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Transportation Impact Study
Couch Mill Road Subdivision
Knox County, Tennessee

Revised February 2022

Prepared for:
Safe Harbor Development
308 Letterman Road
Knoxville, TN 37919

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EXECUTIVE SUMMARY

Preface:

Safe Harbor Development is proposing a residential development on the south side of Couch Mill Road near the intersection of Couch Mill Road at Sam Lee Road. The name of this proposed residential development has not been selected and is referenced in this report as the "Couch Mill Road Subdivision". The subdivision is proposed to have 393 residential lots on 131.2 +/- acres with a mixture of single-family detached houses and multi-family attached townhouses. This development is anticipated to be fully built out and occupied by 2028 and proposes two entrances on Couch Mill Road. This study's primary purpose is to determine and evaluate the potential impacts of the development on the adjacent transportation system. The study includes a review of the primary access roads and intersections and is a Level 2 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 findings of this study include the following:

- The Couch Mill Road Subdivision with 278 single-family detached houses and 115 multi-family attached townhouses is calculated to generate 3,667 trips at full build-out and occupancy on an average weekday. Of these daily trips, 250 are expected to occur during the AM peak hour and 347 in the PM peak hour in 2028.
- The primary access roads for this development, Couch Mill Road and Sam Lee Road, have existing road widths of 18 to 21 feet in between the proposed subdivision entrances and the existing 4-way intersection of Sam Lee Road at Steele Road and Swafford Road.
- The first major control point outside the proposed subdivision entrances is the 4-way intersection of Sam Lee Road at Steele Road and Swafford Road. This intersection will experience greater vehicle volumes and delays in the projected 2028 conditions due to the Couch Mill Road Subdivision-generated trips and general traffic growth.
- The proposed entrances on Couch Mill Road were analyzed regarding intersection capacity and are projected to operate with very low vehicle delays in the projected 2028 peak hour conditions. Neither of the proposed subdivision entrances on Couch Mill Road will warrant separate left or right-turn entering traffic lanes.

Recommendations:

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

- The intersection of Sam Lee Road at Steele Road and Swafford Road is recommended to maintain operations under Two-Way Stop Control based on the projected 2028 conditions. More significant growth in the general area than anticipated and projected in this study may necessitate and warrant this intersection in the future to operate under All-Way Stop Control (or as a roundabout), but these modifications are not recommended at this time based on the projected impact from the trips generated by the Couch Mill Road Subdivision.
- Couch Mill Road and Sam Lee Road are recommended to be widened 1 to 3 feet up to a 21-foot width for approximately 3,050 feet between the Couch Mill Road Subdivision Proposed West Entrance and the intersection of Sam Lee at Steele Road and Swafford Road.
- It is recommended that Stop Signs (R1-1) be installed, and 24" white stop bars be applied to the Proposed Entrance approaches at Couch Mill Road. The stop bars should be applied a minimum of 4 feet away from the edge of Couch Mill Road and placed at the desired stopping point that maximizes the sight distance.
- Intersection sight distance at the Proposed Entrance approaches must not be impacted by future landscaping, signage, or existing vegetation. Based on a posted speed limit of 30-mph on Couch Mill Road, the required intersection sight distance is 300 feet looking in each direction at both entrances. The stopping sight distance is calculated to be 195 feet looking west and 200 feet looking east at the Proposed East Entrance (Road "A"). At the Proposed West Entrance (Road "G"), the calculated stopping sight distance is 210 feet looking west and 190 feet looking east. A visual inspection determined that these sight distances are available with caveats. The site designer must ensure that the required sight distances are available and provided in the design plans.
- It is recommended that 25-mph Speed Limit Signs (R2-1) be posted near the beginning of Road "A" (Proposed East Entrance) and Road "G" (Proposed West Entrance) within the development. End of roadway signage (OM4-1) should be installed at the southern end of Road "B" and Road "F".
- Stop Signs (R1-1) and 24" white stop bars should be installed on the new internal roadways and locations, as shown in the report.

- Sight distance at the new internal intersections in the development must not be impacted by new signage, future landscaping, parked vehicles, or other structures. With a proposed internal speed limit of 25-mph, the internal intersection sight distance requirement is 250 feet, and the stopping sight distance required is 155 feet for a level road grade. The site designer should ensure that internal sight distance lengths are met and account for other designed internal road grades.
- All drainage grates and covers for the residential development need to be pedestrian and bicycle safe.
- Sidewalks should have appropriate ADA-compliant curbed ramps at intersection corners, and the sidewalks are recommended to be 5 feet minimum in width to meet Knox County regulations. White crosswalks should be marked on the road pavement where pedestrians are expected to cross.
- The United States Postal Service (USPS) has implemented updated delivery guidelines in new residential subdivisions. If directed by the local post office, the site designer should include a parking area within the development for a centralized mail delivery center.
- Traffic calming measures might be needed for this development. Several roads within the development have long and straight road segments. The development's possible need for traffic calming measures should be coordinated with Knox County Engineering and Public Works during the detailed design phase.
- Lots in the subdivision should not directly access Couch Mill Road.
- Knox County has recently completed a greenway study and showed Couch Mill Road as a route for a new greenway connecting Hardin Valley to Powell. The developer should discuss with Knox County if this potential greenway path is desirable or feasible to implement on the edge of the development property along Couch Mill Road.
- All internal and external road and intersection elements should be designed to AASHTO, Tennessee Department of Transportation (TDOT), and Knox County specifications and guidelines to ensure proper operations.

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 on the south side of Couch Mill Road in between Sam Lee Road and Williams Bend Road in deep Northwest Knox County, TN. The development has proposed two entrances on Couch Mill Road to the east of Sam Lee Road. Transportation impacts associated with the proposed development were analyzed at the following existing and proposed roadways and intersections, where the most significant impact is expected and as requested by Knoxville/Knox County Planning:

- Sam Lee Road at Steele Road and Swafford Road
- Couch Mill Road at Sam Lee Road
- Couch Mill Road at the Proposed East Entrance
- Couch Mill Road at the Proposed West Entrance

The proposed development property is located in an area that is rapidly changing from rural to suburbanized. There are many standalone single-family residences, established subdivisions, undeveloped/farm/woodland properties, and several subdivisions currently under construction in the vicinity of this development. West Knox Utility has a pump station building/facility to the south of the intersection of Couch Mill Road at Sam Lee Road and directly adjacent to the site development property. The proposed development site is currently undeveloped, with most of the land recently used for farm production with a few barn structures and ponds. The site also has a few pockets of hardwood trees.

