto Beverly Place from Beverly Road during times of significant vehicle queues suggested some motorists were cutting thru to avoid the long queues at the intersection.

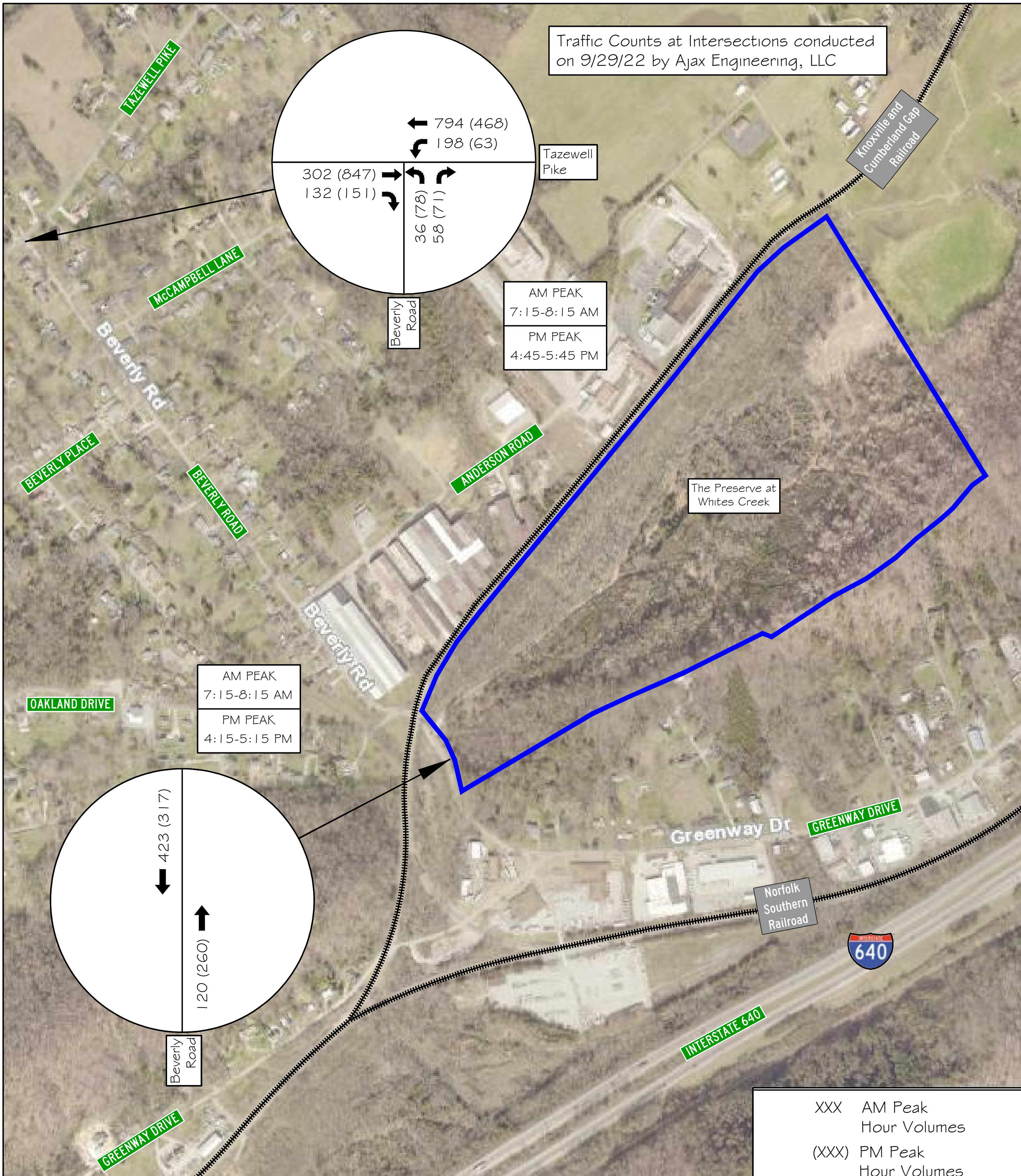


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FIGURE 4

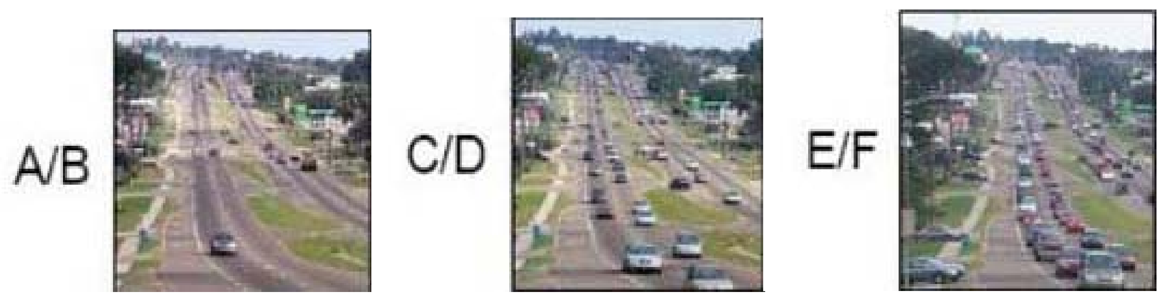
The Preserve at Whites Creek

2022 Peak Hour Traffic Volumes - EXISTING TRAFFIC CONDITIONS

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

Methodology:

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



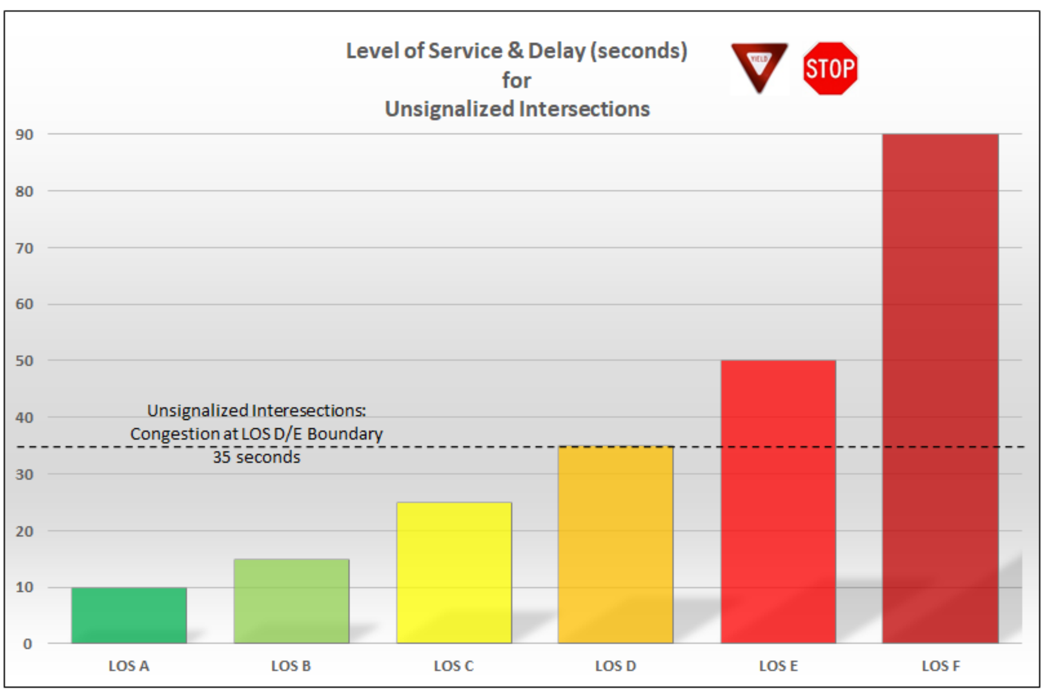
LOS is defined by delay per vehicle (seconds), and roadway facilities are also characterized by the volume-to-capacity ratio (v/c). LOS designations, which are based on delay, are reported differently for unsignalized and signalized intersections. For example, a delay of 20 seconds at an unsignalized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

For unsignalized intersections, LOS is measured in terms of delay (in seconds). This measure is an attempt to quantify delay that includes travel time, driver discomfort, and fuel consumption. For unsignalized intersections, the analysis assumes that the mainline thru and right-turn traffic does not stop and is not affected by the traffic on the minor side streets. Thus, the LOS for a two-way stop (or yield) controlled intersection is defined by the delay for each minor approach and major street left-turn movements. Table 2 lists the level of service criteria for unsignalized intersections. The analysis results of unsignalized intersections using the HCM methodologies are conservative due to the more significant vehicle gap parameters used in the method. More often, in normal road conditions, drivers are more willing to accept smaller gaps in traffic than what is modeled using the HCM methodology. The unsignalized intersection methodology also does not account for more significant gaps sometimes produced by nearby upstream and downstream signalized intersections. For unsignalized intersections, in most instances, the upper limit of acceptable delay during peak hours is the LOS D/E boundary at 35 seconds.

TABLE 2
LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS

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

Source: Highway Capacity Manual, 6th Edition



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

As shown in Table 3, the northbound approach of Beverly Road at Tazewell Pike is calculated to operate with very poor LOS and high vehicle delays during the peak hours in the existing 2022 conditions. The northbound approach of Beverly Road is calculated to operate overcapacity in the existing conditions during both the AM and PM peak hours. The calculated length of the vehicle queues is presented later in the report, and these queue results closely matched the observed queue lengths on Beverly Road.

TABLE 3
2022 INTERSECTION CAPACITY ANALYSIS RESULTS -
EXISTING TRAFFIC CONDITIONS

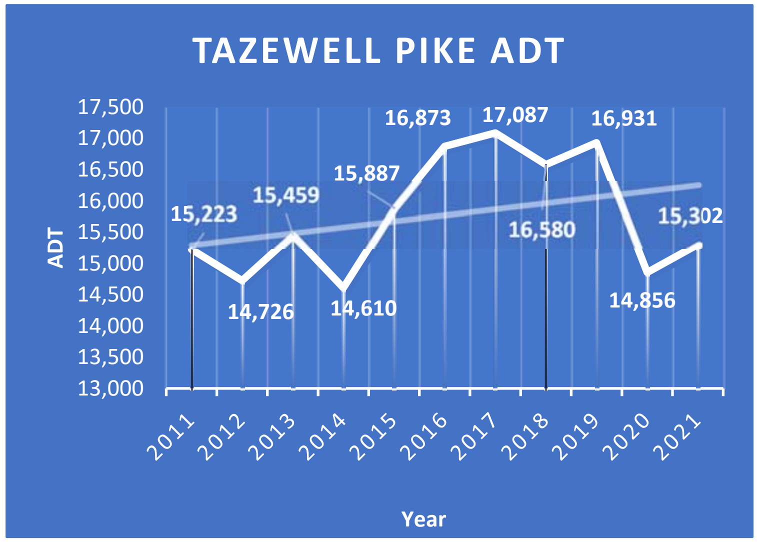
INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Tazewell Pike (EB & WB) at Beverly Road (NB)	STOP Unsignalized	Northbound Left/Right	F	1531.8	3.897	F	501.5	1.877
		Westbound Left	A	9.8	0.299	B	11.5	0.126

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology
[a] Level of Service , [b] Average Delay (sec/vehicle) , [c] Volume-to-Capacity Ratio

- **<u>PROJECTED TRAFFIC CONDITIONS (WITHOUT THE PROJECT):</u>**

Horizon year traffic conditions represent the projected traffic volumes in the study area without the proposed project being developed (no-build option). The build-out and full occupancy for this proposed development is assumed to occur by 2027.

Vehicular traffic in the study area has shown both low and modest growth over the past ten years, according to the TDOT count stations. As shown in Appendix A, Tazewell Pike has experienced annual growth of +0.1% over the past ten years, and Greenway Drive (just east of Beverly Road) has seen a +1.7% growth rate over the past ten years. The ADT on Tazewell Pike has fluctuated regularly over the past ten years.



Annual growth rates were assumed and applied to the existing 2022 volumes obtained at the intersection and at Beverly Road adjacent to the site to calculate the future volumes in the horizon year of 2027 without the potential development traffic.

A growth rate of 3% was used for Beverly Road, and 2% was assumed for Tazewell Pike. Higher rates were used to provide a conservative analysis and consider the possibility of increased growth due to the construction of other developments. These conservative rates would take into account the opening of the Amazon Fulfillment Warehouse at the former Knoxville Center Mall to the south and east of the proposed residential development. This warehouse is essentially completed, but the anticipated opening date was recently announced to be flexible due to changes in the retail and financial markets. Amazon previously said the warehouse facility would open sometime in 2022.

Capacity analyses were undertaken to determine the projected LOS in 2027 without the project at the intersection of Tazewell Pike at Beverly Road. The results are shown in Table 4, and Appendix G includes the capacity analysis worksheets. The results in Table 4 are similar to the existing 2022 results shown in Table 3, but with much higher vehicle delays on the northbound approach of Beverly Road. The northbound approach of Beverly Road is calculated to operate overcapacity in the projected 2027 conditions, even without the project. Figure 5 shows the projected 2027 traffic volumes without the project at the intersection and on Beverly Road adjacent to the development site during the AM and PM peak hours.

TABLE 4
2027 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS (WITHOUT THE PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Tazwell Pike (EB & WB) at Beverly Road (NB)	STOP Unsignalized	Northbound Left/Right	F	7531.7	16.116	F	970.7	2.888
		Westbound Left	B	10.4	0.344	B	12.4	0.152

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology
[a] Level of Service , [b] Average Delay (sec/vehicle) , [c] Volume-to-Capacity Ratio

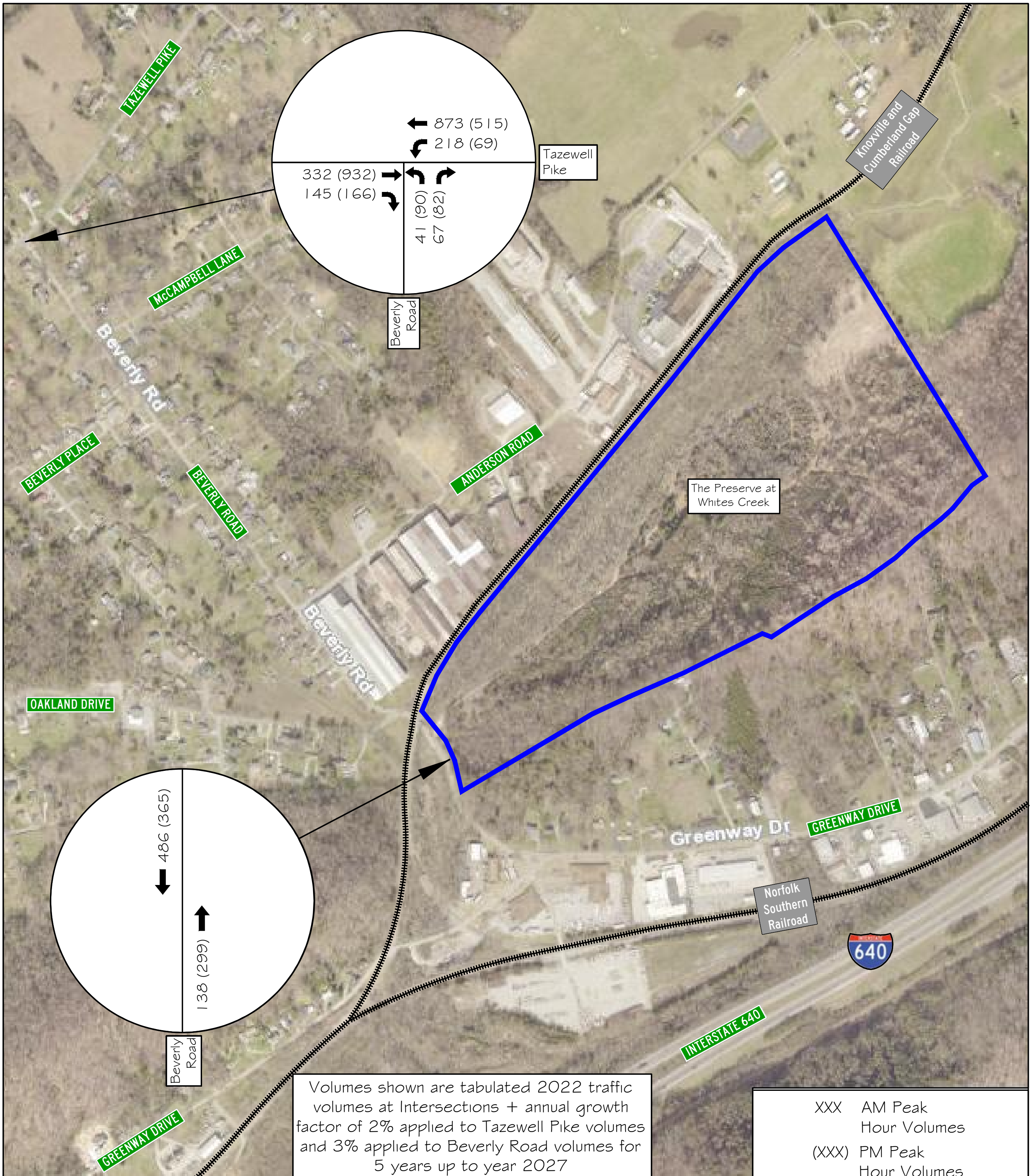


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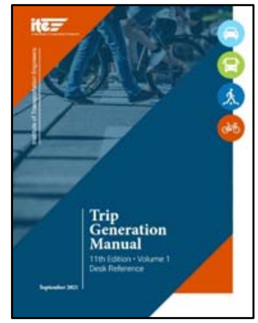
FIGURE 5

The Preserve at Whites Creek

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
(WITHOUT THE PROJECT)

- **TRIP GENERATION:**



A generated trip is a single or one-direction vehicle movement entering or exiting the study site. The estimated amount of traffic that the 120 single-family detached houses will generate was calculated based on rates and equations provided by the Trip Generation Manual, 11th Edition, a publication of the Institute of Transportation Engineers (ITE). The Trip Generation Manual is the traditional and most popular resource for determining trip generation rates when transportation impact studies are produced. The trip rate for the 75 multi-family attached townhouses was based upon equations provided by Knoxville-Knox County Planning. These equations were developed from an extensive local study to estimate townhouse (and apartment) trip generation in the surrounding area and were published in December 1999. For Knox County, this is the preferred rate to use for apartments and townhouses. This local rate calculates higher trip rates than the similar ITE land use.

The data and calculations from ITE and the local study for the proposed land uses are shown in Appendix H. A summary of this information is presented in the following table:

TABLE 5
TRIP GENERATION FOR THE PRESERVE AT WHITES CREEK
120 Single-Family Detached Homes & 75 Multi-Family Attached Townhouses

ITE LAND USE CODE	LAND USE DESCRIPTION	# OF UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	120	1,193	26%	74%		63%	37%	
				23	65	88	74	44	118
Local Trip Rate	Multi-Family Attached Townhouses	75	737	22%	78%		55%	45%	
				9	32	41	33	27	60
Total New Volume Site Trips			**1,930**	**32**	**97**	**129**	**107**	**71**	**178**

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

For the proposed residential development, it is estimated that 32 vehicles will enter and 97 will exit, for a total of 129 generated trips during the AM peak hour in the year 2027. Similarly, it is estimated that 107 vehicles will enter and 71 will exit, for a total of 178 generated trips during the

PM peak hour in the year 2027. The calculated trips generated for an average weekday are estimated to be 1,930 vehicles for the proposed development. No vehicle trip reductions were included in the calculations or analysis.

- **TRIP DISTRIBUTION AND ASSIGNMENT:**

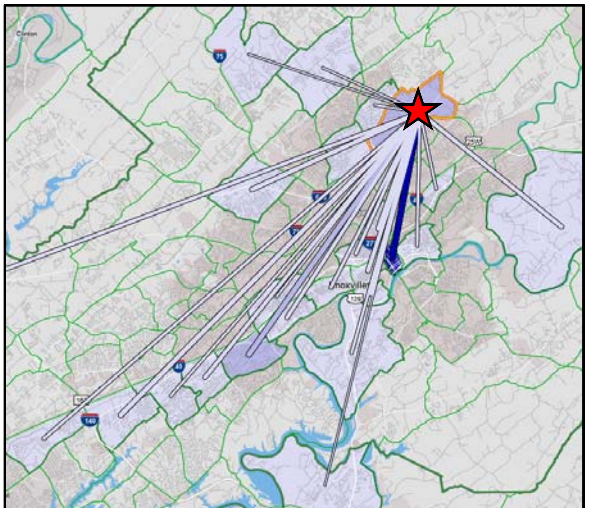
The projected trip distribution and assignment for The Preserve at Whites Creek development are based on several sources and engineering judgments. The first source is based on the existing traffic count volumes and the observed travel directions collected at the intersection of Tazewell Pike at Beverly Road, Beverly Road adjacent to the proposed development site, and an auxiliary, abbreviated traffic count at the intersection of Beverly Road at McCampbell Lane. This auxiliary count was located 600 feet southeast of the intersection of Tazewell Pike at Beverly Road. McCampbell Lane provides the sole outside road access for 38 single-family detached houses. These houses are located on McCampbell Lane and Shannon Lane. The results of this additional count are shown in Appendix F.

The auxiliary counts shown in Appendix F are a tabulation of the residents on McCampbell Lane and Shannon Lane entering and exiting to and from Beverly Road. Overall, it was determined that these residents traveled in the following percentages in the AM and PM peak hours:

Beverly Road at McCampbell Lane

AM PEAK HOUR	
Enter from North	100%
Enter from South	0%
Exit to South	40%
Exit to North	60%
PM PEAK HOUR	
Enter from North	47%
Enter from South	53%
Exit to South	50%
Exit to North	50%

During the traffic counts, significant splits were observed on Beverly Road adjacent to the development site during the morning peak hours. In the AM peak hour, over 75% of thru traffic was observed traveling south towards Greenway Drive and 25% north. In the PM peak hour, the splits were more even, with 55% heading south and 45% traveling north on Beverly Road. Similar northbound and southbound directional movements (the turning movements at the intersection) were observed at the Tazewell Pike and Beverly Road intersection. The thru movements on Tazewell Pike showed a heavy directional flow, with nearly 2/3 heading west in the AM peak hour (towards Knoxville) and 2/3 heading east in the PM peak hour (away from Knoxville).

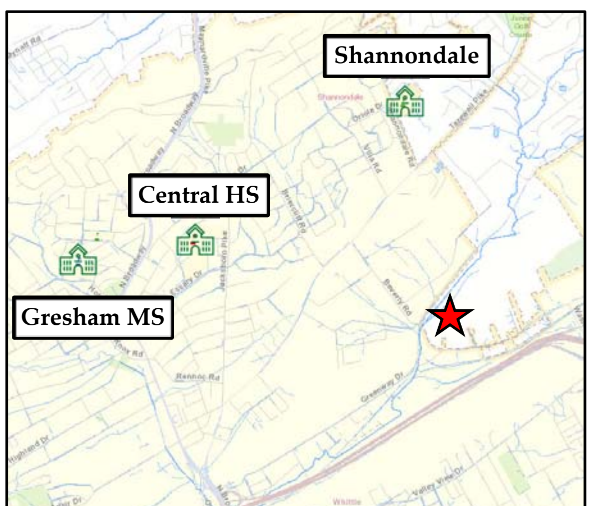


2019 Census Bureau Work-Based Trips to & from Census Tract 42

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 generated trips by the development, and these trips are more likely to travel to and from the south and southwest. This assertion is based on data from the United States Bureau website for Census Tract 42, where the development property is located. Based on 2019 (latest available) census data and as shown in Appendix I, most work-based trips in the surrounding area correspond to downtown Knoxville, the city center, the University of Tennessee area, and areas of West Knoxville. Some work-based trips will also be drawn to and from Oak Ridge, the Forks of the River Industrial areas, and some closer to the development site in the Fountain City area. As described earlier, if and when the Amazon fulfillment center is opened at the former Knoxville Center Mall, it can be expected that this proposed residential development will see some travel to and from this distribution warehouse.