View of Proposed Development Site (Looking South from Couch Mill Road)

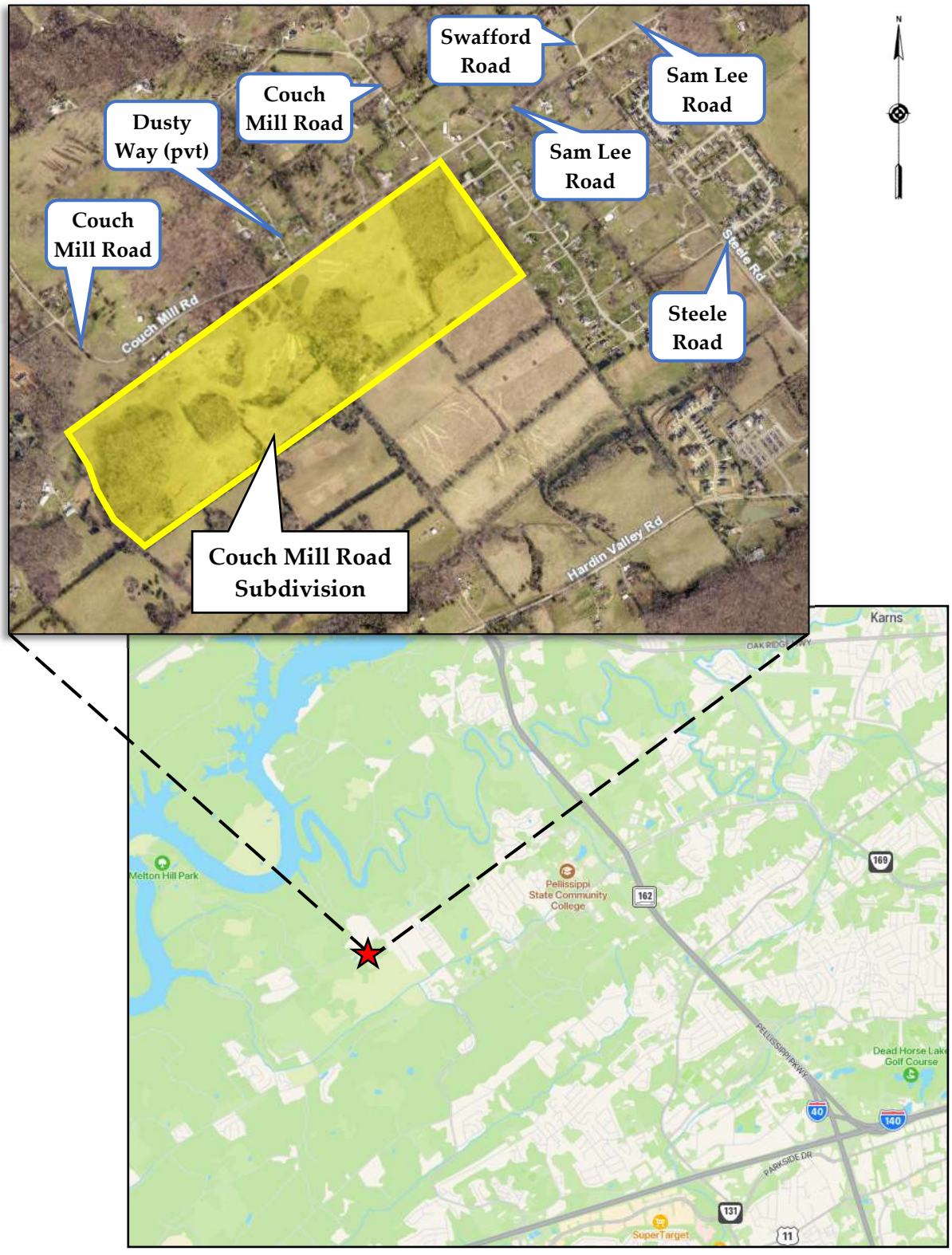


Figure 1
Location Map

- **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
Couch Mill Road	Major Collector	30 mph	2 undivided	18-20 feet	None	No sidewalks along roadway	No bike lanes
Sam Lee Road	Major Collector	30 mph	2 undivided	18.5-21 feet	None	No sidewalks along roadway	No bike lanes

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

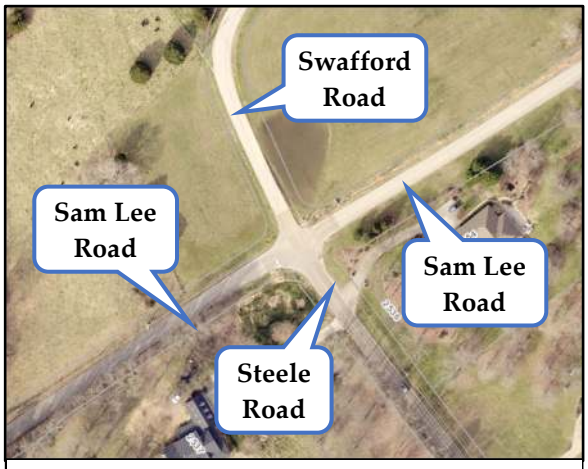
Couch Mill Road is classified as a Major Collector and traverses in a very diverse pattern from the northeast to the southwest and is broken into two sections separated by Beaver Creek. From its beginning on the northwest side at a t-intersection with Guinn Road, the northern section of Couch Mill Road dead-ends on the southwest side at Beaver Creek. The southern section of Couch Mill Road is where the proposed subdivision will have road access provided by two entrances. The southern section of Couch Mill Road begins on the south side of Beaver Creek and makes several turns along its route. It eventually ends at a t-intersection with East Gallaher Ferry Road/Williams Bend Road to the southwest. Near the northwest corner of the proposed development property, the southern section of Couch Mill Road makes a sharp turn (90˚) at a t-intersection with Sam Lee Road. At this t-intersection, Sam Lee Road is the east approach, and Couch Mill Road consists of the north and west approaches. The north approach of Couch Mill Road is controlled by a Stop Sign (R1-1), with the east and west approaches being uncontrolled.

Intersection of Couch Mill Road at Sam Lee Road

Couch Mill Road adjacent to the subdivision property consists of a 2-lane pavement section with faded white edge lines and a faded double yellow centerline. Pavement widths along Couch Mill

Road near the development site were measured to fluctuate between 18 feet in width to just over 20 feet. Roadway lighting is not present along Couch Mill Road. Couch Mill Road has relatively flat slopes outside the pavement edge but is occupied with trees, mailboxes, and fencing.

Sam Lee Road is classified as a Major Collector and traverses in a very circuitous pattern from the northeast to the southwest. From the southwest, Sam Lee Road begins at the t-intersection with Couch Mill Road, crosses Steele Road and Swafford Road at a 4-way intersection, and continues to Solway Road for a total length of 2.6 miles. Closer to the development property, Sam Lee Road was measured with 18.5 to 21 feet pavement widths.