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 Shannondale Elementary, Gresham Middle, and Central High School.

Shannondale Elementary is 1.6 miles away by roadway north of the development site. The most direct route to Shannondale Elementary will be north on Beverly Road and east on Tazewell Pike. Gresham Middle School is 2.7 miles away by roadway, west and on the other side of Broadway, with the most direct route to the north on Beverly Road and west on Tazewell Pike. Central High School is 1.8 miles away by roadway north and west, and the most direct route to Central High School will be similar to the initial path to Gresham Middle School.



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.

Figure 6 shows the projected distribution of traffic entering and exiting the development at the Proposed Entrance on Beverly Road. The percentages shown in the figure only pertain to the trips generated by the proposed dwellings in the development calculated from the ITE and local trip rates. Ultimately, the projected trip distribution was heavily based on the observed traffic at the intersection of Beverly Road at McCampbell Lane and the traffic flows adjacent to the site on Beverly Road. Furthermore, the assumed distribution of vehicles entering from the north (southbound left turns) in the PM peak hour was weighted heavier than would otherwise. This weighting was done to account for the nearby railroad crossing and analyze a worst-case scenario of whether vehicle queues at the Proposed Entrance could back up to the railroad track.

Figure 7 shows the traffic assignment of the computed trips generated by the development and is based on the assumed distribution of trips shown in Figure 6. The trips and percentages shown in Figures 6 and 7 at the intersection of Tazewell Pike at Beverly Road assume that all the trips generated by the proposed development to and from the north will travel through this intersection. However, the possibility exists that some of these trips will travel via Oakland Drive, Beverly Place, or Anderson Road instead and bypass this intersection.

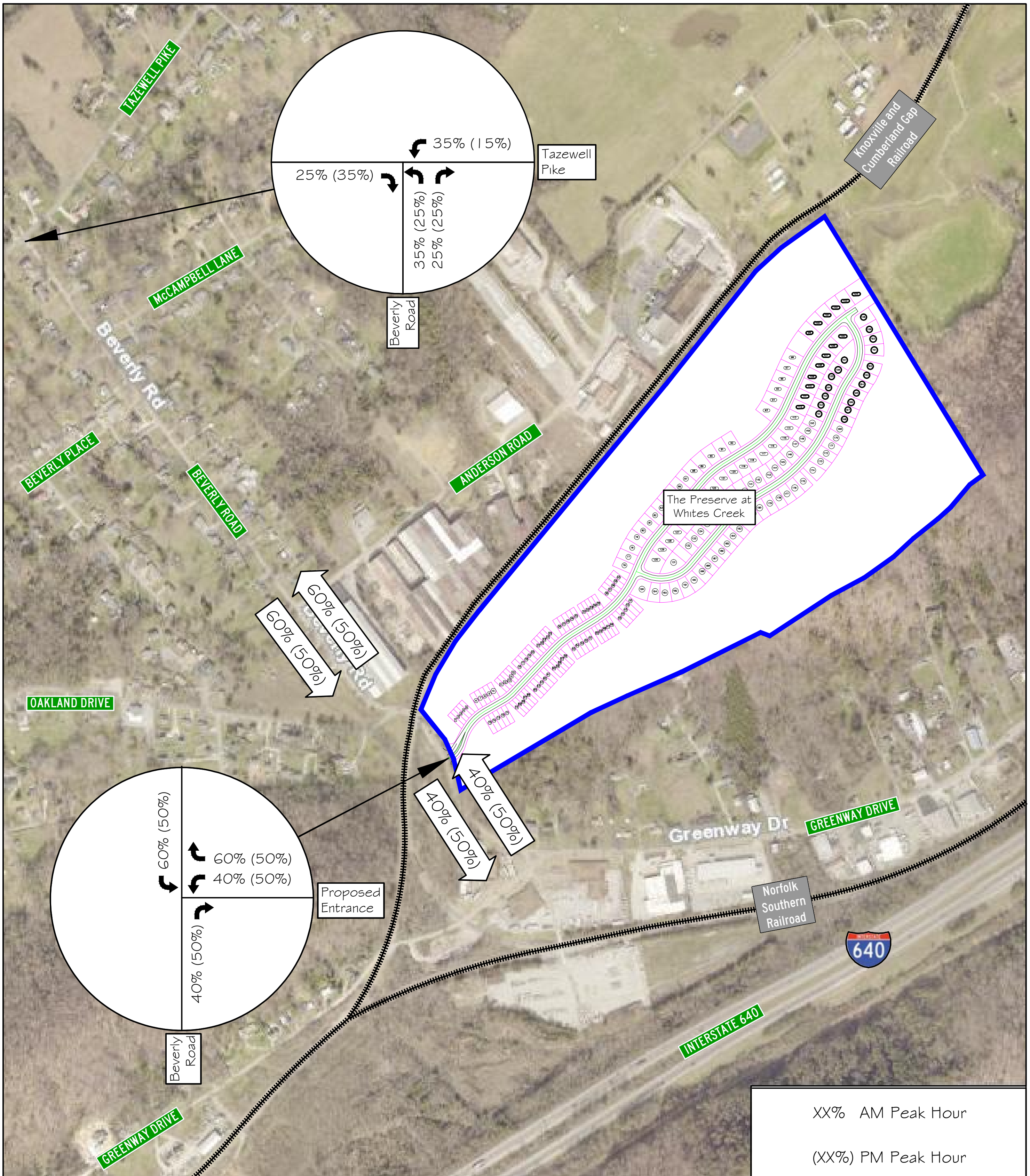


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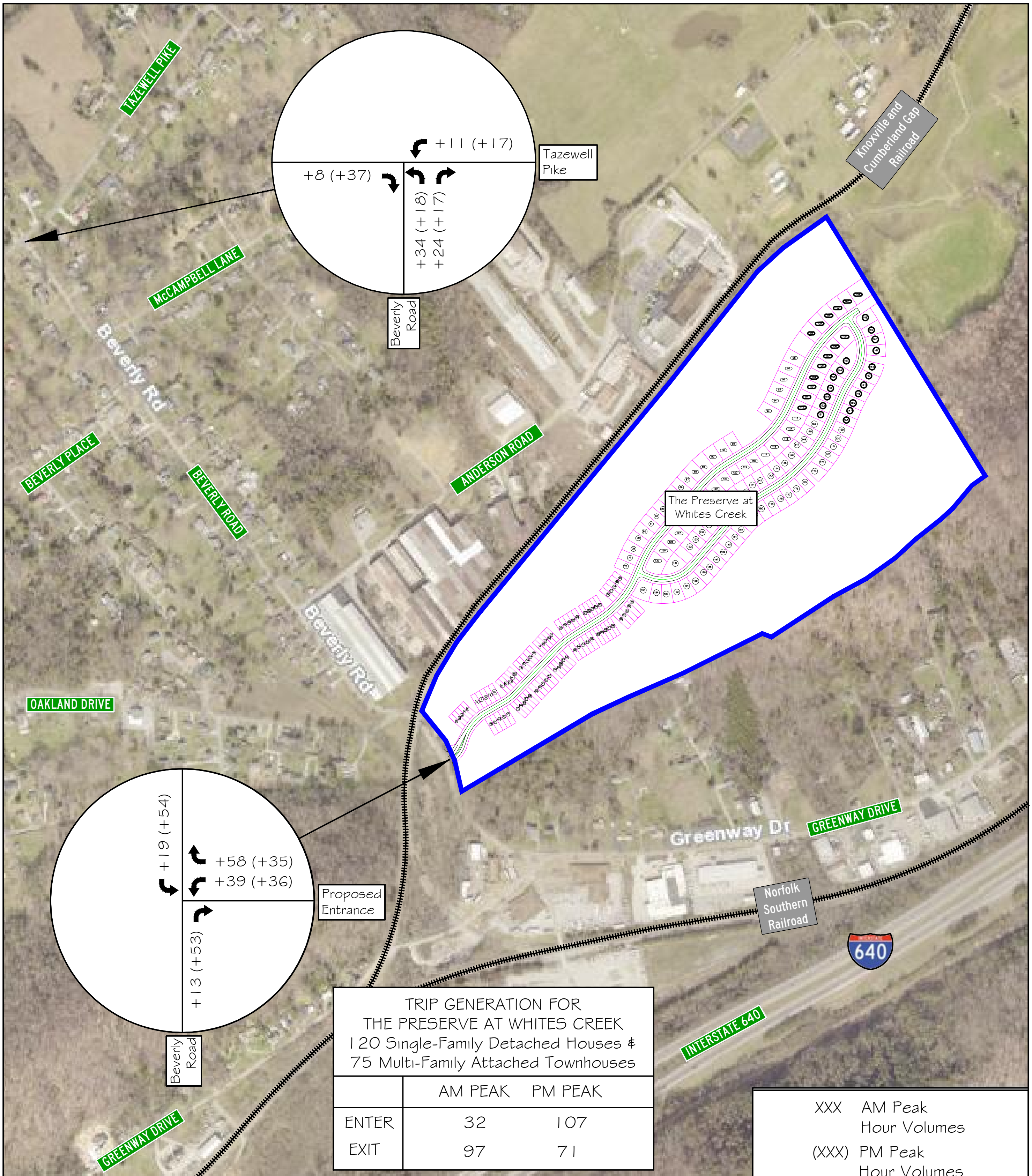
FIGURE 6

The Preserve at Whites Creek

Directional Distribution of Generated Traffic during AM and PM Peak Hour



TRIP GENERATION FOR THE PRESERVE AT WHITES CREEK
120 Single-Family Detached Houses & 75 Multi-Family Attached Townhouses

	AM PEAK	PM PEAK
ENTER	32	107
EXIT	97	71

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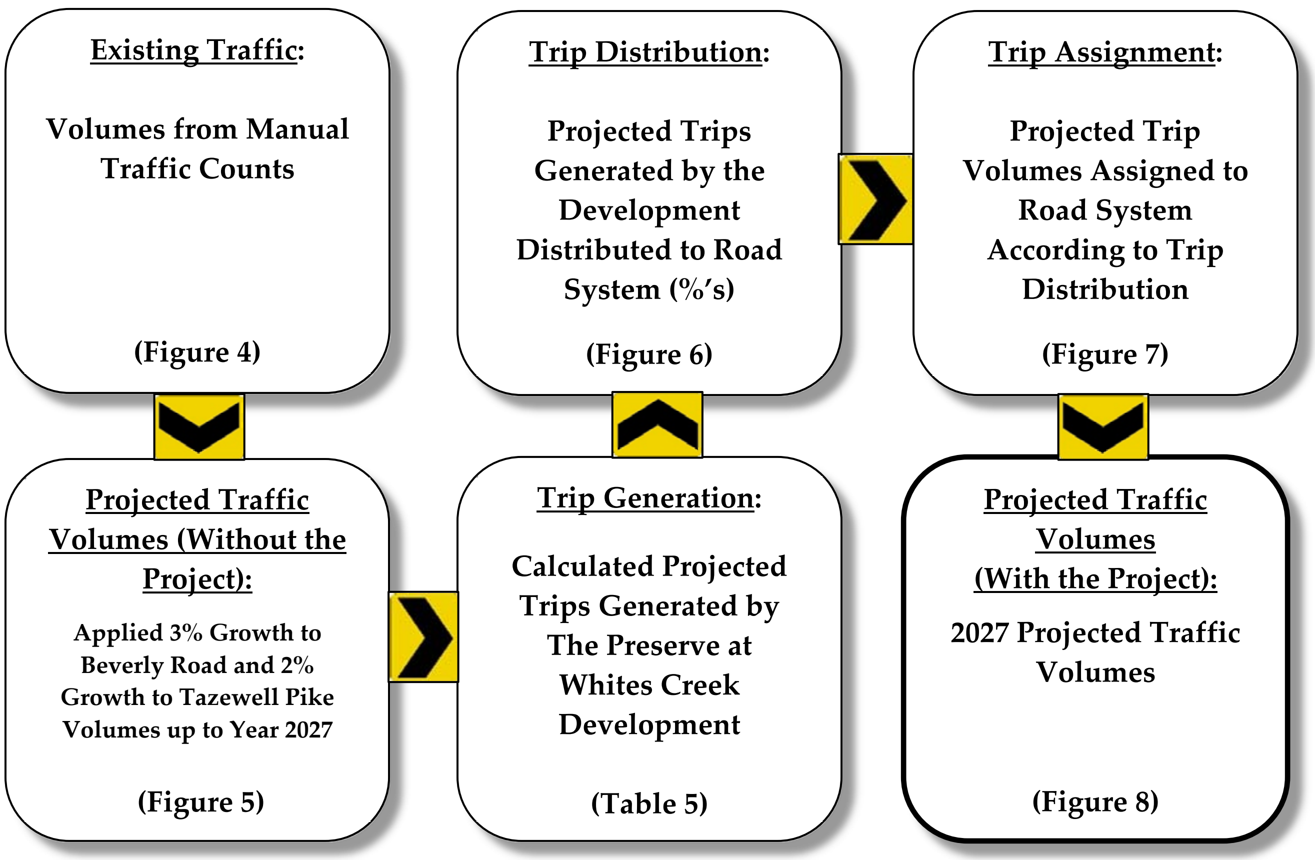
FIGURE 7

The Preserve at Whites Creek

Traffic Assignment of Generated Traffic during AM and PM Peak Hour

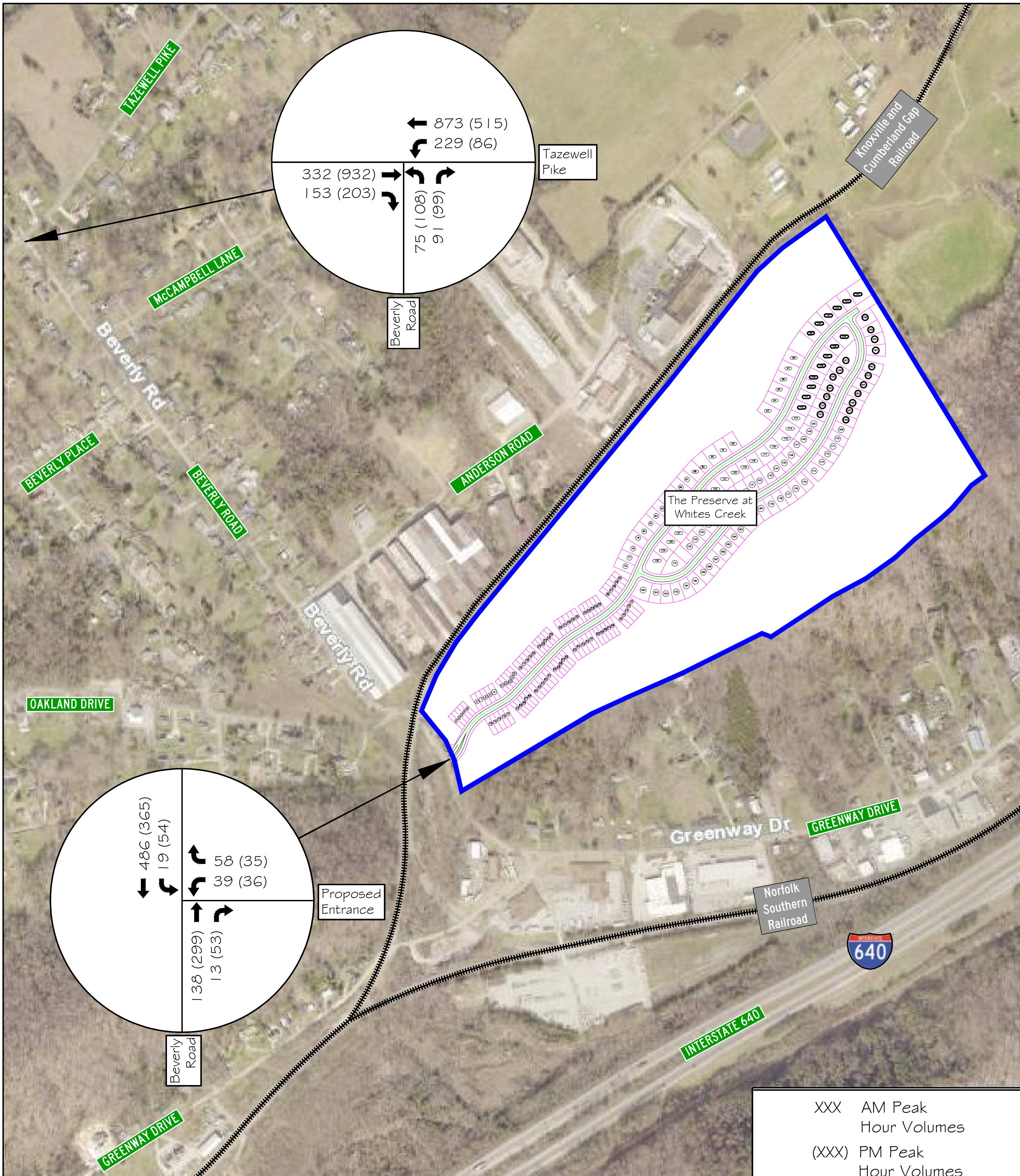
- <u>**PROJECTED TRAFFIC CONDITIONS (WITH THE PROJECT)**</u>**:**

Overall, several additive steps were taken to estimate the <u>total</u> projected traffic volumes at the Tazewell Pike at Beverly Road intersection and the Proposed Entrance at Beverly Road when The Preserve at Whites Creek development is constructed and occupied in 2027. The steps are illustrated below for clarity and review:



The calculated peak hour traffic (Table 5) generated by The Preserve at Whites Creek development was added to the 2027 horizon year traffic (Figure 5) by following the predicted trip distributions and assignments (Figures 6 and 7). This procedure was completed to obtain the <u>total</u> projected traffic volumes when the proposed development is fully built out and occupied in 2027. Figure 8 shows the projected 2027 AM and PM peak hours with the generated development traffic at the studied intersections.

The volumes shown in Figure 8 at the intersection of Tazewell Pike at Beverly Road assume that all the trips generated by the proposed development will travel through this intersection. However, the possibility exists that some of these trips will travel via Oakland Drive, Beverly Place, or Anderson Road instead and bypass this intersection.



AJAX ENGINEERING

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

NOT TO SCALE

NORTH

FIGURE 8

The Preserve at Whites Creek

2027 Peak Hour Traffic Volumes - PROJECTED TRAFFIC CONDITIONS (WITH THE PROJECT)

Capacity analyses were conducted to determine the projected LOS at the studied intersections with the development traffic in 2027. The projected 2027 peak hour calculations with the project resulted in average to good LOS with low vehicle delays for the Proposed Entrance intersection at Beverly Road, as shown in Table 6. The intersection of Tazewell Pike at Beverly Road in the projected 2027 conditions is calculated to operate with intolerable vehicle delays for the Beverly Road approach in the peak hours. The northbound approach of Beverly Road is calculated to operate overcapacity in the projected 2027 conditions, several times over. Appendix G includes the worksheets for these capacity analyses.

TABLE 6
2027 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS (WITH THE PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Tazewell Pike (EB & WB) at Beverly Road (NB)	STOP Unsignalized	Northbound Left/Right	F	29361.8	62.268	F	1545.9	4.138
		Westbound Left	B	10.6	0.365	B	13.1	0.197
Beverly Road (SB & NB) at Proposed Entrance (WB)	STOP Unsignalized	Westbound Left/Right	B	14.2	0.216	C	16.1	0.196
		Southbound Left	A	7.6	0.015	A	8.2	0.051

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology
[a] Level of Service , [b] Average Delay (sec/vehicle) , [c] Volume-to-Capacity Ratio

- **<u>POTENTIAL TRANSPORTATION SAFETY ISSUES</u>:**

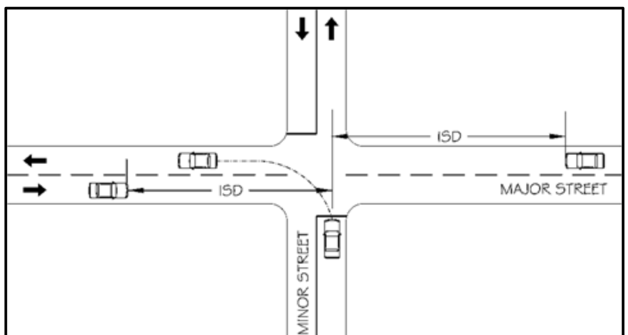
The study area was investigated for potential existing and future safety issues when the development is constructed. These adjacent transportation system features are discussed in the following pages.

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

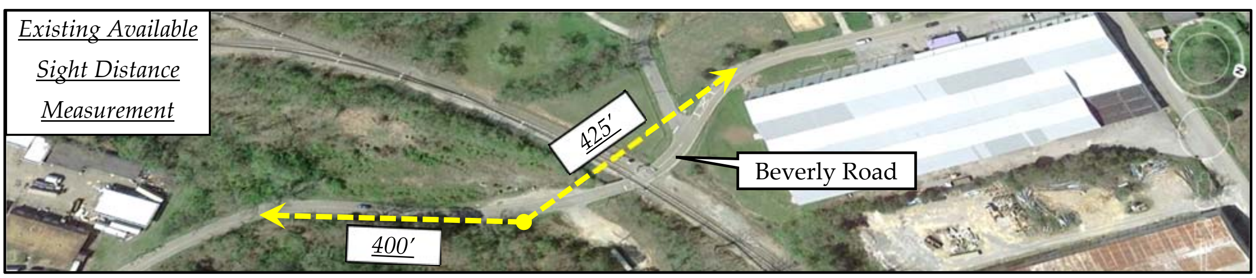
Three traffic maneuvers are available for vehicles stopped on a minor street at a 4-way intersection: (1) left-turn, (2) right-turn, (3) or a crossing maneuver across the major street. For turns from the minor street, ISD is needed to allow a stopped motorist to turn onto a major street without being 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.

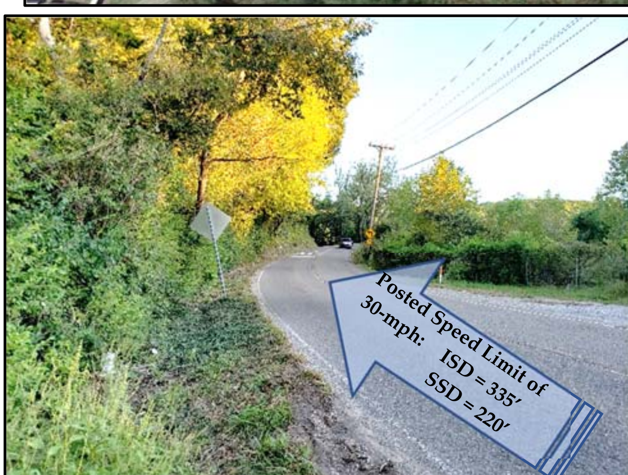
With a posted speed limit of 30-mph on Beverly Road at the Proposed Entrance, the ISD is 335 feet calculated based on AASHTO's (American Association of State Highway Transportation Officials) guidance.

Beverly Road has a 7% road grade downhill to the north at the Proposed Entrance location on the southern side and 0.5% on the northern side (the difference is due to the entrance's location on a vertical curve). Based on the posted speed limit of 30-mph on Beverly Road and the existing road grades, the SSD is calculated to be 200 feet looking to the north and 220 feet to the south.

Visual observations of the sight distances at the Proposed Entrance location on Beverly Road were undertaken. Using a Nikon Laser Rangefinder at the Proposed Entrance location, the available sight distance was visually estimated to be 425' feet to the north (towards Tazewell Pike) and 400' feet to the south. Based on visual observation, the available sight distances from the Proposed Entrance on Beverly Road will be adequate.

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





View of Sight Distance on Beverly Road at Proposed Entrance Location (Looking South)

View of Sight Distance on Beverly Road at Proposed Entrance Location (Looking North)

EVALUATION OF TURN LANE THRESHOLDS

An evaluation of the need for separate entering turn lanes into the development in the projected 2027 conditions was conducted for the Proposed Entrance at Beverly Road.