Intersection of Sam Lee Road at Steele Road and Swafford Road

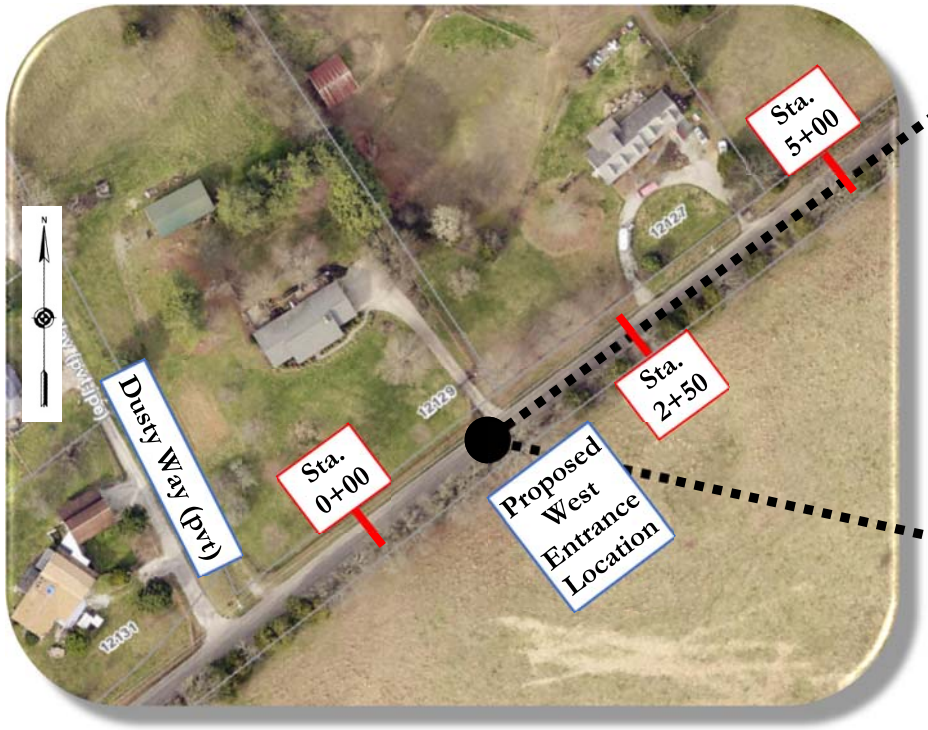
The section of Sam Lee Road between Couch Mill Road and its intersection with Steele Road and Swafford Road has more recently applied white edge lines and double yellow centerline than what exists on Couch Mill Road adjacent to the development property. At the 4-way intersection at Steele Road and Swafford Road, the east and west approaches of Sam Lee Road operate under stop conditions. The Swafford Road and Steele Road approaches at the intersection operate freely. Steele Road provides access to Hardin Valley Road 0.9 miles to the southeast. Steele Road also provides access to Hardin Valley Elementary School, Hardin Valley Middle School, several dozen houses, and a shopping center with a Food City grocery store. Swafford Road traverses to the north from the intersection for 2.1 miles, where it terminates at Guinn Road. Swafford Road is characterized by single-family homes, undeveloped properties, and farms.

Road pavement width measurements were made on Couch Mill Road and Sam Lee Road between the proposed development site and the 4-way intersection of Sam Lee Road at Steele Road and Swafford Road. Width measurements were made every 250 feet and are shown in the following pages from the west to the east.

Figure 2 shows the existing lane configurations of the roadways examined in the study, the traffic count locations, and the current traffic signage in the study area. The traffic signage shown in Figure 2 only includes warning and regulatory signage near the development site. The pages following Figure 2 give a further overview of the site study area with photographs.

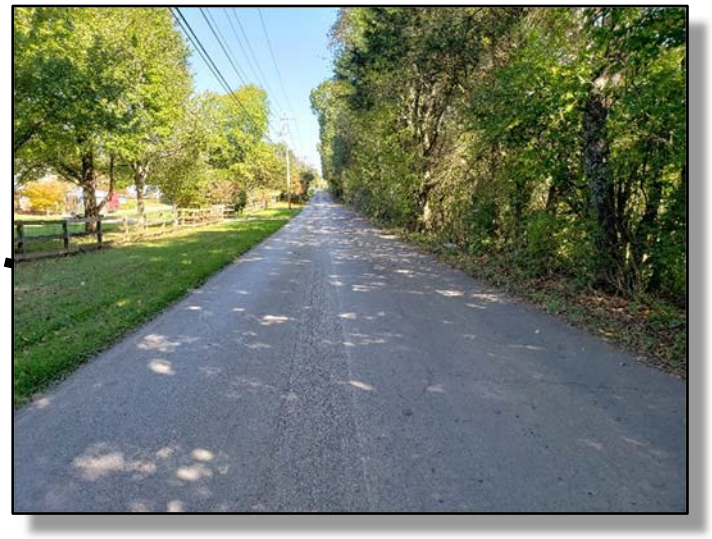
Section 1 Information:

Pavement Width of Couch Mill Road @:
Station 0+00 = 19 feet
Station 2+50 = 19.5 feet
Station 5+00 = 19 feet



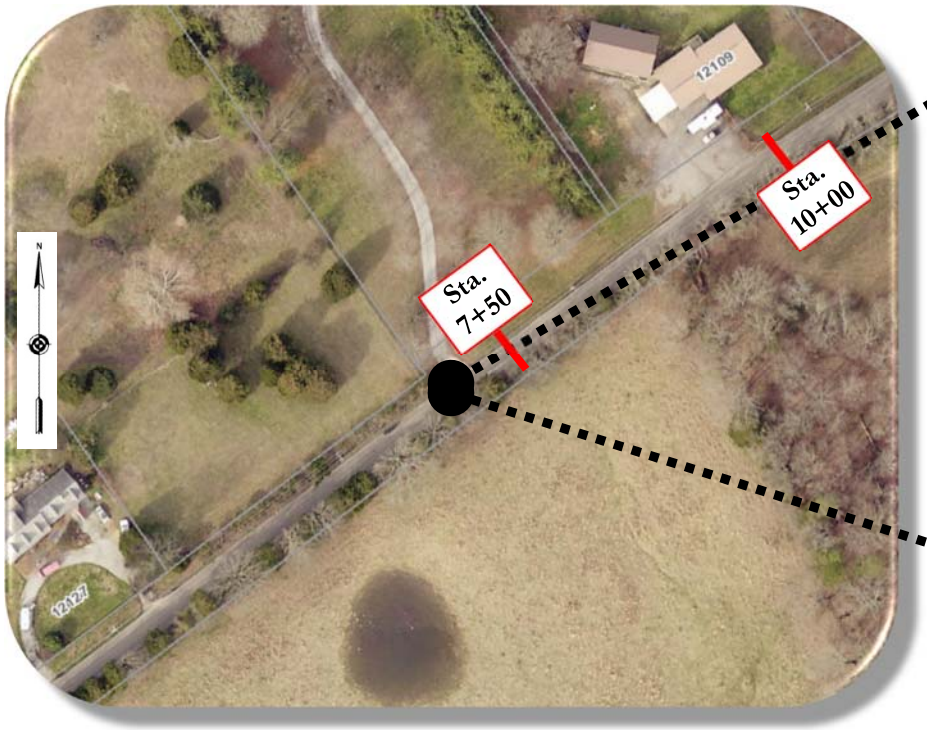
Couch Mill Road at Proposed West Entrance Location