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

With a posted speed limit of 30-mph on Beverly Road, separate left and right-turn entering lanes are not warranted at the Proposed Entrance based on the projected 2027 AM and PM peak hour traffic volumes. The worksheets for these evaluations are provided in Appendix J.

PROJECTED VEHICLE QUEUES

An additional software program was used to calculate the 2027 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 (Version 11) software was utilized to estimate the projected vehicle queues.

The 95th percentile vehicle queue is the recognized measurement in the traffic 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. The 95th percentile vehicle queue lengths at the intersection of Tazewell Pike at Beverly Road are shown in Table 7 for the existing 2022 conditions, projected 2027 conditions without the project, and the projected 2027 conditions with the project. The calculated vehicle queue lengths for the Proposed Entrance at Beverly Road are shown in Table 8. The vehicle queue worksheet results from the SimTraffic software are in Appendix K.

TABLE 7
VEHICLE QUEUE RESULTS SUMMARY - TAZEWELL PIKE AT BEVERLY ROAD

INTERSECTION	APPROACH/ MOVEMENT	SIMTRAFFIC 95th PERCENTILE QUEUE LENGTH (ft)					
		EXISTING 2022 CONDITIONS		PROJECTED 2027 CONDITIONS (WITHOUT THE PROJECT)		PROJECTED 2027 CONDITIONS (WITH THE PROJECT)	
		AM PEAK HOUR	PM PEAK HOUR	AM PEAK HOUR	PM PEAK HOUR	AM PEAK HOUR	PM PEAK HOUR
Tazwell Pike (EB & WB) at Beverly Road (NB)	Eastbound Thru/Right	14	18	16	16	13	20
	Westbound Left/Thru/Right	301	318	426	485	463	668
	Northbound Left/Right	292	967	832	2039	1965	2051

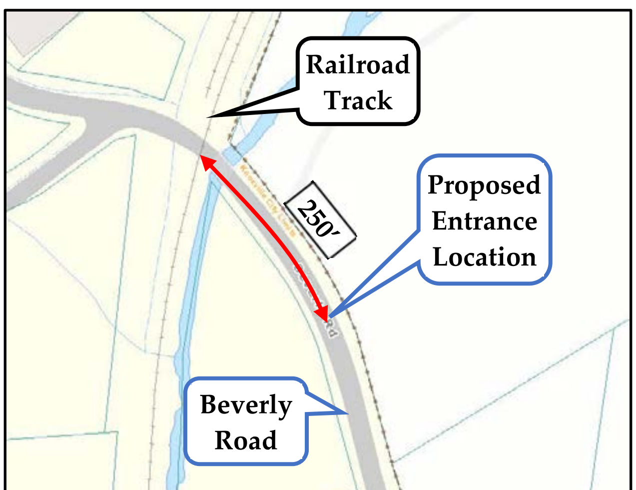
Note: 95th percentile queues were calculated in SimTraffic 11 software

TABLE 8
VEHICLE QUEUE RESULTS SUMMARY - BEVERLY ROAD AT PROPOSED ENTRANCE

INTERSECTION	APPROACH/ MOVEMENT	SIMTRAFFIC 95th PERCENTILE QUEUE LENGTH (ft)	
		PROJECTED 2027 CONDITIONS (WITH THE PROJECT)	
		AM PEAK HOUR	PM PEAK HOUR
Beverly Road (SB & NB) at Proposed Entrance (WB)	Westbound Left/Right	59	55
	Southbound Left/Thru	23	61

Note: 95th percentile queues were calculated in SimTraffic 11 software

Table 7 shows that the projected vehicle queues on Beverly Road at the intersection with Tazewell Pike will be intolerable and has existing and projected unreasonable vehicle queue lengths on the Tazewell Pike approaches as well.



Proposed Entrance on Beverly Road

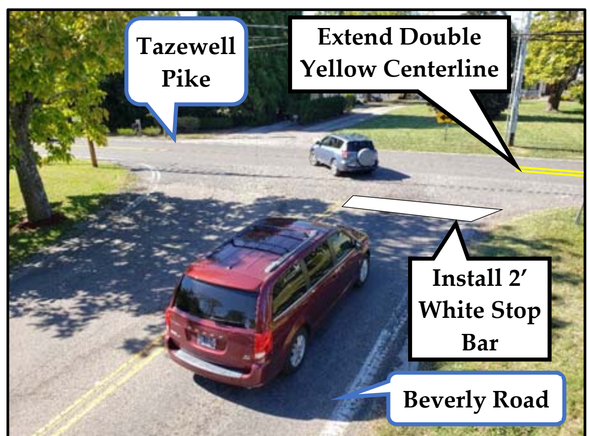
The Proposed Entrance on Beverly Road will be located approximately 250 feet from the railway (centerline to centerline). Based on the calculations, the longest southbound vehicle queue in the projected 2027 conditions at the Proposed Entrance is 61 feet in the PM peak hour, as shown in Table 8. This queue calculation suggests that the Proposed Entrance location will be located far enough away from the railroad to ensure that vehicle queues do not back up onto the railroad track.

CONCLUSIONS & RECOMMENDATIONS

The following is an overview of recommendations to minimize the transportation impacts of The Preserve at Whites Creek on the adjacent transportation system while attempting to achieve an acceptable traffic flow and safety level.

1 **<u>Tazewell Pike at Beverly Road</u>**: The existing and projected 2027 level of service calculations for this intersection resulted in very poor LOS and massively long queues on Beverly Road during peak hours. These poor operations will increase cut-thru traffic on adjacent roadways if remediation is not carried out. These side roads are primarily residential and are not constructed to handle a large influx of vehicles or vehicles speeding to compensate for the perceived lost time due to the longer travel distances to and from Tazewell Pike. The recent placement of speed humps on Beverly Place attests to the traffic volumes spilling from Beverly Road.

In the interim, to reduce the possibility of vehicles clipping each other at the intersection, it is recommended that a 24" white stop bar be installed on Beverly Road and the yellow double centerline on the westbound approach of Tazewell Pike be extended further west. It is believed that these pavement markings would provide a better visual target to designate the appropriate location and turning path for westbound left-turn motorists on Tazewell Pike turning onto Beverly Road and reduce the number of "short-turns".



Tazewell Pike at Beverly Road (Looking Northwest)

There was a study in the past that determined that this intersection met warrants for traffic signalization. Though traffic signal warrants were met in the past, it is not known by the analyst why this intersection was not remediated with a traffic signal. It is highly recommended that this intersection be converted to a traffic signal as soon as feasible. In addition to installing a traffic signal, turn lanes on the approaches at the t-intersection will need to be constructed to remediate the vehicle delays and queues fully. Overall, the existing vehicle delays and queues are not acceptable and are projected to worsen in the future, even without The Preserve at Whites Creek being developed.

As a further investigation into potential remediation for this intersection in the projected 2027 conditions, the intersection was analyzed with a traffic signal to provide some general recommendations based on the results of this study. The traffic signal timing at the intersection was optimized in Synchro software. The intersection was designed to fully contain the projected 95th percentile vehicle queue lengths and result in reasonable LOS. The results of this additional analysis are included in Appendix G, and the results are shown in Table 9.

TABLE 9
2027 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS (WITH THE PROJECT) AND TRAFFIC SIGNAL

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Tazwell Pike (EB & WB) at Beverly Road (NB)	Signalized	Eastbound	A	5.9		C	30.2	
		Westbound	B	17.6		B	10.5	
		Northbound	C	25.1		C	28.6	
		Summary	B	15.5	0.730	C	24.1	0.780

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2000 intersection methodology
[a] Level of Service , [b] Average Delay (sec/vehicle) , [c] Volume-to-Capacity Ratio

The analysis with a traffic signal and the results shown in Table 9 included additional lanes at the intersection. These lanes included a new eastbound right-turn lane on Tazewell Pike with a storage length of 75 feet, a new westbound left-turn lane on Tazewell Pike with a storage length of 100 feet, and a northbound right-turn lane on Beverly Road with a storage length of 125 feet. Compared to the results in Table 6, with the intersection operating as-is with stop conditions on Beverly Road, the vehicle delays for the northbound approach are incredibly reduced with a traffic signal and additional lanes.

Traffic Signal Design at Intersection of Tazewell Pike at Beverly Road

2 **Beverly Road at Proposed Entrance**: The projected 2027 level of service calculations for the Proposed Entrance intersection at Beverly Road resulted in low vehicle delays. The construction of left and right-turn lanes on Beverly Road for entering traffic is not warranted at the Proposed Entrance. Dual exiting lanes are shown in the layout plan, but a single exiting lane for the development entrance will be sufficient.

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

2b) Sight distances at the Proposed Entrance approach at Beverly Road must not be impacted by future landscaping, signage, or existing vegetation. Based on a posted speed limit of 30-mph on Beverly Road, the required intersection sight distance is 335 feet looking in each direction at the entrance. The stopping sight distance is 200 feet looking to the north and 220 feet to the south at the Proposed Entrance location on Beverly Road. A visual inspection determined that the intersection and stopping sight distances are available at the Proposed Entrance location. The site designer must ensure that these sight distances are accounted for and provided in the design plans.

Since there is existing vegetation and a sharp horizontal curve to the south of the Proposed Entrance on Beverly Road, it is recommended that a registered land surveyor make measurements to determine the available sight distance. Likewise, while the sight distance to the north appears to be more than what is required, it is recommended that the registered land surveyor measure the sight distance to the north as well. The horizontal s-curve alignment of Beverly Road, the railroad structures, and the vegetation along the railroad hinders full sight distance availability.

2c) The 95th percentile vehicle queue calculations for the southbound approach in the projected 2027 conditions on Beverly Road at the Proposed Entrance resulted in 61 feet. This distance is available between the railroad track and the Proposed Entrance location. Due to the hazards presented at an at-grade railroad crossing, it is recommended that the site designer keep this separation between the two.

Keeping the Proposed Entrance on Beverly Road as far south from the railroad and creek crossing helps ensure that any potential backups do not extend back to the track.

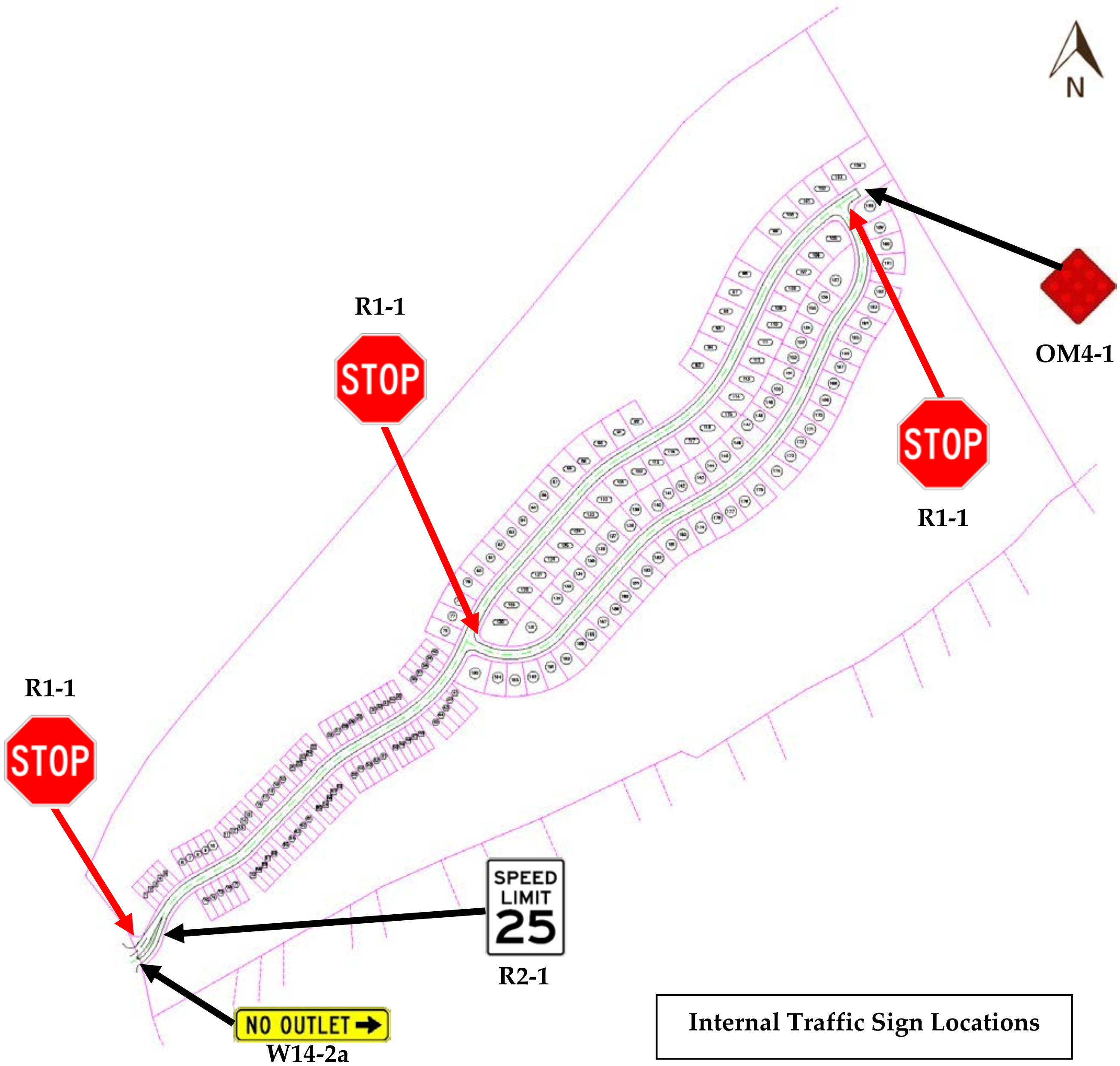
Furthermore, due to the low elevation and proximity to Whites Creek, keeping the Proposed Entrance away, there will be a reduced possibility that the entrance will be blocked during significant storm events.

The potential for a secondary access point into the development is non-existent. This non-potential is due to the limited road frontage along Beverly Road, the existing land features, and the lack of other roads around the development property. The existing land features include the mountain ridge with steep topography, Whites Creek, the railroad line, and these all contribute to limited opportunities to develop a secondary access point.

3 **<u>The Preserve at Whites Creek Internal Roads:</u>** The layout plan shows one entrance on Beverly Road constructed for the development, as shown in Figure 3.

3a) A 25-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the development entrance off Beverly Road. It is recommended that a "No Outlet" Sign (W14-2a) be installed at the front of the development at Beverly Road. This sign can be installed above or below the street name sign.

3b) End of roadway signage (OM4-1) should be installed at the eastern end of Road "A" if a stub road is constructed. Stop Signs (R1-1) with 24" white stop bars and other traffic signage are recommended to be installed at the internal locations, as shown below:



Internal Traffic Sign Locations

3c) Sight distance at the new internal road intersections must not be impacted by signage, parked cars, or future landscaping. With a proposed speed limit of 25-mph in the development, the internal intersection sight distance is 250 feet. The required stopping sight distance is 155 feet for a level road grade. The site designer should ensure that these internal sight distance lengths are met.

3d) All drainage grates and covers for the residential development must be pedestrian and bicycle safe.

3e) The site designer should include a parking area and a centralized mail delivery center within the development if directed by the local post office. The site plan does not show a general location in the development, but a specific plan with a parking area should be designed and provided if required.

3f) For residential subdivisions with a single access point and more than 150 units, the County has a long-standing unwritten design policy requiring a boulevard road typical section at the entrance. This policy is to ensure access to the subdivision during potential emergencies. Since the proposed layout of The Preserve at Whites Creek only includes one means of ingress and egress and will have 195 units, the subdivision entrance is recommended to be designed and constructed with a boulevard roadway section. At a minimum, the boulevard section should have a 10-foot median with 2 – 18-foot lanes within 60 feet of right-of-way. Typically, a boulevard road section is designed and constructed to the first intersecting street within the development, which would be Road "B" in this case.

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

Other Transporation Considerations: Other transportation-related considerations include the following:

4a) It is recommended that a "Do Not Stop on Tracks" (R8-8) sign be installed to provide additional awareness regarding the railroad crossing if an unexpectedly long vehicle queue forms on the southbound approach of Beverly Road at the intersection with the Proposed Entrance. The sign should be located on the right-hand side of Beverly Road on the near side (north side) of the railroad grade crossing facing southbound traffic.

Do Not Stop on Tracks (R8-8)

4b) According to Google Street Maps, as recently as February 2019, a "Narrow Bridge" (W5-2) sign was installed for southbound traffic on Beverly Road just north of the railroad crossing and south of the intersection with Oakland Drive. This sign is no longer installed. To match the existing warning sign for northbound traffic on Beverly Road before the bridge and to provide advance warning, this signage should be reinstalled. Its previous location may need re-examination since the image in Google Maps shows the signage leaning backward, suggesting that a larger vehicle turning right from Oakland Drive to southbound Beverly Road may have struck and pushed it over.

Narrow Bridge (W5-2)

4c) The existing bridge alignment and width on Beverly Road adjacent to the rail crossing are not ideal. Still, it has sufficient width (just over 20 feet) even though it does make some motorists driving larger vehicles uncomfortable to cross simultaneously, as observed. However, this bridge, along with the s-curvature of Beverly Road and the railroad crossing, does seem to reduce vehicle speeds in the vicinity and acts as a "natural" traffic calming measure.

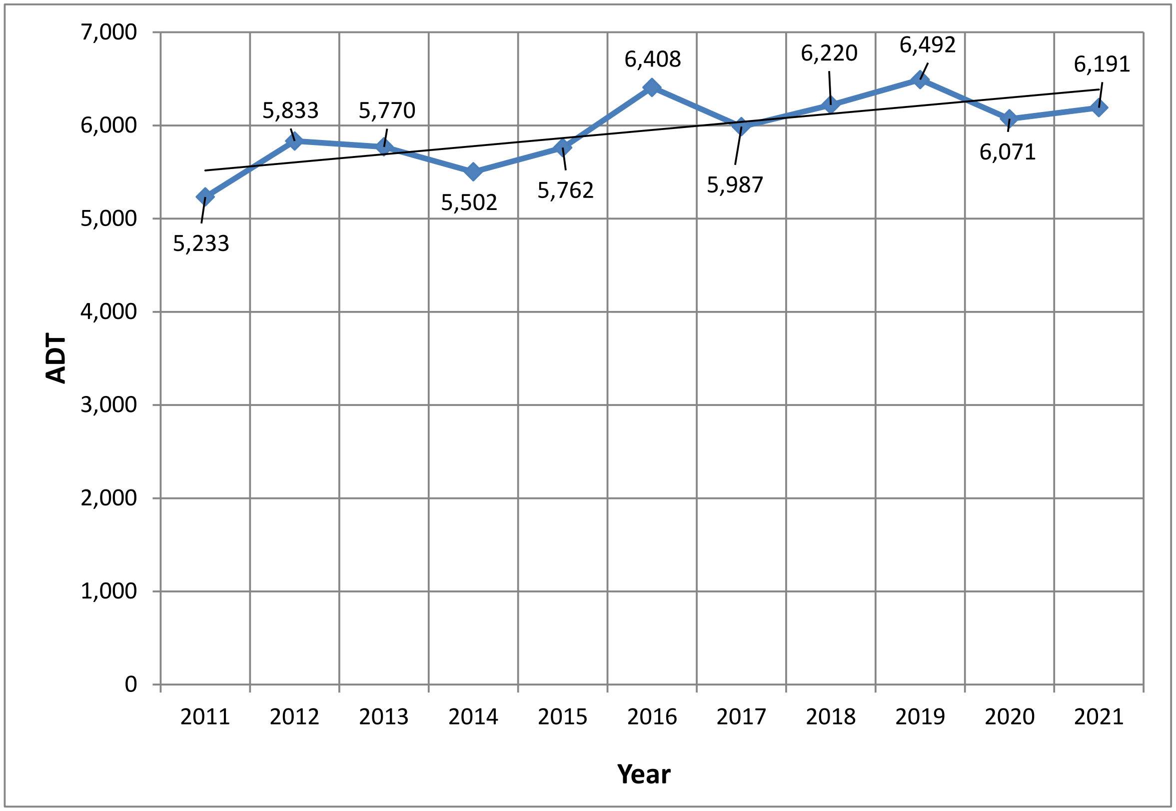
APPENDIX A

HISTORICAL TRAFFIC COUNT DATA

Historical Traffic Counts

Organization: TDOT
Station ID #: 47000508
Location: Greenway Drive, east of Beverly Road

YEAR	ADT	Trendline
2011	5,233	
2012	5,833	
2013	5,770	
2014	5,502	
2015	5,762	
2016	6,408	
2017	5,987	
2018	6,220	
2019	6,492	
2020	6,071	
2021	6,191	



2011 - 2021 Growth Rate = 18.3%
Average Annual Growth Rate = 1.7%

TN TDOT Department of Transportation

TCDS Help MS2

Transportation Data Management System

Home | TMC | TCLS | RSMS | NMDS | WOTS | TFMS

Login | Locate | Locate All | Email This

Auto-Locate OFF

List View | All DIRs

Record 7631 of 15612 Goto Record go

Location ID	47000508	MPO ID	
Type	SPOT	HPMS ID	
On NHS		On HPMS	
LRS ID	4705653001	LRS Loc Pt.	1.058
SF Group	Urban	Route Type	
AF Group	18	Route	
CF Group	Knox	Active	Yes
Class Dist Grp	18	Category	CC
Seas Clss Grp			
WIM Group			
QC Group	Default		
Fnct'l Class	Minor Collector	Milepost	
Located On	GREENWAY DR.		
Loc On Alias			
	KNOXVILLE NE		

More Detail

STATION DATA

Directions: 2-WAY

AADT

	Year	AADT	DHV-30	K %	D %	PA	BC	Src
	2021	6,191	557	9	65	6,104 (99%)	87 (1%)	
	2020	6,071	663	11	65	5,865 (97%)	206 (3%)	
	2019	6,492		12	65			
	2018	6,220		10	65			
	2017	5,987[2]						

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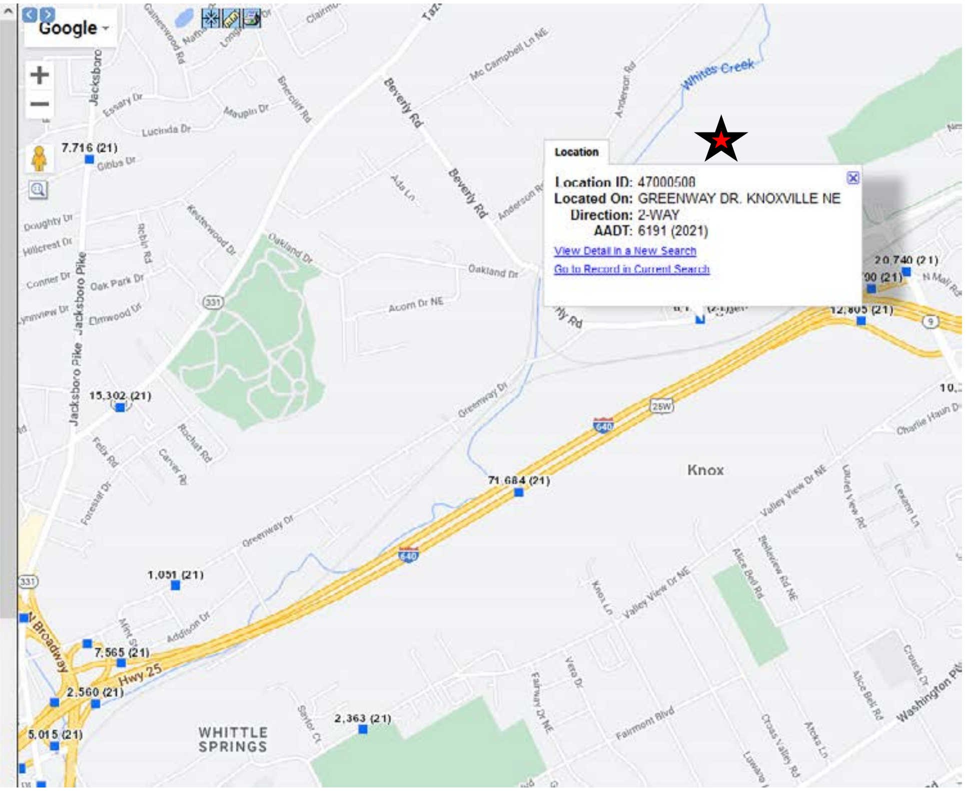
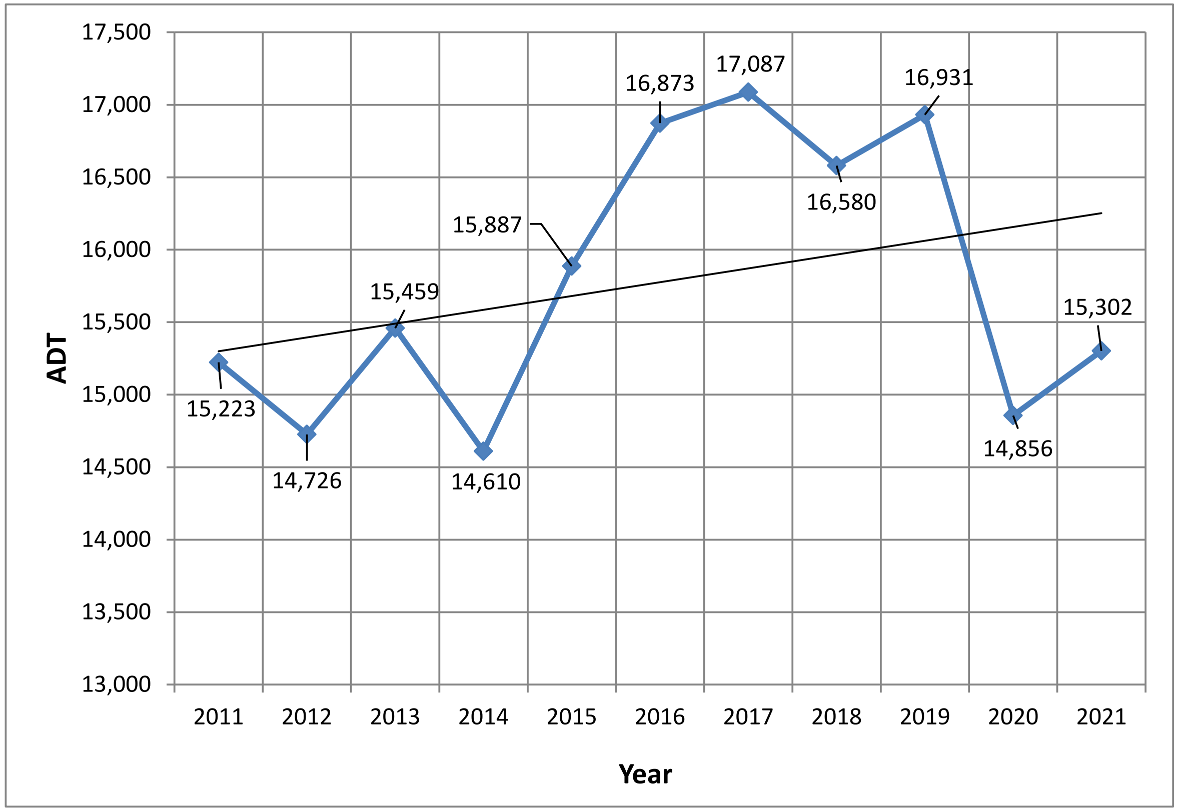


Historical Traffic Counts

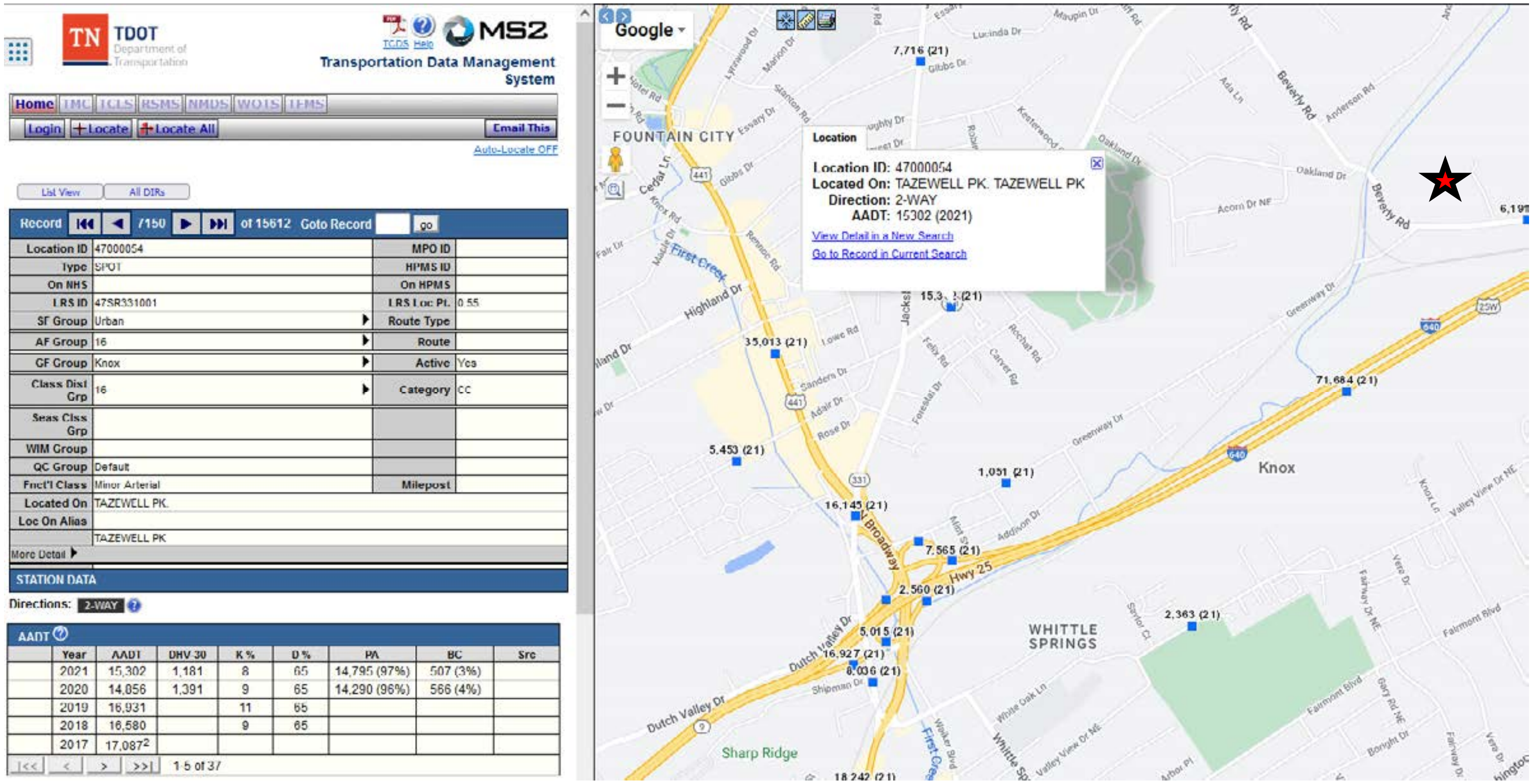
Organization: TDOT
Station ID #: 47000054
Location: Tazewell Pike, east of Jacksboro Pike

YEAR	ADT	Trendline
2011	15,223	
2012	14,726	
2013	15,459	
2014	14,610	
2015	15,887	
2016	16,873	
2017	17,087	
2018	16,580	
2019	16,931	
2020	14,856	
2021	15,302	



2011 - 2021 Growth Rate = 0.5%

Average Annual Growth Rate = 0.1%



Year	AADT	DHV 30	K %	D %	PA	BC	Src
2021	15,302	1,181	8	65	14,795 (97%)	507 (3%)	
2020	14,856	1,391	9	65	14,290 (96%)	566 (4%)	
2019	16,931		11	65			
2018	16,580		9	65			
2017	17,087[2]						

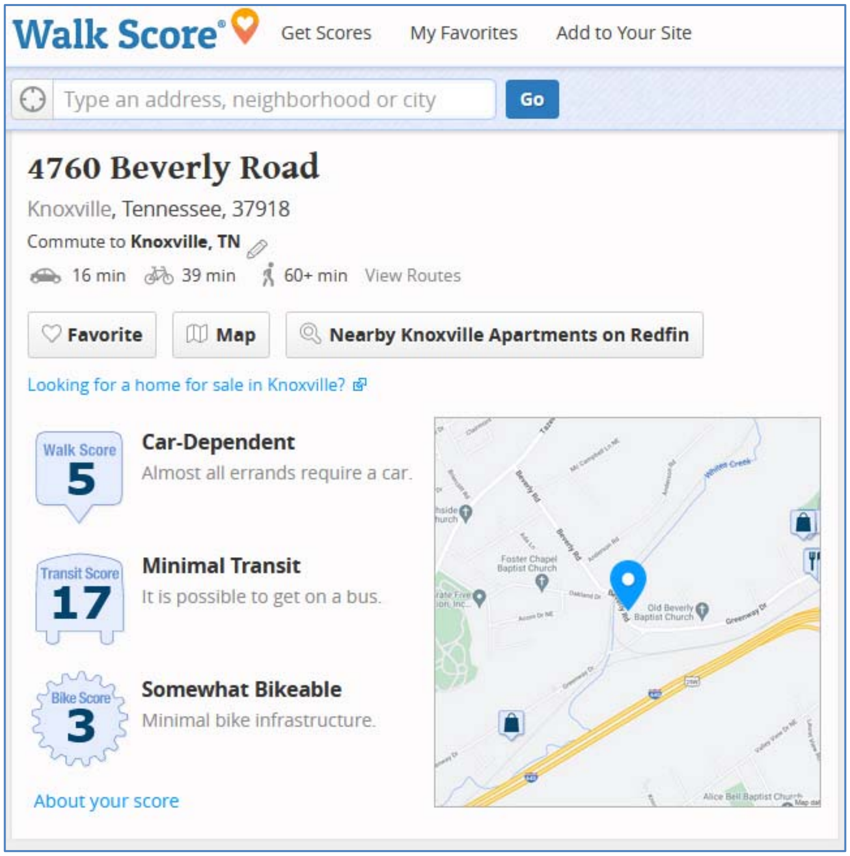
1-5 of 37

APPENDIX B

WALK SCORE

WALKSCORE

(from walkscore.com)



Scores for 4760 Beverly Road

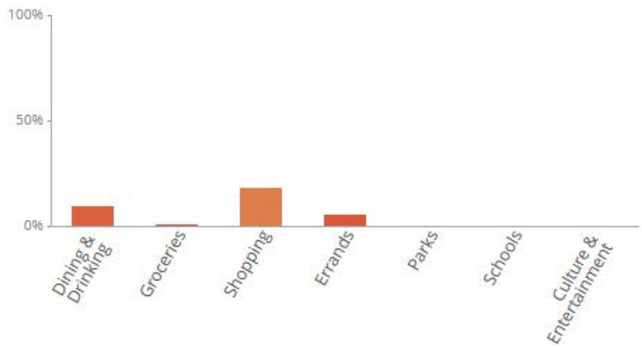
×

Walk Score 5 | Transit Score 17 | Bike Score 3

Walk Score	Transit Score	Bike Score

Score Details | **What is Walk Score**

The Walk Score for 4760 Beverly Road is based on the following categories.



Scores for 4760 Beverly Road

×

Walk Score 5 | Transit Score 17 | Bike Score 3

Walk Score	Transit Score	Bike Score

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

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

Scores for 4760 Beverly Road

×

Walk Score	Transit Score	Bike Score

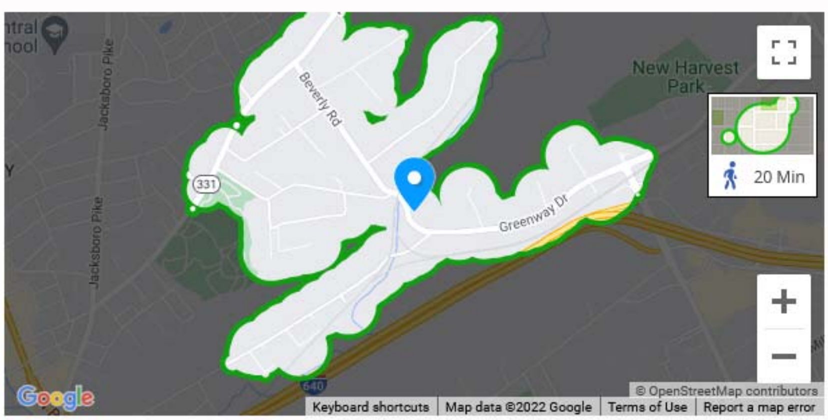
Bike Score measures whether an area is good for biking based on bike lanes and trails, hills, road connectivity, and destinations.

90-100	**Biker's Paradise** Daily errands can be accomplished on a bike
70-89	**Very Bikeable** Biking is convenient for most trips
50-69	**Bikeable** Some bike infrastructure
0-49	**Somewhat Bikeable** Minimal bike infrastructure

Travel Time Map

Add to your site

Explore how far you can travel by car, bus, bike and foot from 4760 Beverly Road.



What's Nearby

Restaurants:
Habaneros Mexican Grill .7mi

Coffee:
Starbucks .3mi

Bars:

Groceries:
Honey Baked Ham .9mi

Parks:
Fountain City Park 1.7mi

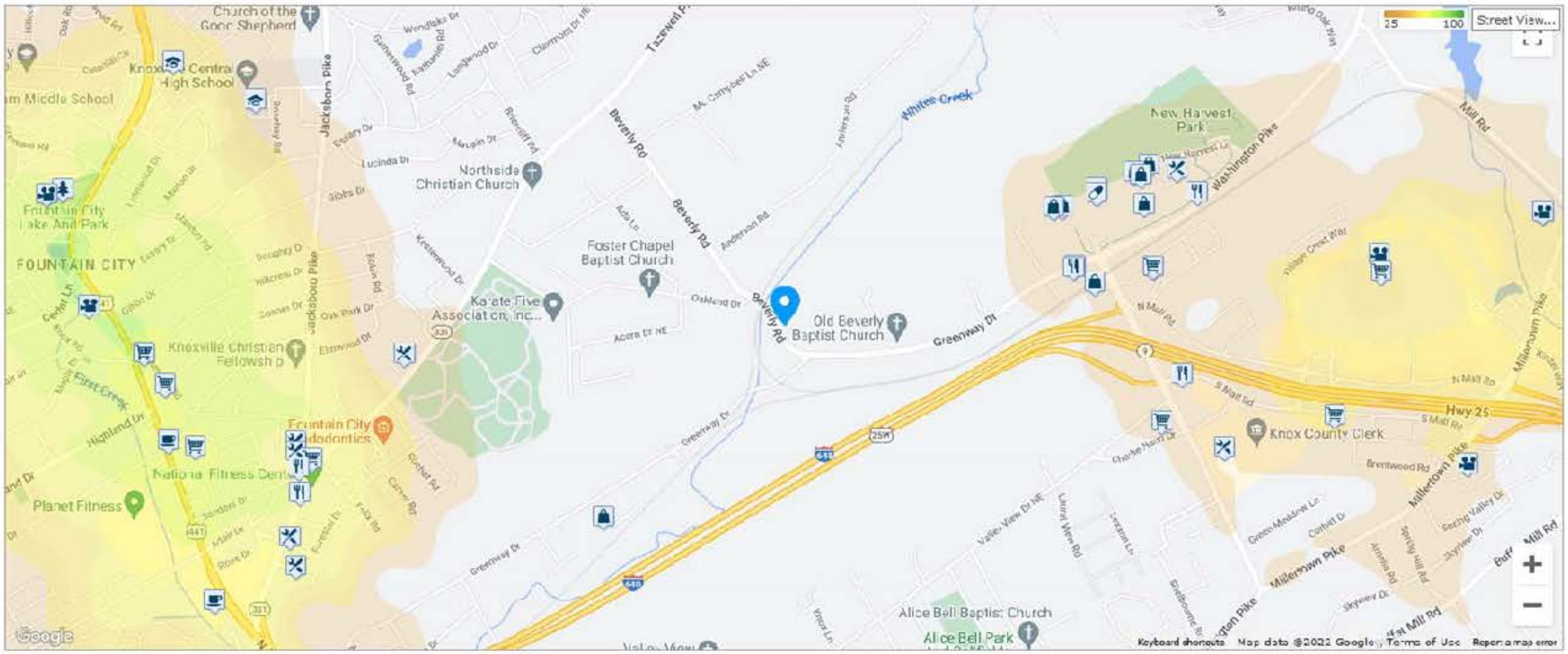
Schools:
Richard Yoakley School 1.2mi

Shopping:
Volunteer Lawn Care .5mi

Entertainment:
Regal Entertainment Group 1.5mi

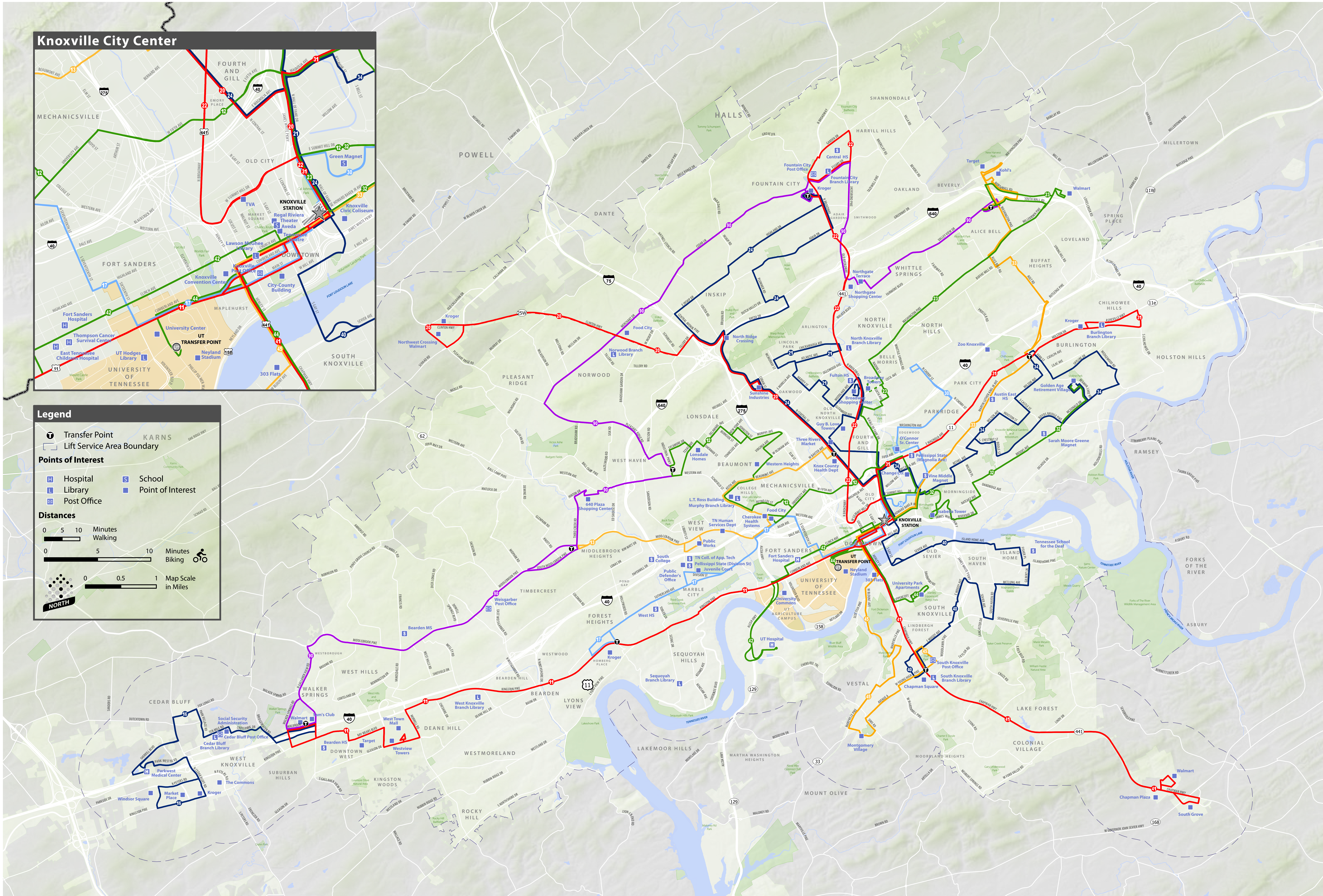
Errands:
Target Pharmacy .3mi

Search Nearby:

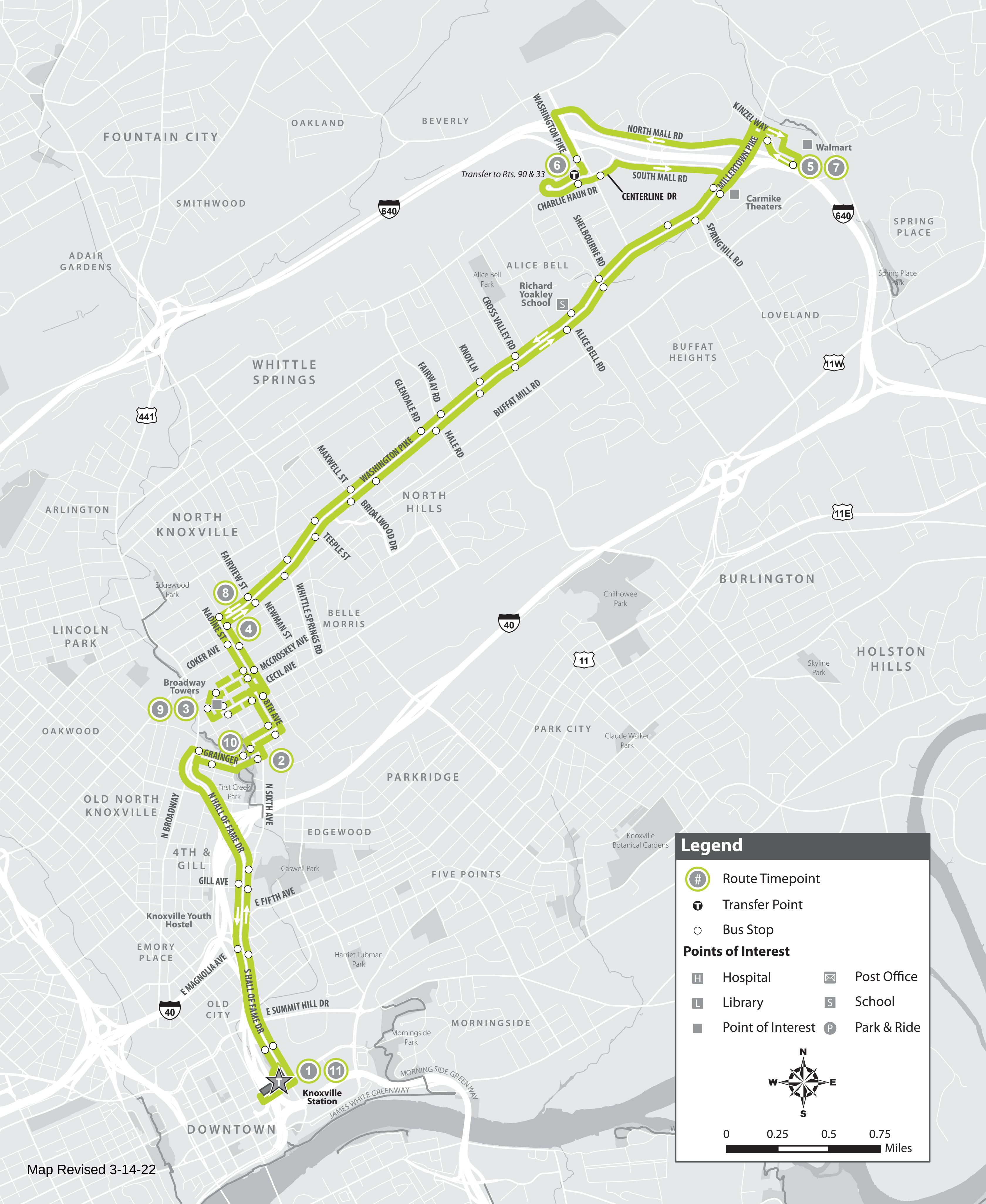


APPENDIX C

KNOXVILLE AREA TRANSIT MAP AND INFORMATION



Knoxville City Center
Legend
Transfer Point
Lift Service Area Boundary
Points of Interest
Hospital
Library
Post Office
School
Point of Interest
Distances
0 5 10 Minutes Walking
0 5 10 Minutes Biking
0 0.5 1 Map Scale in Miles
NORTH
KNOXVILLE STATION
UT TRANSFER POINT
MECHANICSVILLE
FOURTH AND GILL
OLD CITY
FORT SANDERS
DOWNTOWN
UNIVERSITY OF TENNESSEE
SOUTH KNOXVILLE
MAPLEHURST
HALLS
POWELL
FOUNTAIN CITY
SHANNONDALE
HARRILL HILLS
OAKLAND
BEVERLY
MILLERTOWN
SPRING PLACE
ALICE BELL
LOVELAND
WHITTLE SPRINGS
BUFFAT HEIGHTS
CHILHOWEE HILLS
NORTH KNOXVILLE
NORTH HILLS
BURLINGTON
HOLSTON HILLS
PARK CITY
PARKRIDGE
RAMSEY
INSKIP
ARLINGTON
LINCOLN PARK
BELLE MORRIS
NORWOOD
PLEASANT RIDGE
DANTE
LONSDALE
WEST HAVEN
BEAUMONT
COLLEGE HILLS
WEST VIEW
MIDDLEBROOK HEIGHTS
TIMBERCREST
FOREST HEIGHTS
MARBLE CITY
SEQUOYAH HILLS
BEARDEN
LYONS VIEW
WEST HILLS
WALKER SPRINGS
CEDAR BLUFF
WEST KNOXVILLE
SUBURBAN HILLS
DOWNTOWN WEST
KINGSTON WOODS
ROCKY HILL
WESTMORELAND
DEANE HILL
LAKEMOOR HILLS
MARTHA WASHINGTON HEIGHTS
VESTAL
MOUNT OLIVE
LAKE FOREST
COLONIAL VILLAGE
MOORELAND HEIGHTS
OLD SEVIER
SOUTH HAVEN
ISLAND HOME
FORKS OF THE RIVER
ASBURY
LINDBERGH FOREST
KARNS