View of Couch Mill Road (Looking Southwest)



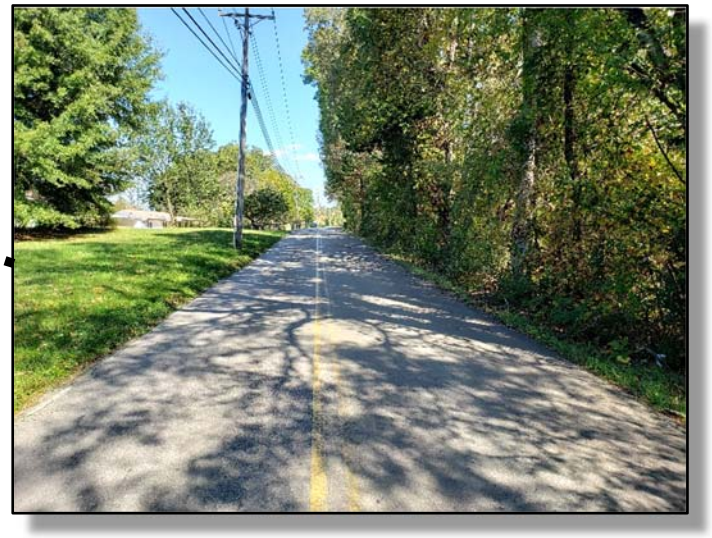
View of Couch Mill Road (Looking Northeast)

Section 2 Information:
Pavement Width of Couch Mill Road @:
Station 7+50 = 18 feet
Station 10+00 = 19.5 feet



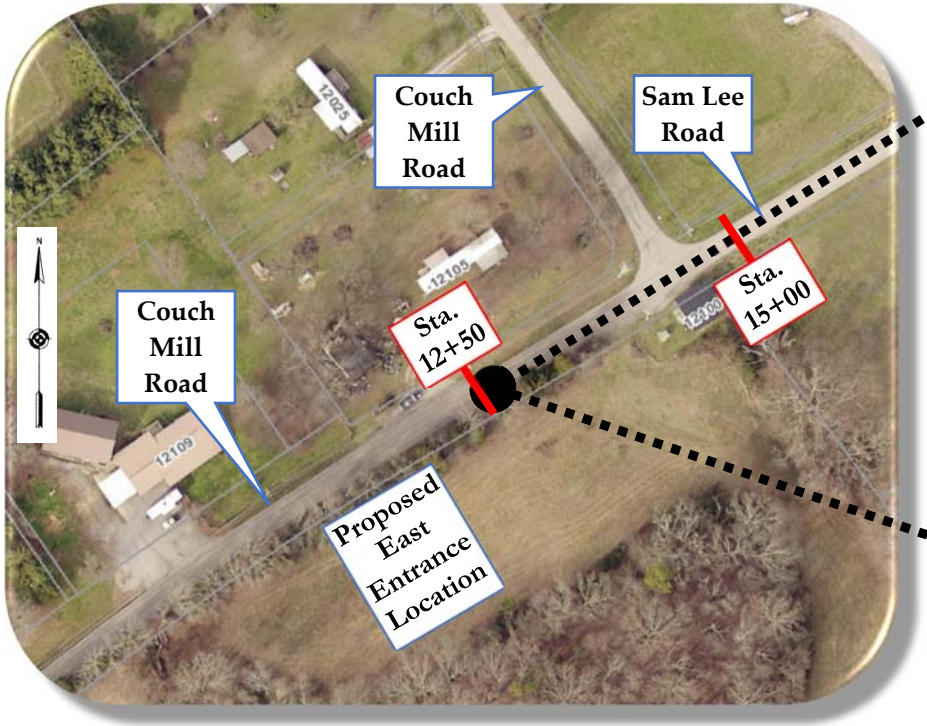
Couch Mill Road

View of Couch Mill Road
(Looking Southwest)



View of Couch Mill Road
(Looking Northeast)

Section 3 Information:
Pavement Width of Couch Mill Road @:
Station 12+50 = 20.5 feet
Pavement Width of Sam Lee Road @:
Station 15+00 = 19.25 feet

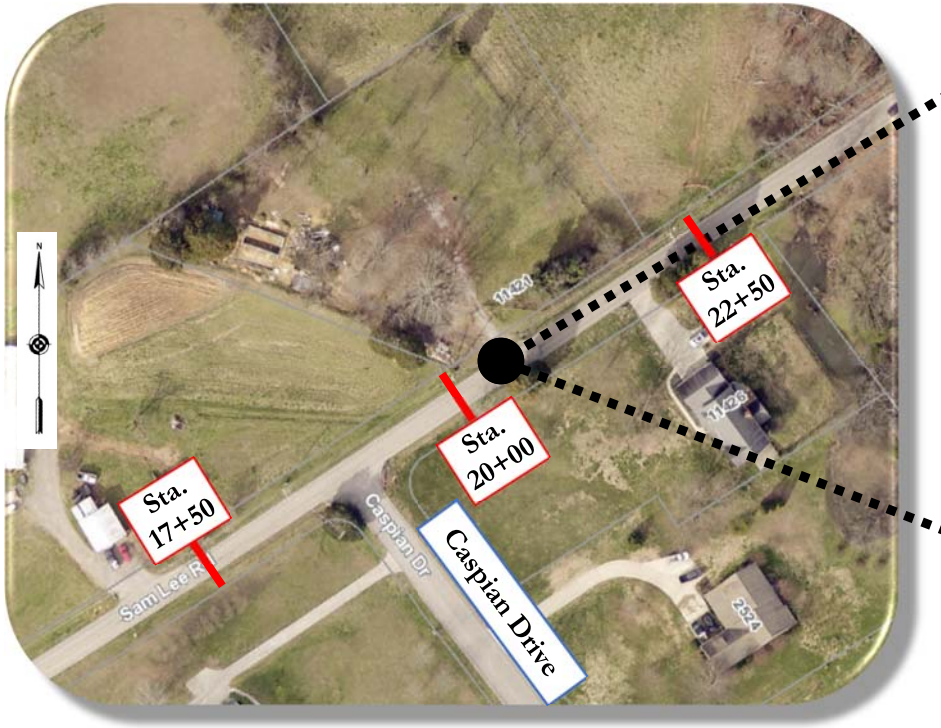


Couch Mill Road at Proposed East Entrance Location

View of Couch Mill Road (Looking Southwest)