Map Revised 3-14-22

Route 23 - Millertown: Weekdays

Going away from downtown							*Going toward downtown*					
Knoxville Station Bay I	**Grainger @ Sixth**	**Broadway Towers**	**Nadine @ Washington Pike**	**Walmart**	**Charlie Haun at Washingt on Pike**	**Goes on to serve**	**Charlie Haun @ Washingt on Pike**	**Walmart**	**Washington Pike @ Fairview**	**Broadway Towers**	**Sixth @ Grainger**	**Knoxville Station Bay I**
1	**2**	**3**	**4**	**5**	**6**		**6**	**7**	**8**	**9**	**10**	**11**
							5:30 AM	5:37 AM	5:49 AM		5:56 AM	6:10 AM
							6:30 AM	6:37 AM	6:49 AM		6:56 AM	7:10 AM
6:15 AM	6:24 AM		6:29 AM	6:45 AM	7:00 AM	**Route 33**	7:30 AM	7:37 AM	7:49 AM		7:56 AM	8:10 AM
7:15 AM	7:24 AM		7:29 AM	7:45 AM	8:00 AM	**Route 33**	8:30 AM	8:37 AM	8:49 AM	8:54 AM	8:56 AM	9:10 AM
8:15 AM	8:24 AM		8:29 AM	8:45 AM	9:00 AM	**Route 33**	9:30 AM	9:37 AM	9:49 AM	9:54 AM	9:56 AM	10:10 AM
9:15 AM	9:24 AM	9:27 AM	9:29 AM	9:45 AM	10:00 AM	**Route 33**	10:30 AM	10:37 AM	10:49 AM	10:54 AM	10:56 AM	11:10 AM
10:15 AM	10:24 AM	10:27 AM	10:29 AM	10:45 AM	11:00 AM	**Route 33**	11:30 AM	11:37 AM	11:49 AM	11:54 AM	11:56 AM	12:10 PM
11:15 AM	11:24 AM	11:27 AM	11:29 AM	11:45 AM	12:00 PM	**Route 33**	12:30 PM	12:37 PM	12:49 PM	12:54 PM	12:56 PM	1:10 PM
12:15 PM	12:24 PM	12:27 PM	12:29 PM	12:45 PM	1:00 PM	**Route 33**	1:30 PM	1:37 PM	1:49 PM	1:54 PM	1:56 PM	2:10 PM
1:15 PM	1:24 PM	1:27 PM	1:29 PM	1:45 PM	2:00 PM	**Route 33**	2:30 PM	2:37 PM	2:49 PM	2:54 PM	2:56 PM	3:10 PM
2:15 PM	2:24 PM	2:27 PM	2:29 PM	2:45 PM	3:00 PM	**Route 33**	3:30 PM	3:37 PM	3:49 PM	3:54 PM	3:56 PM	4:10 PM
3:15 PM	3:24 PM	3:27 PM	3:29 PM	3:45 PM	4:00 PM	**Route 33**	4:30 PM	4:37 PM	4:49 PM		4:56 PM	5:10 PM
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5:15 PM	5:24 PM		5:29 PM	5:45 PM	6:00 PM	**Route 33**	6:30 PM	6:37 PM	6:49 PM		6:56 PM	7:10 PM
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7:15 PM	7:24 PM		7:29 PM	7:45 PM	8:00 PM	**Route 33**	8:30 PM	8:37 PM	8:49 PM		8:56 PM	9:10 PM
8:15 PM	8:24 PM		8:29 PM	8:45 PM	9:00 PM							
9:15 PM	9:24 PM		9:29 PM	9:45 PM	10:00 PM							

Route 23 - Millertown: SATURDAYS

Going away from downtown							*Going toward downtown*					
Knoxville Station Bay I	**Grainger @ Sixth**	**Broadway Towers**	**Nadine @ Washington Pike**	**Walmart**	**Charlie Haun @ Washingt on Pike**	**Goes on to serve**	**Charlie Haun @ Washingt on Pike**	**Walmart**	**Washington Pike @ Fairview**	**Broadway Towers**	**Sixth @ Grainger**	**Knoxville Station Bay I**
1	**2**	**3**	**4**	**5**	**6**		**6**	**7**	**8**	**9**	**10**	**11**
							7:30 AM	7:37 AM	7:49 AM		7:56 AM	8:10 AM
7:15 AM	7:24 AM		7:29 AM	7:45 AM	8:00 AM	**Route 33**	8:30 AM	8:37 AM	8:49 AM		8:56 AM	9:10 AM
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8:15 PM	8:24 PM		8:29 PM	8:45 PM	9:00 PM							
9:15 PM	9:24 PM		9:29 PM	9:45 PM	10:00 PM							

Route 23 - Millertown: SUNDAYS

Going away from downtown							*Going toward downtown*					
Knoxville Station Bay I	**Grainger @ Sixth**	**Broadway Towers**	**Nadine @ Washington Pike**	**Walmart**	**Charlie Haun @ Washingt on Pike**	**Goes on to serve**	**Charlie Haun @ Washingt on Pike**	**Walmart**	**Washington Pike @ Fairview**	**Broadway Towers**	**Sixth @ Grainger**	**Knoxville Station Bay I**
1	**2**	**3**	**4**	**5**	**6**		**6**	**7**	**8**	**9**	**10**	**11**
							7:30 AM	7:37 AM	7:49 AM		7:56 AM	8:10 AM
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8:15 AM	8:24 AM		8:29 AM	8:45 AM	9:00 AM	Route 33	9:30 AM	9:37 AM	9:49 AM		9:56 AM	10:10 AM
9:15 AM	9:24 AM		9:29 AM	9:45 AM	10:00 AM	Route 33	10:30 AM	10:37 AM	10:49 AM		10:56 AM	11:10 AM
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1:15 PM	1:24 PM		1:29 PM	1:45 PM	2:00 PM	Route 33	2:30 PM	2:37 PM	2:49 PM		2:56 PM	3:10 PM
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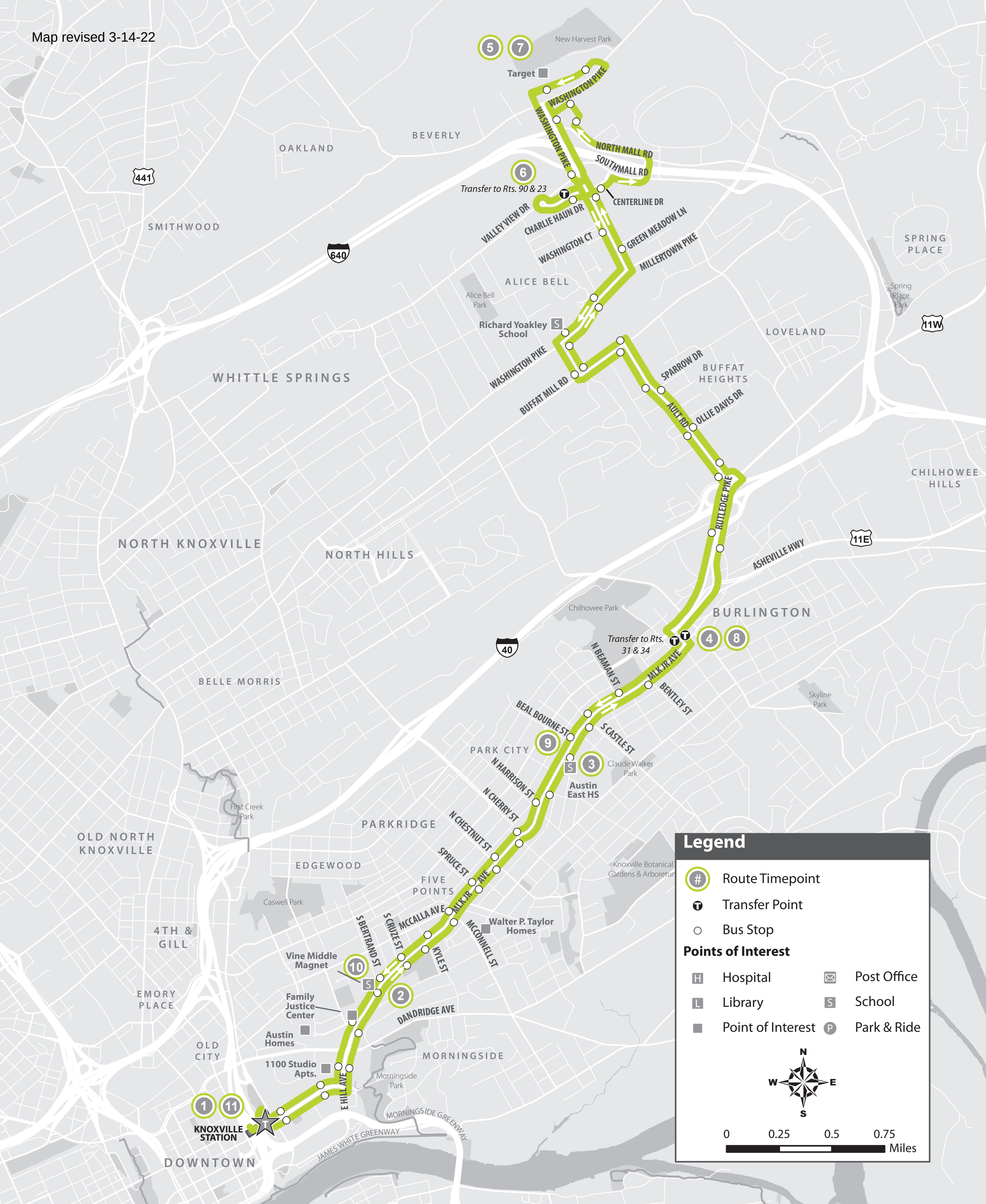
3:15 PM	3:24 PM		3:29 PM	3:45 PM	4:00 PM	Route 33	4:30 PM	4:37 PM	4:49 PM		4:56 PM	5:10 PM
4:15 PM	4:24 PM		4:29 PM	4:45 PM	5:00 PM							
5:15 PM	5:24 PM		5:29 PM	5:45 PM	6:00 PM							

Map revised 3-14-22



Route 33 - MLK, Jr. Ave: Weekdays

Going away from downtown							*Going toward downtown*					
Knoxville Station Bay N	**MLK @ Bertrand**	**Austin East High**	**Kirkwood St. Superstop**	**Target**	**Charlie Haun @ Washington Pike**	**Goes on to serve**	**Charlie Haun @ Washington Pike**	**Target**	**Kirkwood St. Superstop**	**MLK @ Beal Bourne Street**	**MLK @ Bertrand**	**Knoxville Station Bay N**
1	**2**	**3**	**4**	**5**	**6**		**6**	**7**	**8**	**9**	**10**	**11**
									6:24 AM	6:27 AM	6:34 AM	6:40 AM
							7:00 AM	7:07 AM	7:24 AM	7:27 AM	7:34 AM	7:40 AM
6:45 AM	6:48 AM	6:57 AM	7:03 AM	7:16 AM	7:25 AM	**Route 23**	8:00 AM	8:07 AM	8:24 AM	8:27 AM	8:34 AM	8:40 AM
7:45 AM	7:48 AM	7:57 AM	8:03 AM	8:16 AM	8:25 AM	**Route 23**	9:00 AM	9:07 AM	9:24 AM	9:27 AM	9:34 AM	9:40 AM
8:45 AM	8:48 AM	8:57 AM	9:03 AM	9:16 AM	9:25 AM	**Route 23**	10:00 AM	10:07 AM	10:24 AM	10:27 AM	10:34 AM	10:40 AM
9:45 AM	9:48 AM	9:57 AM	10:03 AM	10:16 AM	10:25 AM	**Route 23**	11:00 AM	11:07 AM	11:24 AM	11:27 AM	11:34 AM	11:40 AM
10:45 AM	10:48 AM	10:57 AM	11:03 AM	11:16 AM	11:25 AM	**Route 23**	12:00 PM	12:07 PM	12:24 PM	12:27 PM	12:34 PM	12:40 PM
11:45 AM	11:48 AM	11:57 AM	12:03 PM	12:16 PM	12:25 PM	**Route 23**	1:00 PM	1:07 PM	1:24 PM	1:27 PM	1:34 PM	1:40 PM
12:45 PM	12:48 PM	12:57 PM	1:03 PM	1:16 PM	1:25 PM	**Route 23**	2:00 PM	2:07 PM	2:24 PM	2:27 PM	2:34 PM	2:40 PM
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7:45 PM	7:48 PM	7:57 PM	8:03 PM	8:16 PM	8:25 PM							
8:45 PM	8:48 PM	8:57 PM	9:03 PM	9:16 PM	9:25 PM							

Route 33 - MLK, Jr. Ave: SATURDAYS

Going away from downtown							*Going toward downtown*					
Knoxville Station Bay N	**MLK @ Bertrand**	**Austin East High**	**Kirkwood St. Superstop**	**Target**	**Charlie Haun @ Washington Pike**	**Goes on to serve**	**Charlie Haun @ Washington Pike**	**Target**	**Kirkwood St. Superstop**	**MLK @ Beal Bourne Street**	**MLK @ Bertrand**	**Knoxville Station Bay N**
1	**2**	**3**	**4**	**5**	**6**		**6**	**7**	**8**	**9**	**10**	**11**
									7:24 AM	7:27 AM	7:34 AM	7:40 AM
							8:00 AM	8:07 AM	8:24 AM	8:27 AM	8:34 AM	8:40 AM
7:45 AM	7:48 AM	7:57 AM	8:03 AM	8:16 AM	8:30 AM	**Route 23**	9:00 AM	9:07 AM	9:24 AM	9:27 AM	9:34 AM	9:40 AM
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7:45 PM	7:48 PM	7:57 PM	8:03 PM	8:16 PM	8:30 PM	**Route 23**						
8:45 PM	8:48 PM	8:57 PM	9:03 PM	9:16 PM	9:30 PM							

Route 33 - MLK, Jr. Ave: SUNDAYS

Going away from downtown							*Going toward downtown*					
Knoxville Station Bay N	**MLK @ Bertrand**	**Austin East High**	**Kirkwood St. Superstop**	**Target**	**Charlie Haun @ Washington Pike**	**Goes on to serve**	**Charlie Haun @ Washington Pike**	**Target**	**Kirkwood St. Superstop**	**MLK @ Beal Bourne Street**	**MLK @ Bertrand**	**Knoxville Station Bay N**
1	**2**	**3**	**4**	**5**	**6**		**6**	**7**	**8**	**9**	**10**	**11**
							8:00 AM	8:07 AM	8:24 AM	8:27 AM	8:34 AM	8:40 AM
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3:45 PM	3:48 PM	3:57 PM	4:03 PM	4:16 PM	4:30 PM	**Route 23**						
4:45 PM	4:48 PM	4:57 PM	5:03 PM	5:16 PM	5:30 PM							

APPENDIX D

RAILROAD INVENTORY DATA

U. S. DOT CROSSING INVENTORY FORM

DEPARTMENT OF TRANSPORTATION

FEDERAL RAILROAD ADMINISTRATION

OMB No. 2130-0017

Instructions for the initial reporting of the following types of new or previously unreported crossings: For public highway-rail grade crossings, complete the entire inventory Form. For private highway-rail grade crossings, complete the Header, Parts I and II, and the Submission Information section. For public pathway grade crossings (including pedestrian station grade crossings), complete the Header, Parts I and II, and the Submission Information section. For Private pathway grade crossings, complete the Header, Parts I and II, and the Submission Information section. For grade-separated highway-rail or pathway crossings (including pedestrian station crossings), complete the Header, Part I, and the Submission Information section. For changes to existing data, complete the Header, Part I Items 1-3, and the Submission Information section, in addition to the updated data fields. Note: For private crossings only, Part I Item 20 and Part III Item 2.K. are required unless otherwise noted. An asterisk * denotes an optional field.

A. Revision Date *(MM/DD/YYYY)* 02 / 28 / 2022

B. Reporting Agency ☒ Railroad ☐ Transit ☐ State ☐ Other

C. Reason for Update *(Select only one)* ☐ Change in Data ☐ New Crossing ☐ Closed ☐ No Train Traffic ☐ Quiet Zone Update ☐ Re-Open ☐ Date Change Only ☒ Change in Primary Operating RR ☐ Admin. Correction

D. DOT Crossing Inventory Number 730476N

Part I: Location and Classification Information

1. Primary Operating Railroad Knoxville & Cumberland Gap Railroad LLC [KXCG]

2. State TENNESSEE

3. County KNOX

4. City / Municipality ☒ In ☐ Near KNOXVILLE

5. Street/Road Name & Block Number BEVERLY RD | *(Street/Road Name)* | * *(Block Number)*

6. Highway Type & No. ls

7. Do Other Railroads Operate a Separate Track at Crossing? ☐ Yes ☒ No
If Yes, Specify RR ____, ____, ____, ____

8. Do Other Railroads Operate Over Your Track at Crossing? ☐ Yes ☒ No
If Yes, Specify RR ____, ____, ____, ____

9. Railroad Division or Region ☐ None GULF

10. Railroad Subdivision or District ☐ None KNOXVILLE WEST

11. Branch or Line Name ☐ None MIDDLESBORO LINE

12. RR Milepost ____ | 0006.170 | CG *(prefix)* | *(nnnn.nnn)* | *(suffix)*

13. Line Segment *

14. Nearest RR Timetable Station * KNOXVILLE

15. Parent RR *(if applicable)* ☒ N/A

16. Crossing Owner *(if applicable)* ☒ N/A

17. Crossing Type ☒ Public ☐ Private

18. Crossing Purpose ☒ Highway ☐ Pathway, Ped. ☐ Station, Ped.

19. Crossing Position ☒ At Grade ☐ RR Under ☐ RR Over

20. Public Access *(if Private Crossing)* ☐ Yes ☐ No

21. Type of Train ☒ Freight ☐ Transit ☐ Intercity Passenger ☐ Shared Use Transit ☐ Commuter ☐ Tourist/Other

22. Average Passenger Train Count Per Day ☐ Less Than One Per Day ☐ Number Per Day 0

23. Type of Land Use ☐ Open Space ☐ Farm ☐ Residential ☐ Commercial ☒ Industrial ☐ Institutional ☐ Recreational ☐ RR Yard

24. Is there an Adjacent Crossing with a Separate Number? ☐ Yes ☒ No If Yes, Provide Crossing Number ____

25. Quiet Zone *(FRA provided)* ☒ No ☐ 24 Hr ☐ Partial ☐ Chicago Excused Date Established ____

26. HSR Corridor ID ☒ N/A

27. Latitude in decimal degrees *(WGS84 std: nn.nnnnnnn)* 36.0336955

28. Longitude in decimal degrees *(WGS84 std: -nnn.nnnnnnn)* -83.9029356

29. Lat/Long Source ☒ Actual ☐ Estimated

30.A. Railroad Use *

31.A. State Use *

30.B. Railroad Use *

31.B. State Use *

30.C. Railroad Use *

31.C. State Use *

30.D. Railroad Use *

31.D. State Use *

32.A. Narrative *(Railroad Use)* *

32.B. Narrative *(State Use)* *

33. Emergency Notification Telephone No. *(posted)* 800-946-4744

34. Railroad Contact *(Telephone No.)* 800-946-4744

35. State Contact *(Telephone No.)* 615-741-9558

Part II: Railroad Information

1. Estimated Number of Daily Train Movements

1.A. Total Day Thru Trains *(6 AM to 6 PM)* 1

1.B. Total Night Thru Trains *(6 PM to 6 AM)* 0

1.C. Total Switching Trains 1

1.D. Total Transit Trains 0

1.E. Check if Less Than One Movement Per Day ☐ How many trains per week? ____

2. Year of Train Count Data *(YYYY)* 2021

3. Speed of Train at Crossing
3.A. Maximum Timetable Speed *(mph)* 30
3.B. Typical Speed Range Over Crossing *(mph)* From 5 to 15

4. Type and Count of Tracks
Main 1 Siding 0 Yard 0 Transit 0 Industry 0

5. Train Detection *(Main Track only)*
☐ Constant Warning Time ☒ Motion Detection ☐AFO ☐ PTC ☐ DC ☐ Other ☐ None

6. Is Track Signaled? ☒ Yes ☐ No

7.A. Event Recorder ☐ Yes ☒ No

7.B. Remote Health Monitoring ☐ Yes ☒ No

U. S. DOT CROSSING INVENTORY FORM

A. Revision Date *(MM/DD/YYYY)* 02/28/2022	PAGE 2	D. Crossing Inventory Number *(7 char.)* 730476N

Part III: Highway or Pathway Traffic Control Device Information

1. Are there Signs or Signals? ☒ Yes ☐ No

2. Types of Passive Traffic Control Devices associated with the Crossing

2.A. Crossbuck Assemblies *(count)* 2

2.B. STOP Signs *(R1-1)* *(count)* 0

2.C. YIELD Signs *(R1-2)* *(count)*

2.D. Advance Warning Signs *(Check all that apply; include count)* ☐ None
☒ W10-1 ____ ☐ W10-3 ____ ☐ W10-11 ____
☐ W10-2 ____ ☐ W10-4 ____ ☐ W10-12 ____

2.E. Low Ground Clearance Sign *(W10-5)* ☐ Yes *(count____)* ☒ No

2.F. Pavement Markings ☐ Stop Lines ☐ Dynamic Envelope ☐ RR Xing Symbols ☒ None

2.G. Channelization Devices/Medians ☐ All Approaches ☐ Median ☐ One Approach ☐ None

2.H. EXEMPT Sign *(R15-3)* ☐ Yes ☐ No

2.I. ENS Sign *(I-13)* Displayed ☒ Yes ☐ No

2.J. Other MUTCD Signs ☐ Yes ☒ No
Specify Type ________ Count ______
Specify Type ________ Count ______
Specify Type ________ Count ______

2.K. Private Crossing Signs *(if private)* ☐ Yes ☐ No

2.L. LED Enhanced Signs *(List types)*

3. Types of Train Activated Warning Devices at the Grade Crossing *(specify count of each device for all that apply)*

3.A. Gate Arms *(count)* Roadway 0 Pedestrian 0

3.B. Gate Configuration ☐ 2 Quad ☐ 3 Quad ☐ 4 Quad ☐ Full *(Barrier)* Resistance ☐ Median Gates

3.C. Cantilevered *(or Bridged)* Flashing Light Structures *(count)* Over Traffic Lane 1 ☒ Incandescent; Not Over Traffic Lane 1 ☐ LED

3.D. Mast Mounted Flashing Lights *(count of masts)* 1 ☒ Incandescent ☐ LED ☒ Back Lights Included ☐ Side Lights Included

3.E. Total Count of Flashing Light Pairs 4

3.F. Installation Date of Current Active Warning Devices: *(MM/YYYY)* 12 / 1979 ☐ Not Required

3.G. Wayside Horn ☐ Yes Installed on *(MM/YYYY)* ____/____ ☒ No

3.H. Highway Traffic Signals Controlling Crossing ☐ Yes ☒ No

3.I. Bells *(count)* 1

3.J. Non-Train Active Warning ☐ Flagging/Flagman ☐ Manually Operated Signals ☐ Watchman ☐ Floodlighting ☒ None

3.K. Other Flashing Lights or Warning Devices Count 0 Specify type ________

4.A. Does nearby Hwy Intersection have Traffic Signals? ☐ Yes ☒ No

4.B. Hwy Traffic Signal Interconnection ☒ Not Interconnected ☐ For Traffic Signals ☐ For Warning Signs

4.C. Hwy Traffic Signal Preemption ☐ Simultaneous ☐ Advance

5. Highway Traffic Pre-Signals ☐ Yes ☒ No Storage Distance * 0 Stop Line Distance * 0

6. Highway Monitoring Devices *(Check all that apply)* ☐ Yes - Photo/Video Recording ☐ Yes – Vehicle Presence Detection ☒ None

Part IV: Physical Characteristics

1. Traffic Lanes Crossing Railroad ☐ One-way Traffic ☐ Two-way Traffic ☐ Divided Traffic; Number of Lanes 2

2. Is Roadway/Pathway Paved? ☒ Yes ☐ No

3. Does Track Run Down a Street? ☐ Yes ☒ No

4. Is Crossing Illuminated? *(Street lights within approx. 50 feet from nearest rail)* ☒ Yes ☐ No

5. Crossing Surface *(on Main Track, multiple types allowed)* Installation Date * *(MM/YYYY)* ____/____ Width * ______ Length * ______
☐ 1 Timber ☐ 2 Asphalt ☒ 3 Asphalt and Timber ☐ 4 Concrete ☐ 5 Concrete and Rubber ☐ 6 Rubber ☐ 7 Metal
☐ 8 Unconsolidated ☐ 9 Composite ☐ 10 Other *(specify)* ________

6. Intersecting Roadway within 500 feet? ☒ Yes ☐ No If Yes, Approximate Distance *(feet)* ______

7. Smallest Crossing Angle ☐ 0° – 29° ☐ 30° – 59° ☒ 60° - 90°

8. Is Commercial Power Available? * ☒ Yes ☐ No

Part V: Public Highway Information

1. Highway System
☐ (01) Interstate Highway System
☐ (02) Other Nat Hwy System (NHS)
☐ (03) Federal AID, Not NHS
☒ (08) Non-Federal Aid

2. Functional Classification of Road at Crossing ☐ (0) Rural ☒ (1) Urban
☐ (1) Interstate ☐ (5) Major Collector
☐ (2) Other Freeways and Expressways
☐ (3) Other Principal Arterial ☐ (6) Minor Collector
☐ (4) Minor Arterial ☒ (7) Local

3. Is Crossing on State Highway System? ☐ Yes ☒ No

4. Highway Speed Limit 30 MPH ☒ Posted ☐ Statutory

5. Linear Referencing System *(LRS Route ID)* *

6. LRS Milepost *

7. Annual Average Daily Traffic *(AADT)* Year 2006 AADT 005937

8. Estimated Percent Trucks 06 %

9. Regularly Used by School Buses? ☒ Yes ☐ No Average Number per Day 4

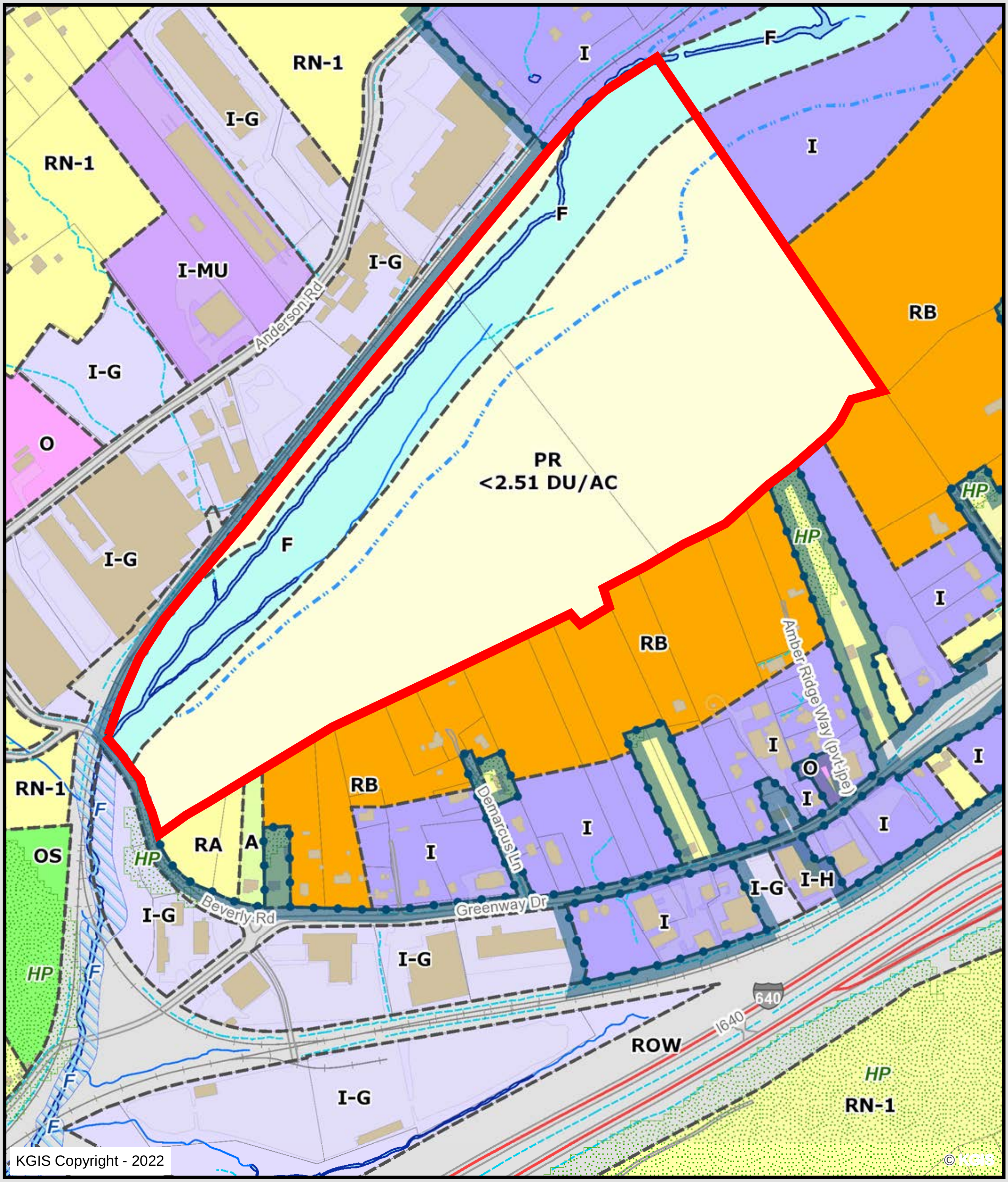
10. Emergency Services Route ☐ Yes ☐ No

Submission Information - *This information is used for administrative purposes and is not available on the public website.*

Submitted by ________ Organization ________ Phone ______ Date ______

APPENDIX E

ZONING MAP



Existing Zoning - 10.3.22

The Preserve at Whites Creek

Knoxville - Knox County - KUB Geographic Information System

Printed: 10/3/2022 at 3:53:17 PM

0 250 500 1,000

ft

APPENDIX F

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: Tazewell Pike (EB and WB)
Minor Street: Beverly Road (NB)
Traffic Control: Stop Sign on Beverly Road

9/29/2022 (Thursday)
Sunny, Mild
Conducted by: Ajax Engineering

	Tazewell Pike		Beverly Road		Tazewell Pike			
TIME	WESTBOUND		NORTHBOUND		EASTBOUND		VEHICLE	PEAK
BEGIN	LT	THRU	LT	RT	THRU	RT	TOTAL	HOUR
7:00 AM	23	192	4	2	70	20	311	
7:15 AM	35	247	5	21	70	19	397	**7:15 AM - 8:15 AM**
7:30 AM	80	180	8	15	74	28	385	
7:45 AM	52	192	9	11	83	44	391	
8:00 AM	31	175	14	11	75	41	347	
8:15 AM	30	184	12	3	69	35	333	
8:30 AM	13	153	5	4	67	20	262	
8:45 AM	7	142	22	3	65	17	256	
TOTAL	271	1465	79	70	573	224	2682	
2:00 PM	8	116	34	9	97	37	301	
2:15 PM	13	89	32	9	128	36	307	
2:30 PM	16	102	21	10	147	44	340	
2:45 PM	24	102	26	21	160	36	369	
3:00 PM	29	108	28	12	136	47	360	
3:15 PM	11	113	32	19	140	45	360	
3:30 PM	14	119	19	20	135	40	347	
3:45 PM	20	97	20	14	151	51	353	
4:00 PM	17	110	25	12	193	39	396	
4:15 PM	12	126	21	11	199	48	417	
4:30 PM	13	109	26	18	213	29	408	
4:45 PM	14	114	17	21	214	38	418	**4:45 PM - 5:45 PM**
5:00 PM	16	109	21	22	202	43	413	
5:15 PM	13	121	15	11	235	26	421	
5:30 PM	20	124	25	17	196	44	426	
5:45 PM	11	129	21	15	189	24	389	
TOTAL	251	1788	383	241	2735	627	6025	

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

	Tazewell Pike		Beverly Road		Tazewell Pike	
TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
7:15 AM	35	247	5	21	70	19
7:30 AM	80	180	8	15	74	28
7:45 AM	52	192	9	11	83	44
8:00 AM	31	175	14	11	75	41
TOTAL	**198**	**794**	**36**	**58**	**302**	**132**
PHF	**0.62**	**0.80**	**0.64**	**0.69**	**0.91**	**0.75**
Truck %	**0.5%**	**0.3%**	**0.0%**	**1.7%**	**2.3%**	**1.5%**

2022 PM Peak Hour **4:45 PM - 5:45 PM**

	Tazewell Pike		Beverly Road		Tazewell Pike	
TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
4:45 PM	14	114	17	21	214	38
5:00 PM	16	109	21	22	202	43
5:15 PM	13	121	15	11	235	26
5:30 PM	20	124	25	17	196	44
TOTAL	**63**	**468**	**78**	**71**	**847**	**151**
PHF	**0.79**	**0.94**	**0.78**	**0.81**	**0.90**	**0.86**
Truck %	**0.0%**	**0.4%**	**0.0%**	**0.0%**	**0.5%**	**0.7%**

TRAFFIC COUNT DATA

Major Street: Beverly Road (SB and NB)
Minor Street: McCampbell Lane (WB)
Traffic Control: Stop Sign on McCampbell Lane

9/29/2022 (Thursday)
Sunny, Mild
Conducted by: Ajax Engineering

	Beverly Road		McCampbell Lane		Beverly Road			
TIME	SOUTHBOUND		WESTBOUND		NORTHBOUND		VEHICLE	PEAK
BEGIN	LT	THRU	LT	RT	THRU	RT	TOTAL	HOUR
7:15 AM	1	-	1	3	-	0	5	**7:15 AM - 8:15 AM**
7:30 AM	2	-	0	1	-	0	3	
7:45 AM	0	-	1	2	-	0	3	
8:00 AM	1	-	4	3	-	0	8	
TOTAL	4	-	6	9	-	0	19	
ENTER FROM NORTH	100%							
ENTER FROM SOUTH						0%		
EXIT TO SOUTH			40%					
EXIT TO NORTH				60%				
4:15 PM	2	-	2	1	-	3		**4:15 PM - 5:15 PM**
4:30 PM	3	-	1	1	-	2		
4:45 PM	2	-	0	1	-	2		
5:00 PM	1	-	0	0	-	2		
TOTAL	8	-	3	3	-	9		
ENTER FROM NORTH	47%							
ENTER FROM SOUTH						53%		
EXIT TO SOUTH			50%					
EXIT TO NORTH				50%				

TRAFFIC COUNT DATA

Major Street: Beverly Road (SB and NB) — 9/29/2022 (Thursday)
Minor Street: n/a — Sunny, Mild
Traffic Control: n/a — Conducted by: Ajax Engineering

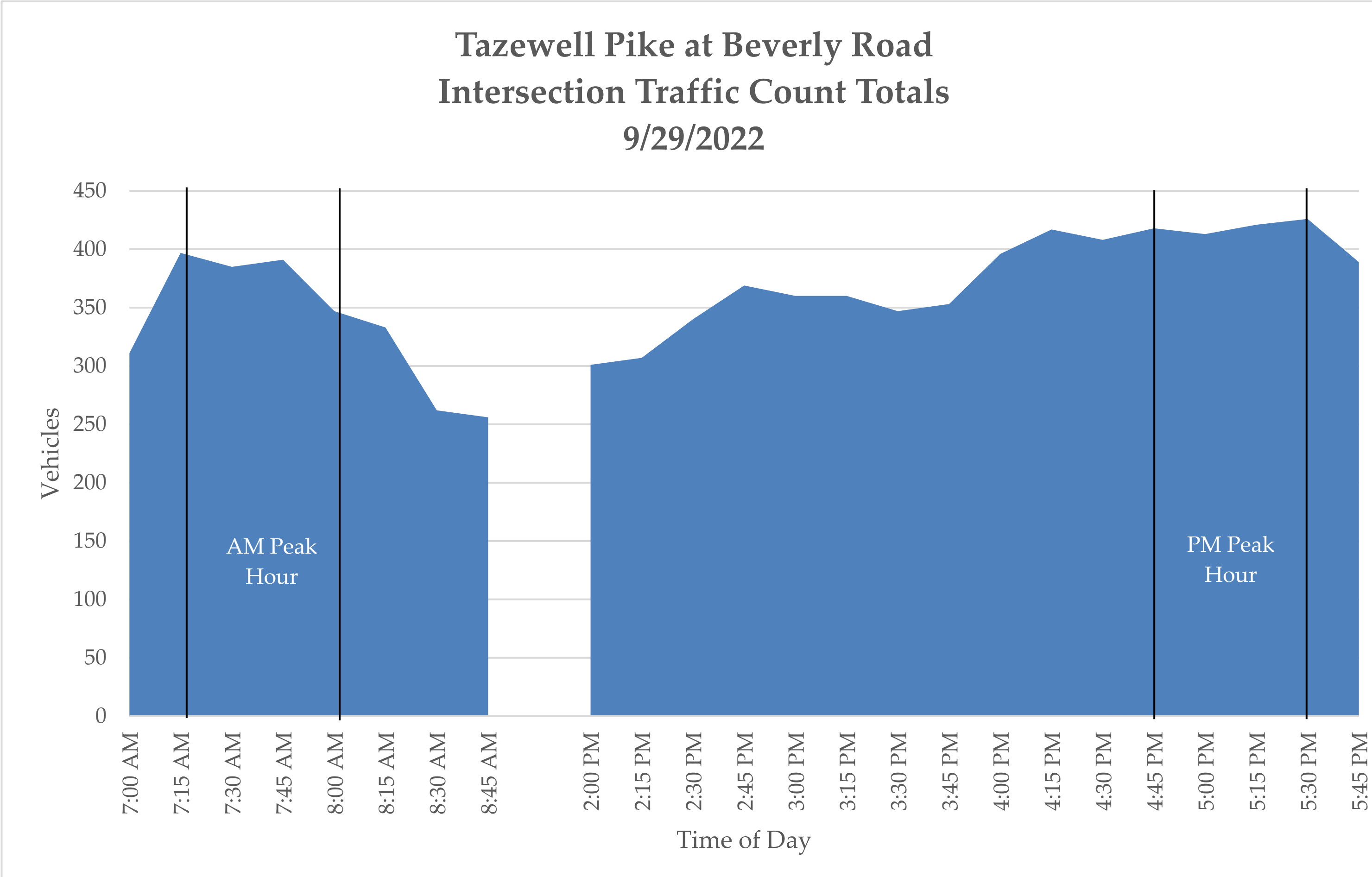
	Beverly Road	Beverly Road		
TIME BEGIN	SOUTHBOUND THRU	NORTHBOUND THRU	VEHICLE TOTAL	PEAK HOUR
7:00 AM	51	14	65	
7:15 AM	78	25	103	**7:15 AM - 8:15 AM**
7:30 AM	148	30	178	
7:45 AM	117	36	153	
8:00 AM	80	29	109	
8:15 AM	80	20	100	
8:30 AM	52	18	70	
8:45 AM	34	21	55	
TOTAL	640	193	833	
2:00 PM	51	51	102	
2:15 PM	64	49	113	
2:30 PM	69	61	130	
2:45 PM	77	52	129	
3:00 PM	84	68	152	
3:15 PM	74	52	126	
3:30 PM	74	44	118	
3:45 PM	76	55	131	
4:00 PM	70	65	135	
4:15 PM	82	71	153	**4:15 PM - 5:15 PM**
4:30 PM	69	70	139	
4:45 PM	72	57	129	
5:00 PM	94	62	156	
5:15 PM	57	64	121	
5:30 PM	87	70	157	
5:45 PM	48	43	91	
TOTAL	1148	934	2082	

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

	Beverly Road	Beverly Road
TIME BEGIN	SOUTHBOUND THRU	NORTHBOUND THRU
7:15 AM	78	25
7:30 AM	148	30
7:45 AM	117	36
8:00 AM	80	29
TOTAL	**423**	**120**
PHF	**0.71**	**0.83**
Truck %	**1.2%**	**0.8%**

2022 PM Peak Hour **4:15 PM - 5:15 PM**

	Beverly Road	Beverly Road
TIME BEGIN	SOUTHBOUND THRU	NORTHBOUND THRU
4:15 PM	82	71
4:30 PM	69	70
4:45 PM	72	57
5:00 PM	94	62
TOTAL	**317**	**260**
PHF	**0.84**	**0.92**
Truck %	**1.6%**	**1.2%**


Tazewell Pike at Beverly Road
Intersection Traffic Count Totals
9/29/2022
Vehicles
450
400
350
300
250
200
150
100
50
0
AM Peak Hour
PM Peak Hour
7:00 AM
7:15 AM
7:30 AM
7:45 AM
8:00 AM
8:15 AM
8:30 AM
8:45 AM
2:00 PM
2:15 PM
2:30 PM
2:45 PM
3:00 PM
3:15 PM
3:30 PM
3:45 PM
4:00 PM
4:15 PM
4:30 PM
4:45 PM
5:00 PM
5:15 PM
5:30 PM
5:45 PM
Time of Day

APPENDIX G

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 11)

EXISTING CONDITIONS

Intersection	
Int Delay, s/veh	111.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	302	132	198	794	36	58
Future Vol, veh/h	302	132	198	794	36	58
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	2	3	-
Peak Hour Factor	91	75	62	80	64	69
Heavy Vehicles, %	2	2	0	0	0	2
Mvmt Flow	332	176	319	993	56	84

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	508	0	2051	420
Stage 1	-	-	-	-	420	-
Stage 2	-	-	-	-	1631	-
Critical Hdwy	-	-	4.1	-	7	6.52
Critical Hdwy Stg 1	-	-	-	-	6	-
Critical Hdwy Stg 2	-	-	-	-	6	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.318
Pot Cap-1 Maneuver	-	-	1067	-	~ 44	612
Stage 1	-	-	-	-	622	-
Stage 2	-	-	-	-	135	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1067	-	~ 15	612
Mov Cap-2 Maneuver	-	-	-	-	~ 15	-
Stage 1	-	-	-	-	622	-
Stage 2	-	-	-	-	~ 45	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.4	$ 1531.8
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	36	-	-	1067	-
HCM Lane V/C Ratio	3.897	-	-	0.299	-
HCM Control Delay (s)	$ 1531.8	-	-	9.8	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	16.3	-	-	1.3	-

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

Intersection	
Int Delay, s/veh	50.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	847	151	63	468	78	71
Future Vol, veh/h	847	151	63	468	78	71
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	2	3	-
Peak Hour Factor	90	86	79	94	78	81
Heavy Vehicles, %	0	1	0	0	0	0
Mvmt Flow	941	176	80	498	100	88

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1117	0	1687	1029
Stage 1	-	-	-	-	1029	-
Stage 2	-	-	-	-	658	-
Critical Hdwy	-	-	4.1	-	7	6.5
Critical Hdwy Stg 1	-	-	-	-	6	-
Critical Hdwy Stg 2	-	-	-	-	6	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	633	-	~ 79	263
Stage 1	-	-	-	-	293	-
Stage 2	-	-	-	-	465	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	633	-	~ 65	263
Mov Cap-2 Maneuver	-	-	-	-	~ 65	-
Stage 1	-	-	-	-	293	-
Stage 2	-	-	-	-	384	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	$ 501.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	100	-	-	633	-
HCM Lane V/C Ratio	1.877	-	-	0.126	-
HCM Control Delay (s)	$ 501.5	-	-	11.5	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	15.5	-	-	0.4	-

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

PROJECTED CONDITIONS (WITHOUT THE PROJECT)

Intersection	
Int Delay, s/veh	563.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	332	145	218	873	41	67
Future Vol, veh/h	332	145	218	873	41	67
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	2	3	-
Peak Hour Factor	91	75	62	80	64	69
Heavy Vehicles, %	2	2	0	0	0	2
Mvmt Flow	365	193	352	1091	64	97

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	558	0	2257	462
Stage 1	-	-	-	-	462	-
Stage 2	-	-	-	-	1795	-
Critical Hdwy	-	-	4.1	-	7	6.52
Critical Hdwy Stg 1	-	-	-	-	6	-
Critical Hdwy Stg 2	-	-	-	-	6	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.318
Pot Cap-1 Maneuver	-	-	1023	-	~ 32	577
Stage 1	-	-	-	-	591	-
Stage 2	-	-	-	-	109	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1023	-	~ 4	577
Mov Cap-2 Maneuver	-	-	-	-	~ 4	-
Stage 1	-	-	-	-	591	-
Stage 2	-	-	-	-	~ 14	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.5	$ 7531.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	10	-	-	1023	-
HCM Lane V/C Ratio	16.116	-	-	0.344	-
HCM Control Delay (s)	$ 7531.7	-	-	10.4	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	21.7	-	-	1.5	-

Notes

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

Intersection	
Int Delay, s/veh	101.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	932	166	69	515	90	82
Future Vol, veh/h	932	166	69	515	90	82
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	2	3	-
Peak Hour Factor	90	86	79	94	78	81
Heavy Vehicles, %	0	1	0	0	0	0
Mvmt Flow	1036	193	87	548	115	101