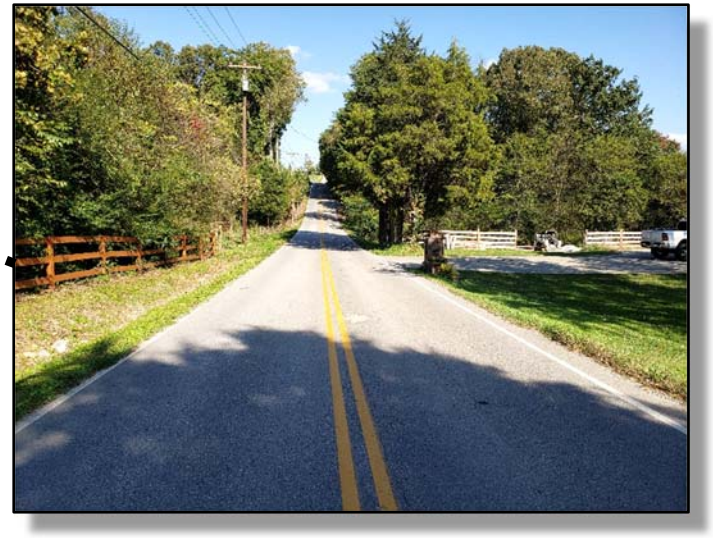
View of Couch Mill Road (Looking Northeast)

Section 4 Information:
Pavement Width of Sam Lee Road @:
Station 17+50 = 18.5 feet
Station 20+00 = 19.75 feet
Station 22+50 = 19 feet



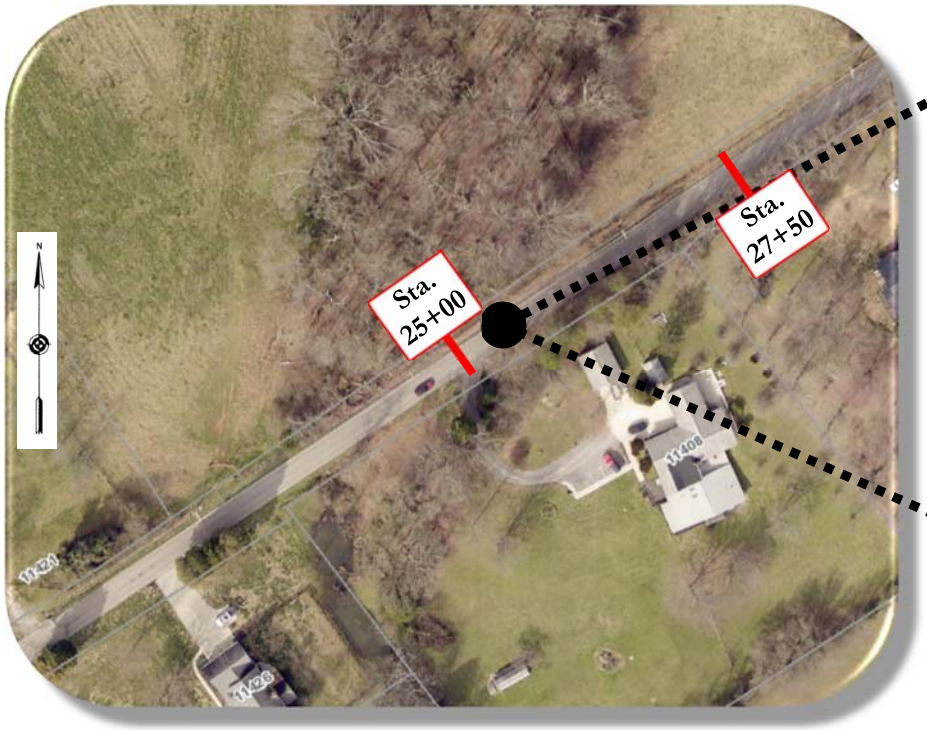
Sam Lee Road at Caspian Drive

View of Sam Lee Road
(Looking Southwest)



View of Sam Lee Road
(Looking Northeast)

Section 5 Information:
Pavement Width of Sam Lee Road @:
Station 25+00 = 19.75 feet
Station 27+50 = 19 feet

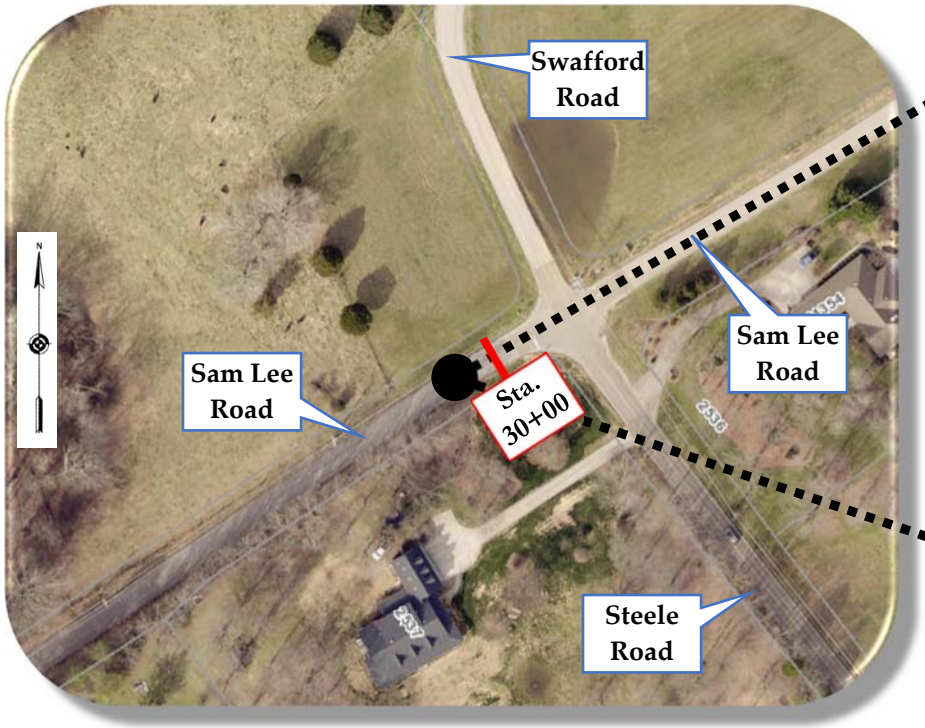


Sam Lee Road

View of Sam Lee Road
(Looking Southwest)

View of Sam Lee Road
(Looking Northeast)

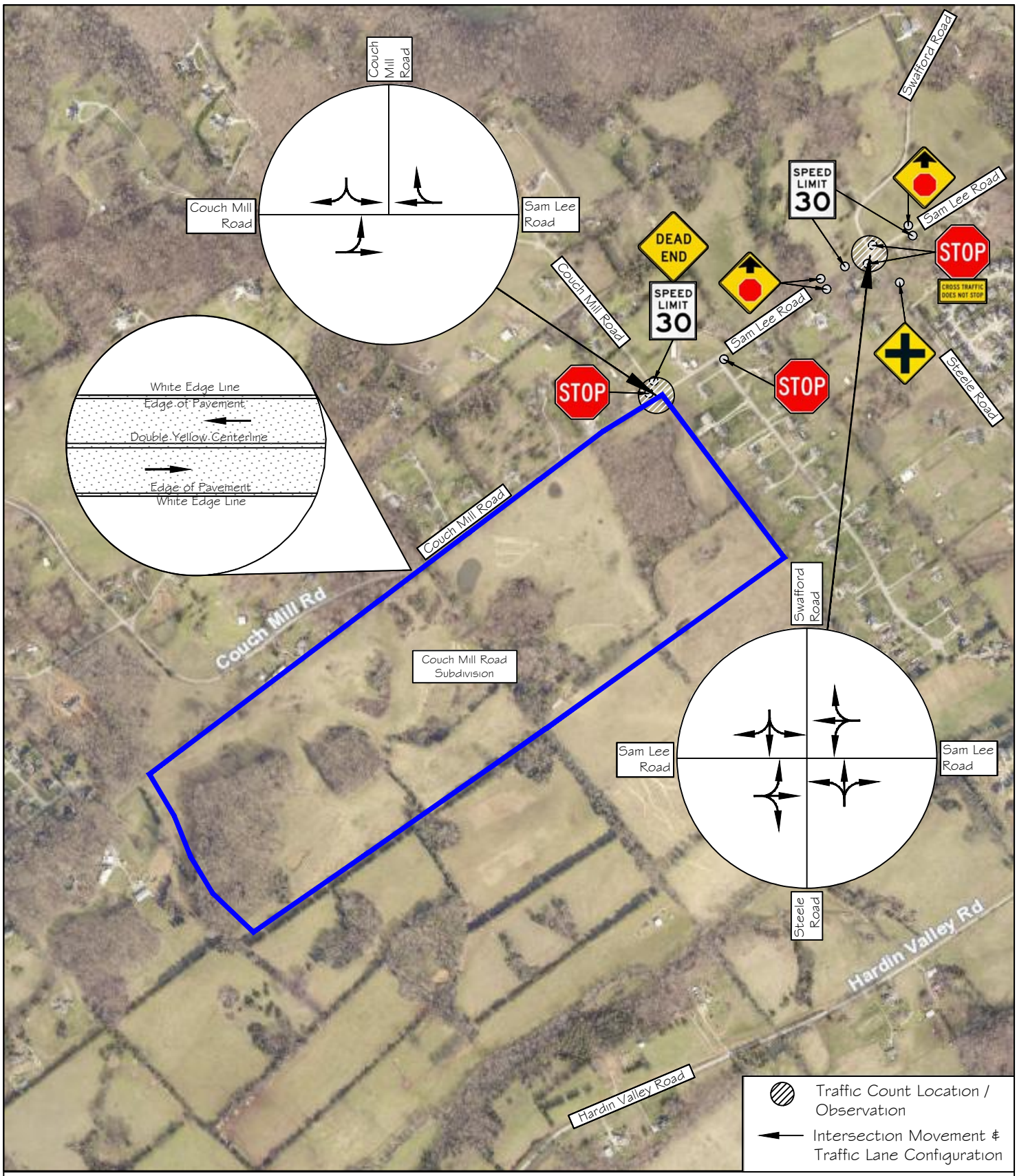
Section 6 Information:
Pavement Width of Sam Lee Road @:
Station 30+00 = 21.5 feet



Sam Lee Road at Steele Road and Swafford Road

View of Sam Lee Road (Looking Southwest)

View of Sam Lee Road (Looking Northeast)