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1229	0	1855	1133
Stage 1	-	-	-	-	1133	-
Stage 2	-	-	-	-	722	-
Critical Hdwy	-	-	4.1	-	7	6.5
Critical Hdwy Stg 1	-	-	-	-	6	-
Critical Hdwy Stg 2	-	-	-	-	6	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	574	-	~ 60	227
Stage 1	-	-	-	-	257	-
Stage 2	-	-	-	-	430	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	574	-	~ 47	227
Mov Cap-2 Maneuver	-	-	-	-	~ 47	-
Stage 1	-	-	-	-	257	-
Stage 2	-	-	-	-	336	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	$ 970.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	75	-	-	574	-
HCM Lane V/C Ratio	2.888	-	-	0.152	-
HCM Control Delay (s)	$ 970.7	-	-	12.4	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	21.5	-	-	0.5	-

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

PROJECTED CONDITIONS (WITH THE PROJECT)

Intersection	
Int Delay, s/veh	3211.4

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Vol, veh/h	332	153	229	873	75	91
Future Vol, veh/h	332	153	229	873	75	91
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	2	3	-
Peak Hour Factor	91	75	62	80	64	69
Heavy Vehicles, %	2	2	0	0	0	2
Mvmt Flow	365	204	369	1091	117	132

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	569	0	2296	467
Stage 1	-	-	-	-	467	-
Stage 2	-	-	-	-	1829	-
Critical Hdwy	-	-	4.1	-	7	6.52
Critical Hdwy Stg 1	-	-	-	-	6	-
Critical Hdwy Stg 2	-	-	-	-	6	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.318
Pot Cap-1 Maneuver	-	-	1013	-	~ 30	573
Stage 1	-	-	-	-	588	-
Stage 2	-	-	-	-	~ 104	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1013	-	~ 2	573
Mov Cap-2 Maneuver	-	-	-	-	~ 2	-
Stage 1	-	-	-	-	588	-
Stage 2	-	-	-	-	~ 8	-

Approach	EB	WB	NW
HCM Control Delay, s	0	2.7	$ 29361.8
HCM LOS			F

Minor Lane/Major Mvmt	NWLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	4	-	-	1013	-
HCM Lane V/C Ratio	62.268	-	-	0.365	-
HCM Control Delay (s)	$ 29361.8	-	-	10.6	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	33.4	-	-	1.7	-

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

Intersection	
Int Delay, s/veh	184.8

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Vol, veh/h	932	203	86	515	108	99
Future Vol, veh/h	932	203	86	515	108	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	2	3	-
Peak Hour Factor	90	86	79	94	78	81
Heavy Vehicles, %	0	1	0	0	0	0
Mvmt Flow	1036	236	109	548	138	122

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1272	0	1920	1154
Stage 1	-	-	-	-	1154	-
Stage 2	-	-	-	-	766	-
Critical Hdwy	-	-	4.1	-	7	6.5
Critical Hdwy Stg 1	-	-	-	-	6	-
Critical Hdwy Stg 2	-	-	-	-	6	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	553	-	~ 54	220
Stage 1	-	-	-	-	250	-
Stage 2	-	-	-	-	407	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	553	-	~ 39	220
Mov Cap-2 Maneuver	-	-	-	-	~ 39	-
Stage 1	-	-	-	-	250	-
Stage 2	-	-	-	-	292	-

Approach	EB	WB	NW
HCM Control Delay, s	0	2.2	$ 1545.9
HCM LOS			F

Minor Lane/Major Mvmt	NWLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	63	-	-	553	-
HCM Lane V/C Ratio	4.138	-	-	0.197	-
HCM Control Delay (s)	$ 1545.9	-	-	13.1	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	28.2	-	-	0.7	-

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

Intersection						
Int Delay, s/veh	1.7					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	39	58	138	13	19	486
Future Vol, veh/h	39	58	138	13	19	486
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	-	-7	-	-	1
Peak Hour Factor	90	90	83	90	90	71
Heavy Vehicles, %	0	0	1	0	0	1
Mvmt Flow	43	64	166	14	21	685

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	900	173	0	0	180	0
Stage 1	173	-	-	-	-	-
Stage 2	727	-	-	-	-	-
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	312	876	-	-	1408	-
Stage 1	862	-	-	-	-	-
Stage 2	482	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	305	876	-	-	1408	-
Mov Cap-2 Maneuver	305	-	-	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	470	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14.2	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	500	1408	-
HCM Lane V/C Ratio	-	-	0.216	0.015	-
HCM Control Delay (s)	-	-	14.2	7.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0	-

Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	36	35	299	53	54	365
Future Vol, veh/h	36	35	299	53	54	365
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	-	-7	-	-	1
Peak Hour Factor	90	90	92	90	90	84
Heavy Vehicles, %	0	0	1	0	0	2
Mvmt Flow	40	39	325	59	60	435

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	910	355	0	0	384	0
Stage 1	355	-	-	-	-	-
Stage 2	555	-	-	-	-	-
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	307	693	-	-	1186	-
Stage 1	714	-	-	-	-	-
Stage 2	579	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	286	693	-	-	1186	-
Mov Cap-2 Maneuver	286	-	-	-	-	-
Stage 1	714	-	-	-	-	-
Stage 2	540	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.1	0	1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	403	1186	-
HCM Lane V/C Ratio	-	-	0.196	0.051	-
HCM Control Delay (s)	-	-	16.1	8.2	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.7	0.2	-

PROJECTED CONDITIONS (WITH THE PROJECT) AND TRAFFIC SIGNAL

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	332	153	229	873	75	91
Future Volume (vph)	332	153	229	873	75	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	1%			2%	3%	
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1853	1575	1787	1881	1778	1560
Flt Permitted	1.00	1.00	0.52	1.00	0.95	1.00
Satd. Flow (perm)	1853	1575	971	1881	1778	1560
Peak-hour factor, PHF	0.91	0.75	0.62	0.80	0.64	0.69
Adj. Flow (vph)	365	204	369	1091	117	132
RTOR Reduction (vph)	0	72	0	0	0	101
Lane Group Flow (vph)	365	132	369	1091	117	31
Heavy Vehicles (%)	2%	2%	0%	0%	0%	2%
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	51.6	51.6	51.6	51.6	18.9	18.9
Effective Green, g (s)	51.6	51.6	51.6	51.6	18.9	18.9
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.24	0.24
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1202	1022	630	1220	422	370
v/s Ratio Prot	0.20			c0.58	c0.07	
v/s Ratio Perm		0.08	0.38			0.02
v/c Ratio	0.30	0.13	0.59	0.89	0.28	0.08
Uniform Delay, d1	6.1	5.3	7.9	11.7	24.7	23.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	1.4	8.7	1.6	0.5
Delay (s)	6.2	5.4	9.3	20.4	26.4	24.0
Level of Service	A	A	A	C	C	C
Approach Delay (s)	5.9			17.6	25.1	
Approach LOS	A			B	C	

Intersection Summary			
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	79.5	Sum of lost time (s)	9.0
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	932	203	86	515	108	99
Future Volume (vph)	932	203	86	515	108	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	1%			2%	3%	
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1890	1591	1787	1881	1778	1591
Flt Permitted	1.00	1.00	0.07	1.00	0.95	1.00
Satd. Flow (perm)	1890	1591	140	1881	1778	1591
Peak-hour factor, PHF	0.90	0.86	0.79	0.94	0.78	0.81
Adj. Flow (vph)	1036	236	109	548	138	122
RTOR Reduction (vph)	0	37	0	0	0	95
Lane Group Flow (vph)	1036	199	109	548	138	27
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	4		3	8	2	
Permitted Phases		4	8			2
Actuated Green, G (s)	49.2	49.2	57.5	57.5	19.3	19.3
Effective Green, g (s)	49.2	49.2	57.5	57.5	19.3	19.3
Actuated g/C Ratio	0.57	0.57	0.67	0.67	0.22	0.22
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1083	912	166	1260	399	357
v/s Ratio Prot	c0.55		c0.03	0.29	c0.08	
v/s Ratio Perm		0.13	0.41			0.02
v/c Ratio	0.96	0.22	0.66	0.43	0.35	0.08
Uniform Delay, d1	17.3	8.9	20.2	6.6	27.9	26.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	17.7	0.1	9.0	0.2	2.4	0.4
Delay (s)	35.0	9.0	29.2	6.8	30.3	26.6
Level of Service	C	A	C	A	C	C
Approach Delay (s)	30.2			10.5	28.6	
Approach LOS	C			B	C	

Intersection Summary			
HCM 2000 Control Delay	24.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	85.8	Sum of lost time (s)	13.5
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX H

ITE AND LOCAL TRIP GENERATION RATES

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)

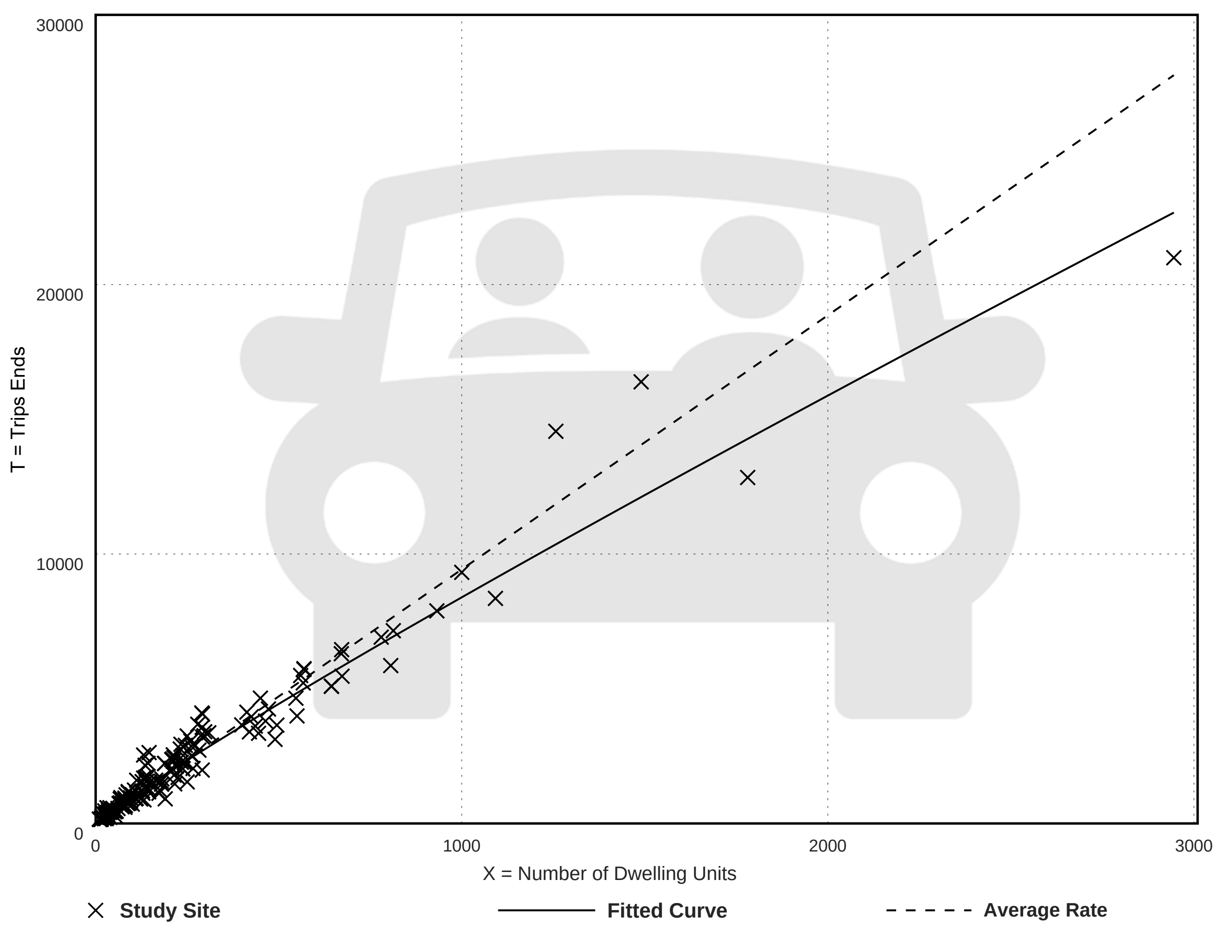
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

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: $\ln(T) = 0.92 \ln(X) + 2.68$

$R^2 = 0.95$

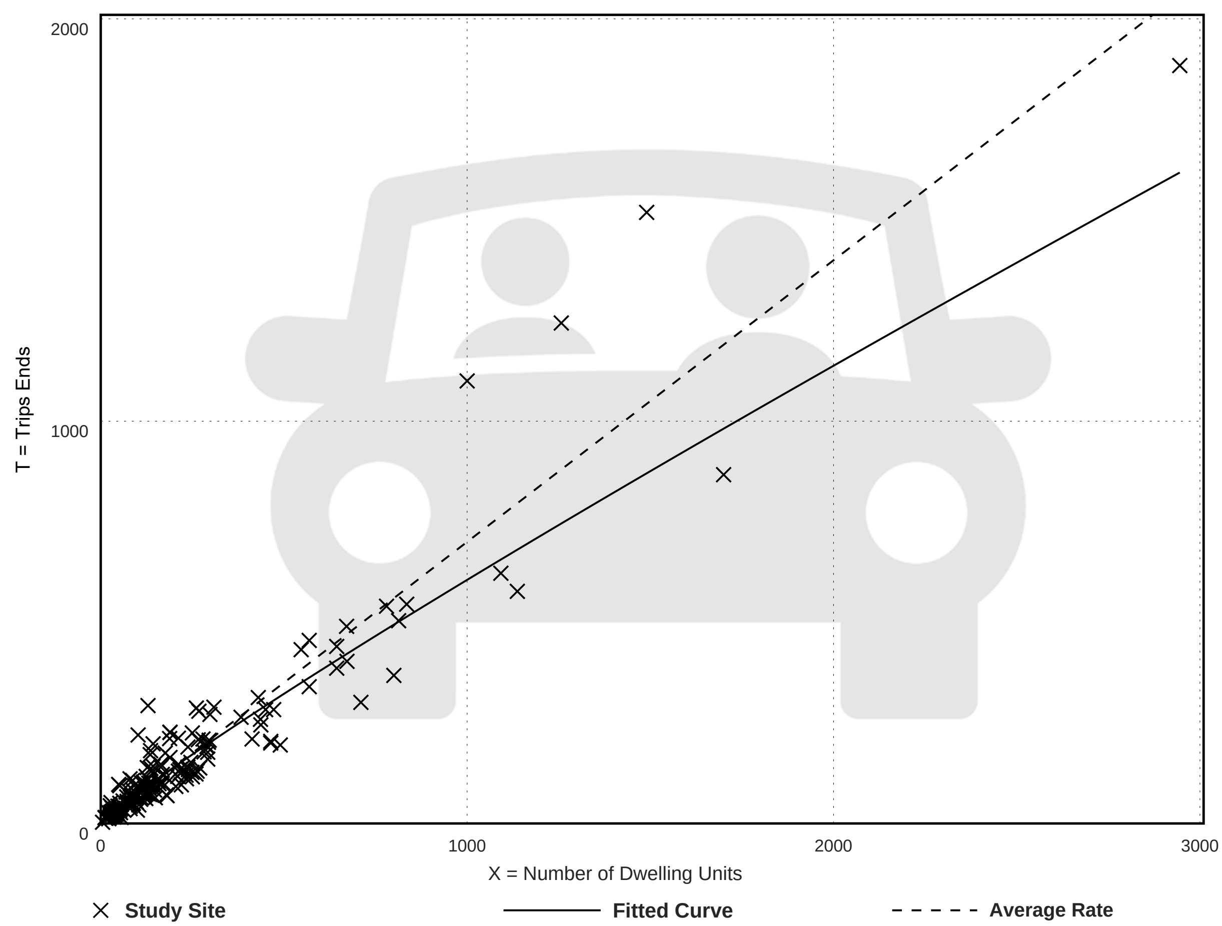
Single-Family Detached Housing
(210)

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



Fitted Curve Equation: $Ln(T) = 0.91\ Ln(X) + 0.12$ **$R^2 = 0.90$**

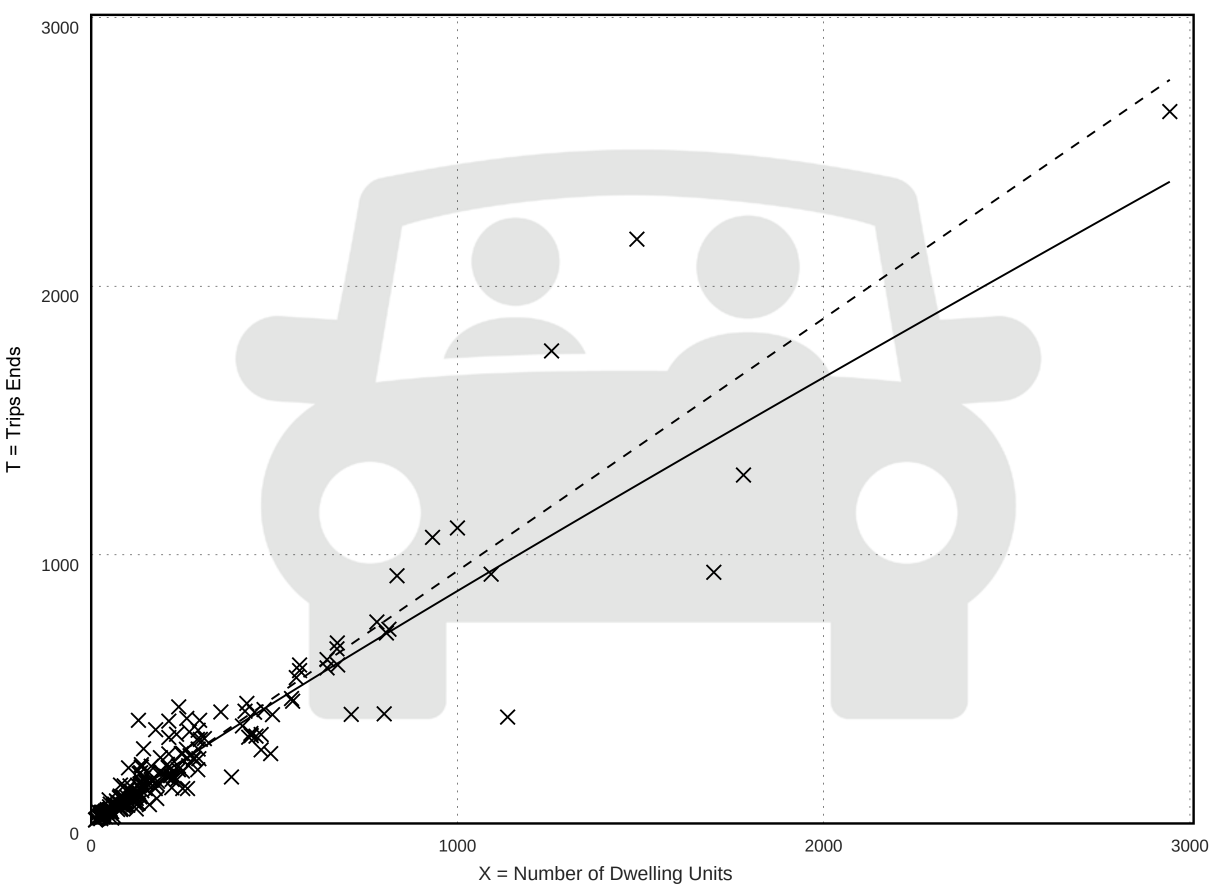
Single-Family Detached Housing
(210)

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



Study Site **Fitted Curve** **Average Rate**

Fitted Curve Equation: Ln(T) = 0.94 Ln(X) + 0.27 **R^2= 0.92**

Local Apartment
Trip Generation Study

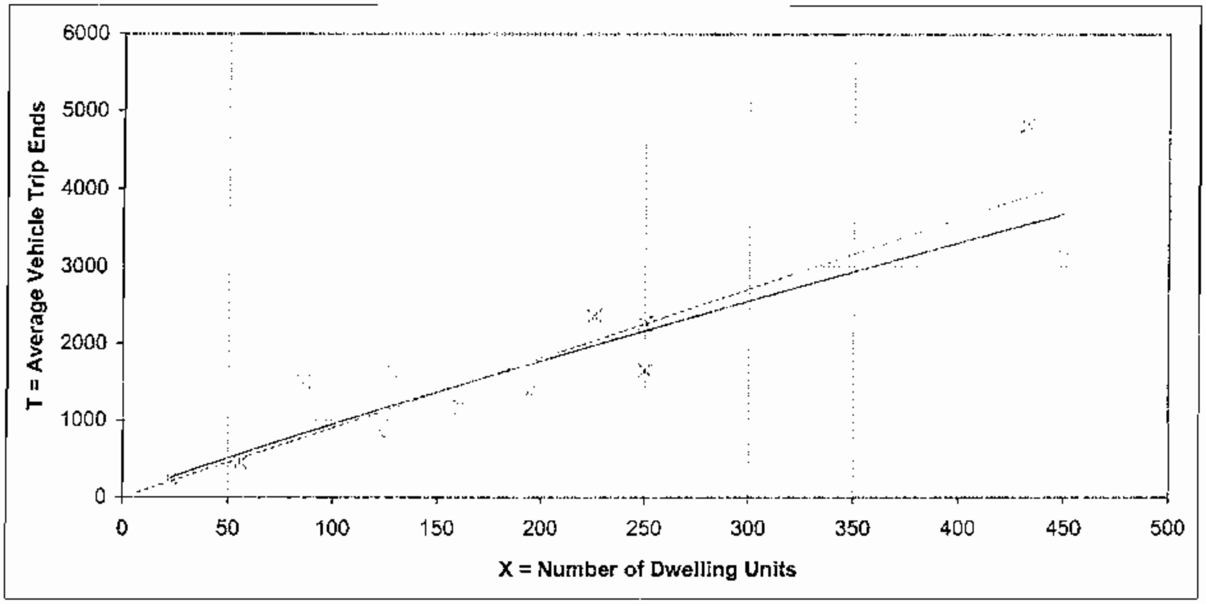
Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday**