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NOT TO SCALE

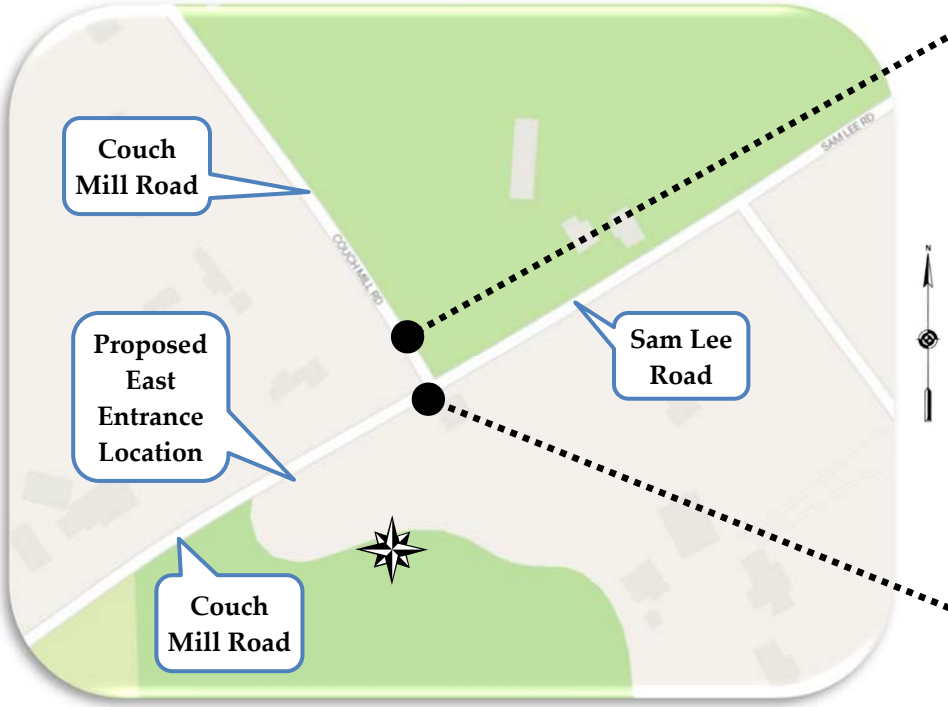
NORTH

FIGURE 2

Couch Mill Road Subdivision

Traffic Count Locations, Traffic Signage & Existing Lane Configurations

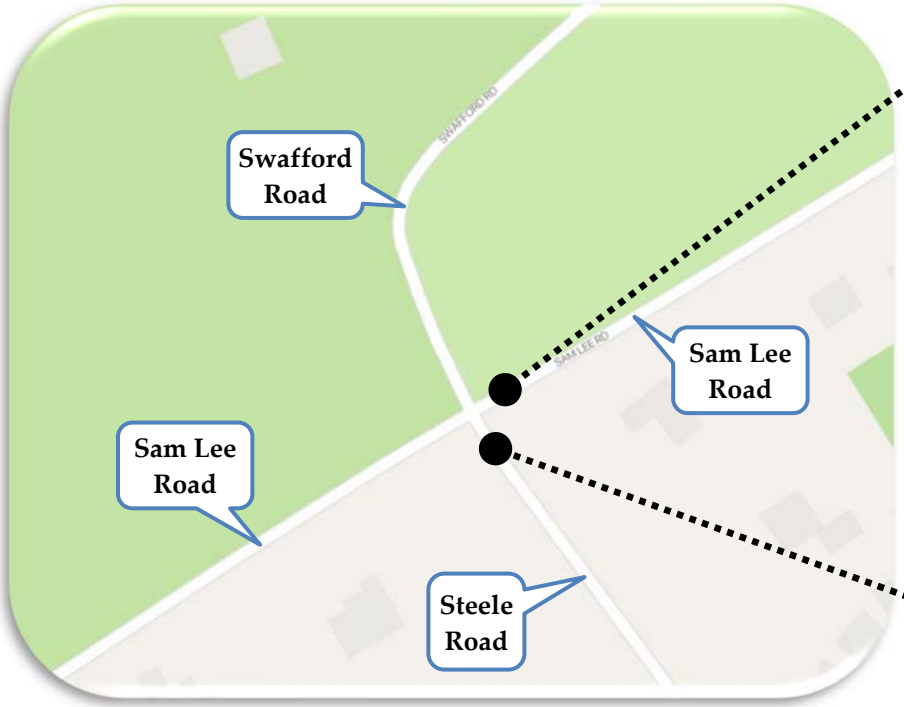
PHOTO EXHIBITS



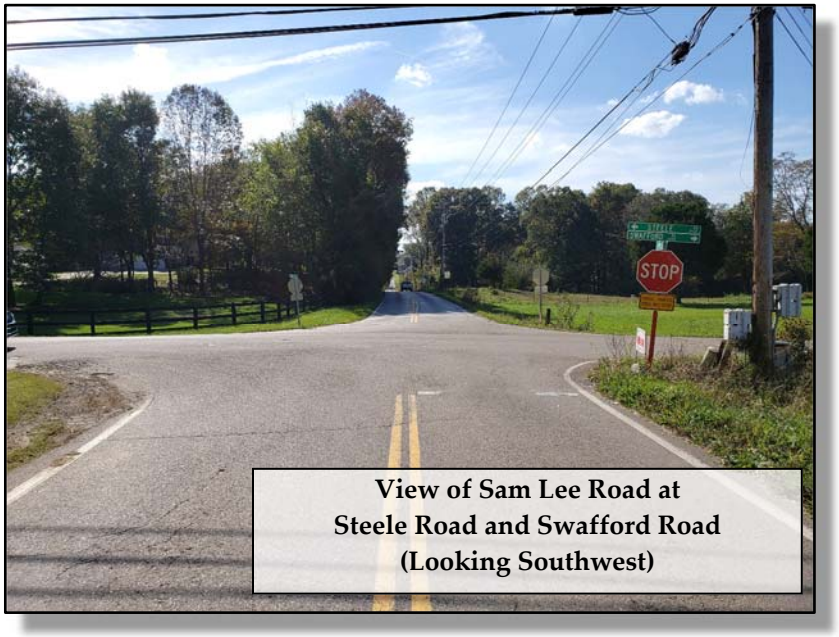
Couch Mill Road at Sam Lee Road

View of Couch Mill Road at Sam Lee Road (Looking Southeast)

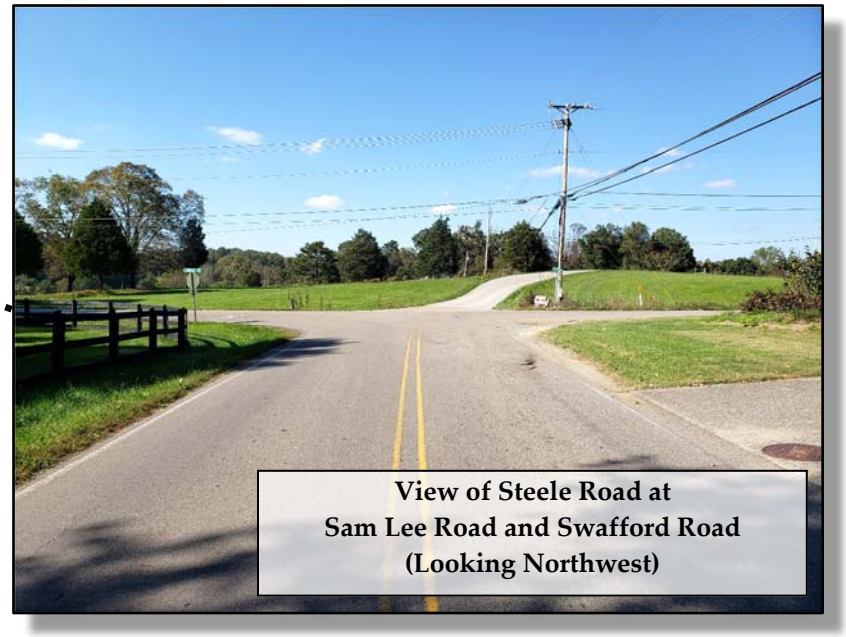
View of Intersection of Couch Mill Road at Sam Lee Road (Looking Northeast)



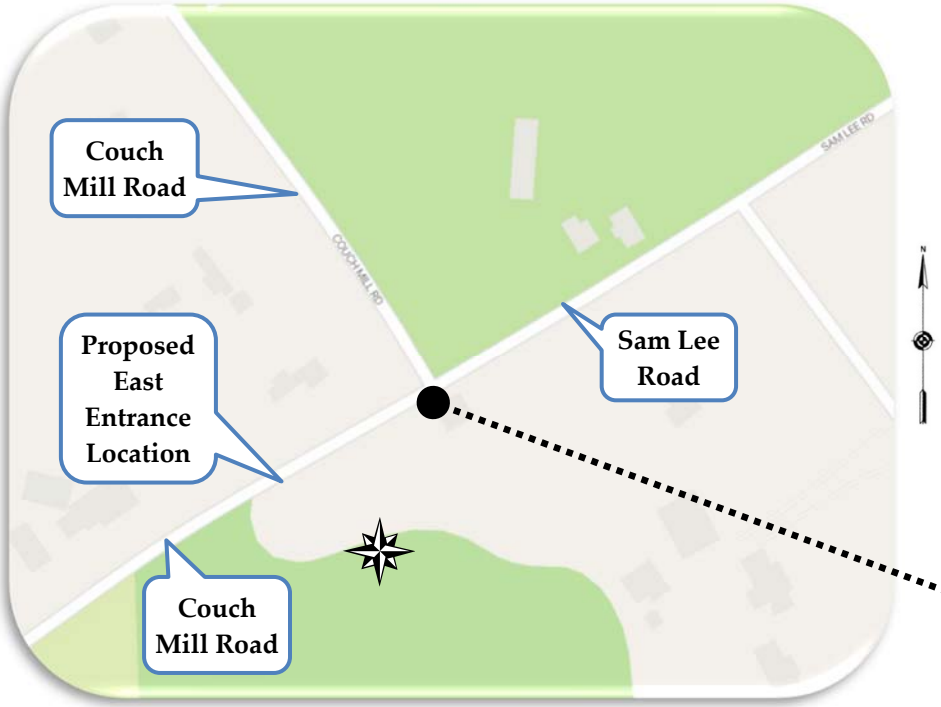
Sam Lee Road at Steele Road and Swafford Road