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

Trip Generation Per Dwelling Unit

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

Data Plot and Equation



X Actual Data Points ——— Fitted Curve Average Rate

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

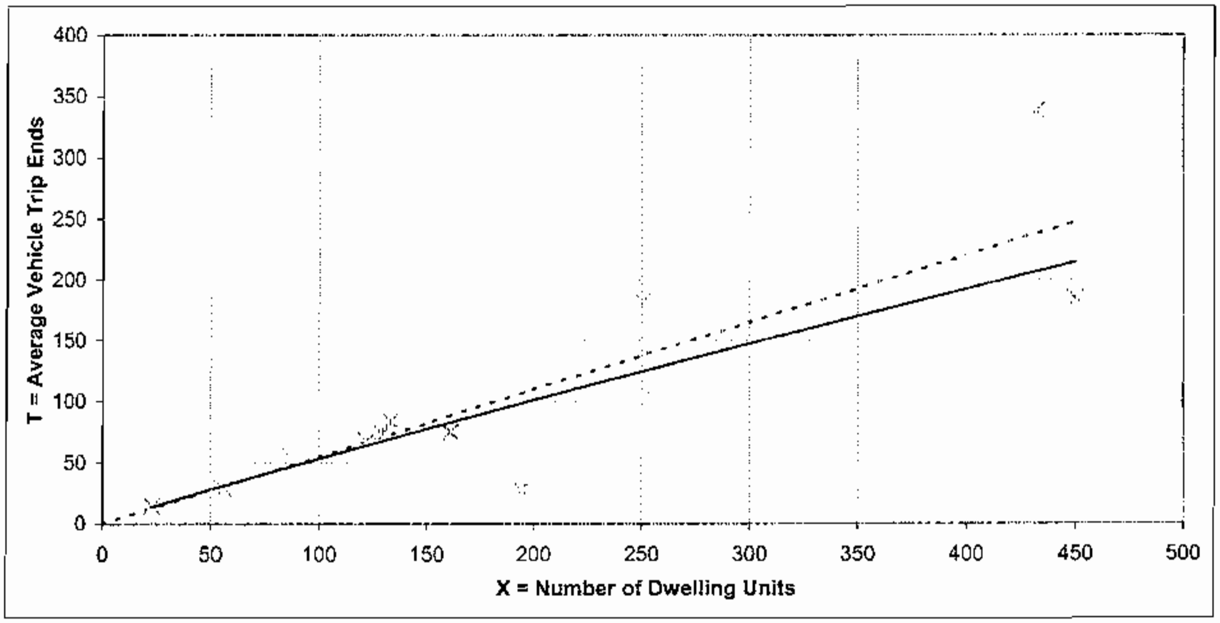
Local Apartment
Trip Generation Study

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

Trip Generation Per Dwelling Unit

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

Data Plot and Equation



X Actual Data Points ——— Fitted Curve Average Rate

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

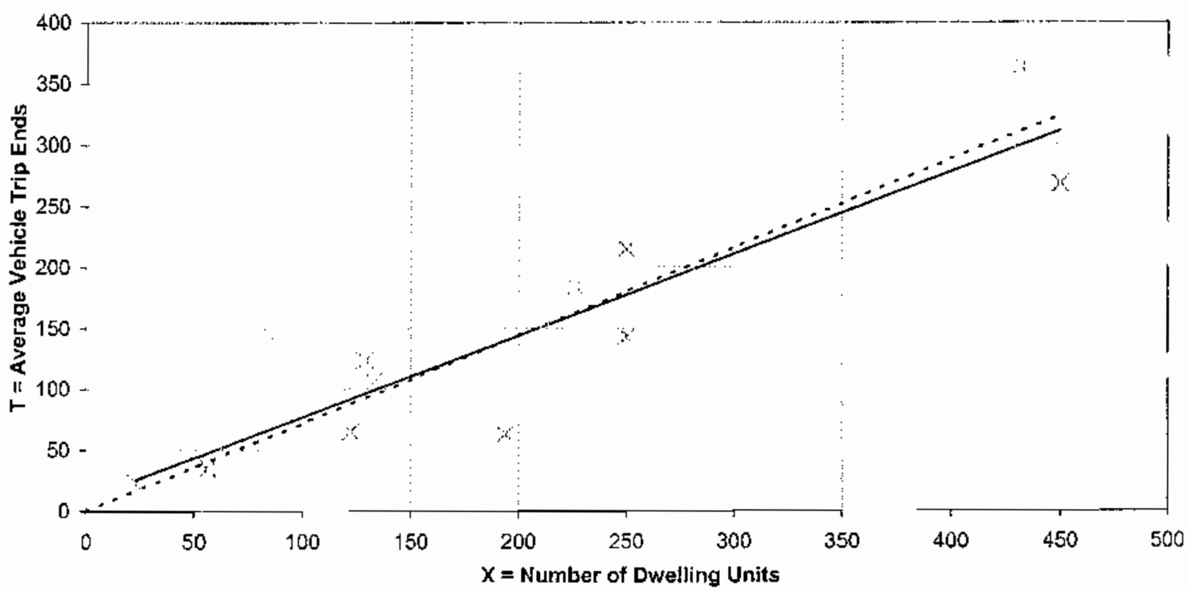
Local Apartment
Trip Generation Study

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

Trip Generation Per Dwelling Unit

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

Data Plot and Equation



X Actual Data Points —— Fitted Curve Average Rate

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

TRIP GENERATION FOR THE PRESERVE AT WHITES CREEK

120 Single-Family Detached Homes & 75 Multi-Family Attached Townhouses

ITE LAND USE CODE	LAND USE DESCRIPTION	# OF UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	120	1,193	26%	74%		63%	37%	
				23	65	88	74	44	118
Local Trip Rate	Multi-Family Attached Townhouses	75	737	22%	78%		55%	45%	
				9	32	41	33	27	60
Total New Volume Site Trips			**1,930**	**32**	**97**	**129**	**107**	**71**	**178**

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

Trips calculated by using Fitted Curve Equations

TRIP GENERATION FOR THE PRESERVE AT WHITES CREEK
120 Single-Family Detached Houses

120 Residential Houses = X

Weekday:

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

Ln(T) =	0.92	*	4.79	+	2.68
Ln(T) =	7.08				
T =	**1,193 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) =	4.48				
T =	**88 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	*	4.79	+	0.27
Ln(T) =	4.77				
T =	**118 trips**				

TRIP GENERATION FOR THE PRESERVE AT WHITES CREEK

75 Multi-Family Attached Townhouses

75 Residential Houses = X

Weekday:

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

T = 15 * 48.49

T = 737 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T = 0.758 * 54

T = 41 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

T = 0.669 * 75 + 10.07

T = 60 trips

APPENDIX I

2019 CENSUS BUREAU DATA

OnTheMap

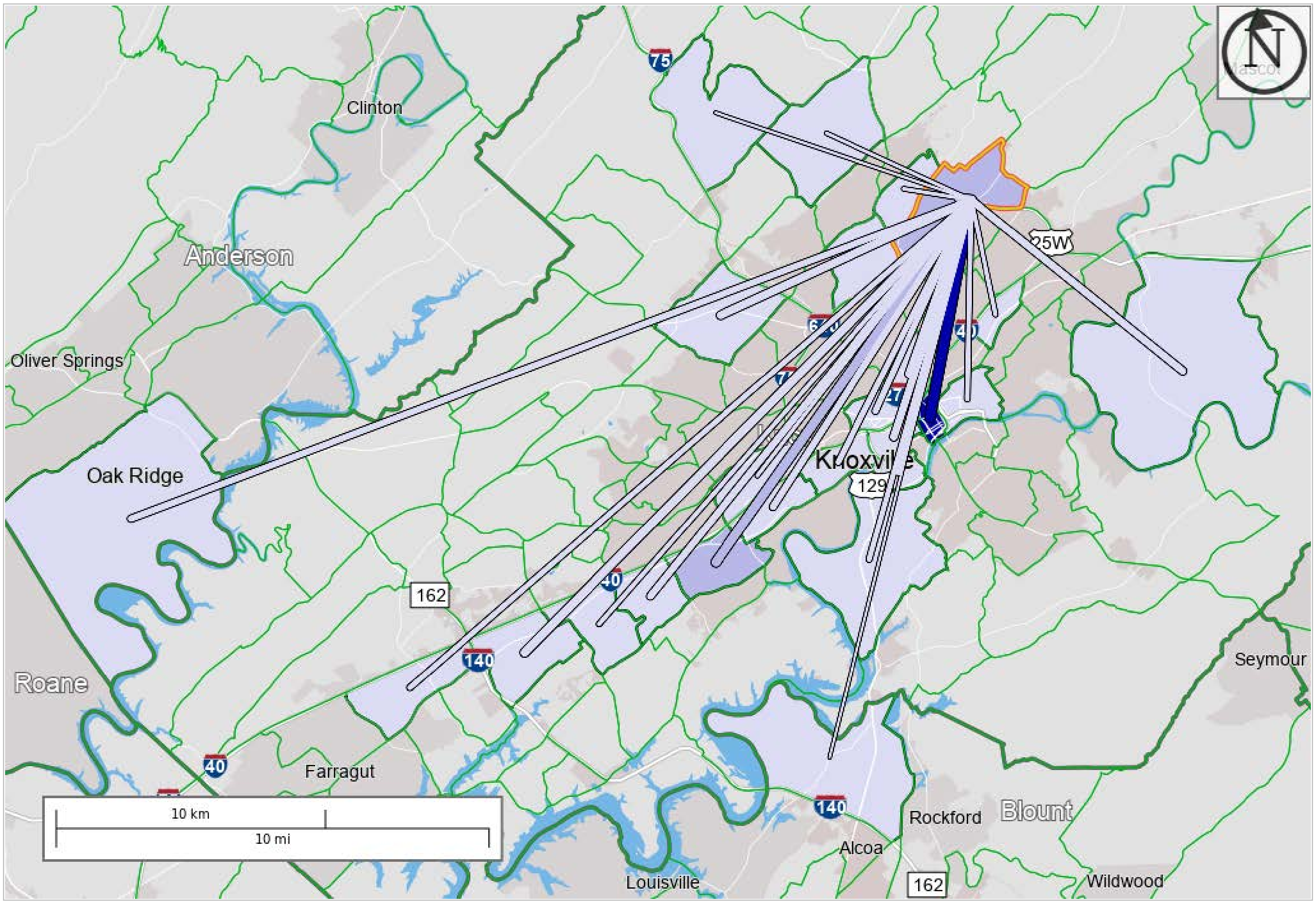
Work Destination Report - Home Selection Area to Work Census Tracts

All Jobs for All Workers in 2019

Created by the U.S. Census Bureau's OnTheMap https://onthemap.ces.census.gov on 10/03/2022

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

All Workers



Map Legend

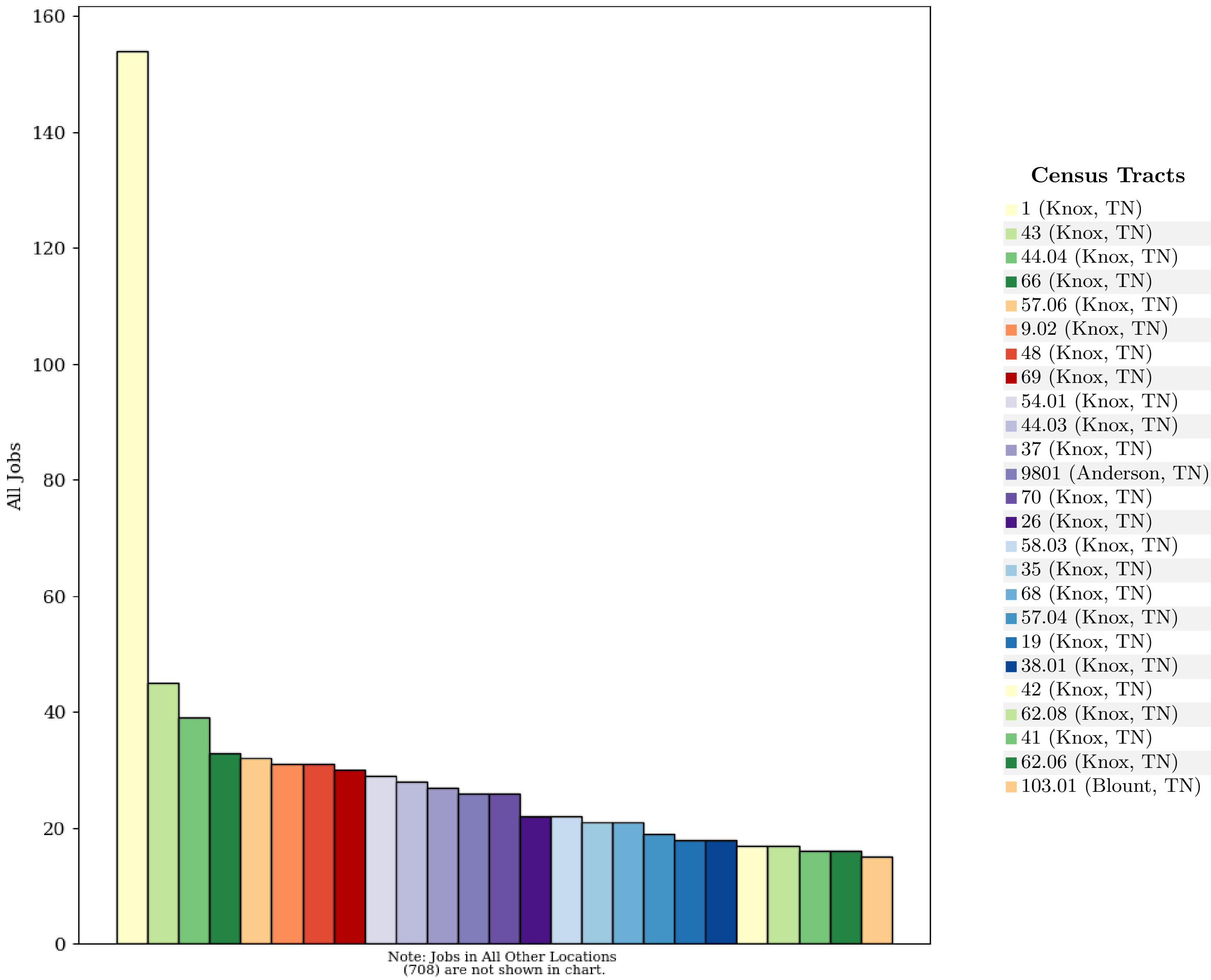
Job Count
- 135 - 154
- 115 - 134
- 95 - 114
- 75 - 94
- 55 - 74
- 35 - 54
- 15 - 34

Selection Areas
- Analysis Selection

Job Count
- 135 - 154
- 115 - 134
- 95 - 114
- 75 - 94
- 55 - 74
- 35 - 54
- 15 - 34

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

All Workers



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

All Workers

	2019	
Census Tracts as Work Destination Area	**Count**	**Share**
All Census Tracts	1,461	100.0
1 (Knox, TN)	154	10.5
43 (Knox, TN)	45	3.1
44.04 (Knox, TN)	39	2.7
66 (Knox, TN)	33	2.3
57.06 (Knox, TN)	32	2.2
9.02 (Knox, TN)	31	2.1
48 (Knox, TN)	31	2.1
69 (Knox, TN)	30	2.1
54.01 (Knox, TN)	29	2.0
44.03 (Knox, TN)	28	1.9

Census Tracts as Work Destination Area	2019 Count	2019 Share
37 (Knox, TN)	27	1.8
9801 (Anderson, TN)	26	1.8
70 (Knox, TN)	26	1.8
26 (Knox, TN)	22	1.5
58.03 (Knox, TN)	22	1.5
35 (Knox, TN)	21	1.4
68 (Knox, TN)	21	1.4
57.04 (Knox, TN)	19	1.3
19 (Knox, TN)	18	1.2
38.01 (Knox, TN)	18	1.2
42 (Knox, TN)	17	1.2
62.08 (Knox, TN)	17	1.2
41 (Knox, TN)	16	1.1
62.06 (Knox, TN)	16	1.1
103.01 (Blount, TN)	15	1.0
All Other Locations	708	48.5

Additional Information

Analysis Settings

Analysis Type	Destination
Destination Type	Census Tracts
Selection area as	Home
Year(s)	2019
Job Type	All Jobs
Selection Area	43 (Knox, TN) from Census Tracts
Selected Census Blocks	78
Analysis Generation Date	10/03/2022 15:56 - OnTheMap 6.8.1
Code Revision	f9358819d46a60bb89052036516a1c8fe8bbbeac
LODES Data Version	20211018_1647

Data Sources

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

Notes

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

United States™ Census Bureau

APPENDIX J

KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS

TABLE 4A

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

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

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	170	140	115	100	80
250 - 299	175	150	125	105	90	70
300 - 349	155	135	110	95	80	65
350 - 399	135	120	100	85	70	60
400 - 449	120	105	90	75	65	55
450 - 499	105	90	80	70	60	50
500 - 549	95	80	70	65	55	50
550 - 599	85	70	65	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

486

138 + 13 = 151

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149	100	80	[illegible]	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	[illegible]	50	45	40
350 - 399	60	55	[illegible]	45	40	40
400 - 449	55	50	[illegible]	45	40	35
450 - 499	50	45	[illegible]	40	35	35
500 - 549	50	45	[illegible]	40	35	35
550 - 599	45	40	[illegible]	35	35	35
600 - 649	40	35	[illegible]	35	35	30
650 - 699	35	35	[illegible]	30	30	30
700 - 749	30	30	30	30	30	30
750 or More	30	30	30	30	30	30

Beverly Road at Proposed Entrance

2027 Projected AM SB Left Turns = 19

SB Left-Turn Lane NOT Warranted

* 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

138

13

Beverly Road at
Proposed Entrance

2027 Projected AM
NB Right Turns = 13

NB Right-Turn Lane NOT
Warranted

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					Yes	Yes
350 - 399				Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499			Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599		Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

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

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)

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	170	140	115	100	80
250 - 299	175	150	125	105	90	70
300 - 349	155	135	110	95	80	65
350 - 399	135	120	100	85	70	60
400 - 449	120	105	90	75	65	55
450 - 499	105	90	80	70	60	50
500 - 549	95	80	70	65	55	50
550 - 599	85	70	65	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

365

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	[illegible]	60	50	50	45	40
350 - 399	60	55	50	45	40	40
400 - 449	55	[illegible]	[illegible]	45	40	35
450 - 499	50	[illegible]	[illegible]	40	35	35
500 - 549	50	[illegible]	[illegible]	40	35	35
550 - 599	45	[illegible]	[illegible]	35	35	35
600 - 649	40	[illegible]	[illegible]	35	35	30
650 - 699	35	[illegible]	[illegible]	30	30	30
700 - 749	30	[illegible]	[illegible]	30	30	30
750 or More	30	30	30	30	30	30

299+ 53 = 352

Beverly Road at
Proposed Entrance

2027 Projected PM
SB Left Turns = 54

SB Left-Turn Lane NOT
Warranted

* 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

299

53

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					Yes	Yes
350 - 399				Yes	Yes	Yes
400 - 449				Yes	Yes	Yes
450 - 499				Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599		Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

Beverly Road at Proposed Entrance

2027 Projected PM NB Right Turns = 53

NB 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						Yes
50 - 99					Yes	Yes
100 - 149				Yes	Yes	Yes
150 - 199			Yes	Yes	Yes	Yes
200 - 249		Yes	Yes	Yes	Yes	Yes
250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349	Yes	Yes	Yes	Yes	Yes	Yes
350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449	Yes	Yes	Yes	Yes	Yes	Yes
450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

APPENDIX K

SimTraffic Vehicle Queue Worksheets

Intersection: 4: Beverly Road & Tazewell Pike

Movement	EB	WB	NW
Directions Served	TR	LT	LR
Maximum Queue (ft)	26	388	324
Average Queue (ft)	2	129	116
95th Queue (ft)	14	301	292
Link Distance (ft)	487	518	1728
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection: 4: Beverly Road & Tazewell Pike

Movement	EB	WB	NW
Directions Served	TR	LT	LR
Maximum Queue (ft)	28	440	847
Average Queue (ft)	3	124	458
95th Queue (ft)	18	318	967
Link Distance (ft)	487	518	1728
Upstream Blk Time (%)		1	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection: 4: Beverly Road & Tazewell Pike

Movement	EB	WB	NW
Directions Served	TR	LT	LR
Maximum Queue (ft)	25	497	702
Average Queue (ft)	3	190	345
95th Queue (ft)	16	426	832
Link Distance (ft)	487	518	1728
Upstream Blk Time (%)		1	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection: 4: Beverly Road & Tazewell Pike

Movement	EB	WB	NW
Directions Served	TR	LT	LR
Maximum Queue (ft)	27	501	1734
Average Queue (ft)	3	209	1304
95th Queue (ft)	16	485	2039
Link Distance (ft)	487	518	1728
Upstream Blk Time (%)		6	36
Queuing Penalty (veh)		0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection: 4: Beverly Road & Tazewell Pike

Movement	EB	WB	NW
Directions Served	TR	LT	LR
Maximum Queue (ft)	28	533	1726
Average Queue (ft)	2	207	1261
95th Queue (ft)	13	463	1965
Link Distance (ft)	487	518	1728
Upstream Blk Time (%)		2	27
Queuing Penalty (veh)		0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection: 4: Beverly Road & Tazewell Pike

Movement	EB	WB	NW
Directions Served	TR	LT	LR
Maximum Queue (ft)	25	533	1742
Average Queue (ft)	5	364	1580
95th Queue (ft)	20	668	2051
Link Distance (ft)	487	518	1728
Upstream Blk Time (%)		30	69
Queuing Penalty (veh)		0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection: 2: Beverly Road & Proposed Entrance

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	74	40
Average Queue (ft)	36	3
95th Queue (ft)	59	23
Link Distance (ft)	201	394
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

Intersection: 2: Beverly Road & Proposed Entrance

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	64	89
Average Queue (ft)	31	20
95th Queue (ft)	55	61
Link Distance (ft)	201	394
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

APPENDIX L

RESPONSE LETTER TO ADDRESS REVIEW COMMENTS

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

November 15, 2022

PROJECT NAME: The Preserve at Whites Creek

TO: Knoxville-Knox County Planning

SUBJECT: Response Document for The Preserve at Whites Creek TIS Review Comments (12-SC-22-C/12-C-22-DP)

Knoxville-Knox County Planning, Knox County Engineering, & City of Knoxville Staff:

The following response document addresses comments in a letter from Mike Conger, PE, dated November 10, 2022. This letter is added to the end of the revised report in Appendix L.

1. **This study is in regard to property that lies in the County but with an access point on a city road (Beverly Road). You have noted that the Knoxville city limit runs along "the eastern edge of Beverly Road" (page 4), but have not explicitly stated that the access point is within the jurisdiction of the City. Please state this at an appropriate point in the study.**

   Response: This requested change was made on Page 4 at the end of the first paragraph.

2. **In the discussion on sight distance (page 44) it states that intersection sight distance (ISD) "is considered the desirable ... standard". This is not accurate since minimum ISD is specified as a requirement in section 3.04.J.5 of the Knoxville-Knox County Subdivision Regulations. Please correct the verbiage in this section to reflect that it is a standard and not optional as could be construed from this section of the TIS.**

   Response: This request to correct the verbiage has been made on Page 44 and updated to state that meeting the ISD is required.

3. **Regarding the sight distance evaluation – since this intersection is within the jurisdiction of the City of Knoxville the subdivision regulations specify that ISD is evaluated per AASHTO standards. Please update the TIS accordingly specifying all**

assumptions and coordinate with the site civil design engineer to include a plan and profile showing sight lines that demonstrate required sight distance is available.

Response: The intersection sight distance discussion has been addressed in various locations in the following:

- Updated on Page 2 in the last bullet point
- Updated on Page 45 in the first paragraph and the images at the bottom of the page
- Updated on Page 50 in point 2b

In addition, the site designer, Scott Williams, is aware of this comment and will address it in the civil site plans.

4. **A traffic signal warrant analysis for the intersection of Tazewell Pk and Beverly Rd should be included since it appears that the recommendation of installing a traffic signal immediately is solely based on the delay component and does not account for other criteria included in MUTCD traffic signal warrants. The TIS should also provide data and analysis to support the recommendation for turn lanes on all approaches at this intersection as well as required storage length. Finally, please also include a capacity (LOS) analysis at full-build out with the signal installed as a scenario shown in Table 6 of the TIS.**

Response: As requested in a follow-up question, a traffic signal warrant analysis was not completed for this intersection. However for the revised report, the intersection was analyzed with a traffic signal to provide some general recommendations based on the projected results of this study. These recommendations are given on Page 49 and include a new table, Table 9. The Synchro results of the intersection with a traffic signal have been added in Appendix G.

5. **It is acknowledged that there are site constraints as noted on page 50 of the TIS that limit the ability to provide a second access to this development. The number of units however points to the need for alternative access in the event of a blocked roadway. When alternative access is not feasible as in this case, Knox County has preferred a boulevard section (typically 18'-10'-18' cross section) from the access point to the first intersection (at Road B) in lieu of a separate second access point. It is less likely that access would be cut off on a boulevard section than on a single 26-foot roadway. The study should recommend this treatment in this situation.**

Response: This comment has been addressed and included on Page 3 in the sixth bullet point and on Page 53 in point 3f.

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

- Updated Title Page
- Updated Table of Contents
- Re-numbered Pages 49 to end

- Updated Page Footers
- A few minor grammatical corrections, including three instances where Tazewell Pike was misspelled
- Added Appendix L to include this response letter

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

Sincerely,

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

ROBERT WILLIAM JACKS III
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 105730
STATE OF TENNESSEE

11/15/2022

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