View of Sam Lee Road at
Steele Road and Swafford Road
(Looking Southwest)



View of Steele Road at
Sam Lee Road and Swafford Road
(Looking Northwest)



Couch Mill Road at Sam Lee Road

View of Project Site on Northwest Side (Looking South)

- **EXISTING TRANSPORTATION VOLUMES PER MODE**:

One vehicular traffic count location exists near the development site, and this count is conducted by the Knoxville Regional Transportation Planning Organization (TPO) every other year. The count location data is the following and can be viewed with further details in Appendix A:

- Existing vehicular roadway traffic:

  The Knoxville TPO reported an Average Daily Traffic (ADT) on Couch Mill Road, west of Steele Road, at 910 vehicles per day in 2019. From 2010 to 2019, this count station has indicated a flat 0.0% average annual growth rate.

- Existing bicycle and pedestrian volumes:

  The average daily pedestrian and bicycle traffic along Couch Mill Road and Sam Lee Road is unknown but is estimated to be minimal due to the lack of facilities. An online website, strava.com, provides "heat" maps detailing exercise routes taken by pedestrians, joggers, and bicyclists. The provided heat maps show the last two years of data, are updated monthly, and are gathered from individuals allowing their smart devices to track and compile their routes (millions of users). Based on the Strava heat map data, some bicycle traffic occurs on Couch Mill Road and Sam Lee Road, but fewer recordings of pedestrians or joggers are observed on Couch Mill Road and Sam Lee Road. The activities in the maps are shown on the roads with color intensities with lighter colors signifying higher activity.

Strava Heat Map for Bicyclists

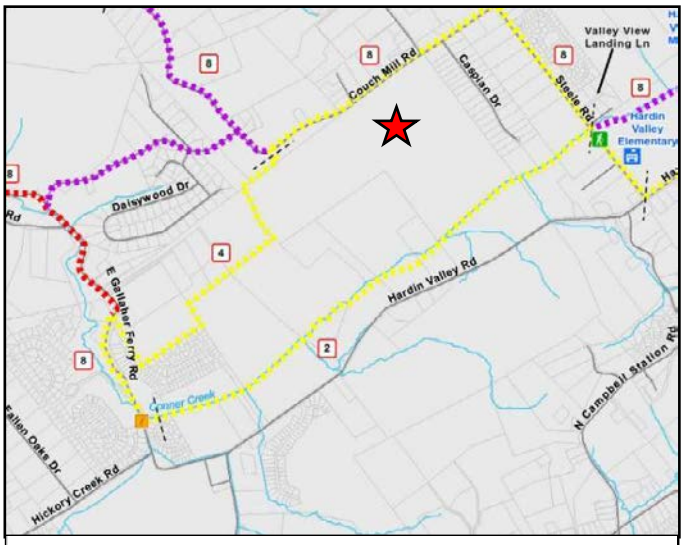
Strava Heat Map for Pedestrian and Joggers

- **ON-STREET PARKING:**

On-street parking was not observed during the site review and is not allowed on Sam Lee Road or Couch Mill Road adjacent to the project site.

- **PEDESTRIAN AND BICYCLE FACILITIES:**

Bicycle lanes are not currently available within the project site study area. The closest bicycle facilities are located nearly four miles to the northeast at Pellissippi State Community College. The Pellissippi Parkway Greenway runs from Pellissippi State Community College south to Carmichael Road and parallels Pellissippi Parkway (SR 162) on the west side. The greenway is paved and is approximately one mile in length.



Knox County Greenway Corridor Study (2020)
Beaver Creek West

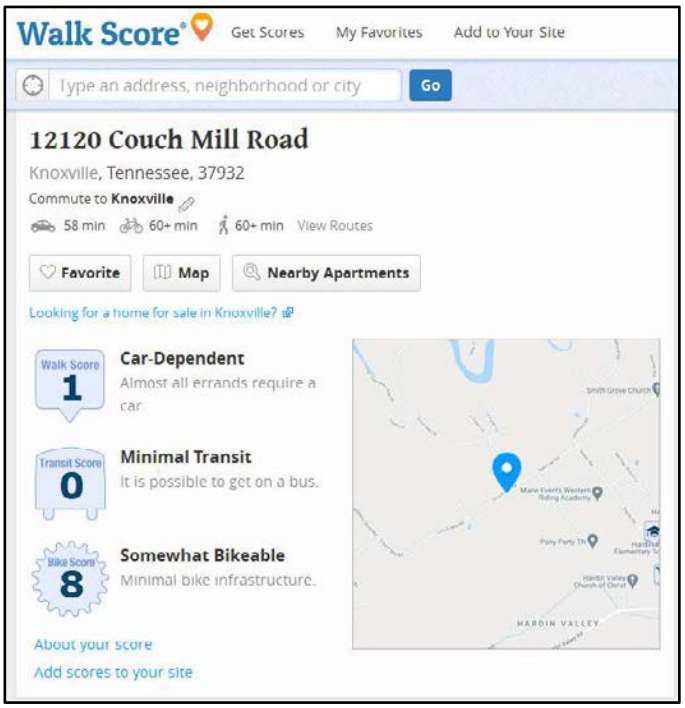
Knox County completed a Greenway Corridor Study in 2020. This study evaluated potential alignments for new greenways throughout Knox County. One of the corridors, Beaver Creek West, was identified and evaluated in the study. This corridor would run from Melton Hill Park in Hardin Valley to Interstate 75 in Powell. One of the preferred routes for this greenway corridor is Couch Mill Road adjacent to the development site and along Sam Lee Road and Steele Road to the east.

The executive summary in the Knox County study states: "The greenway corridor study will be utilized when asking for greenway easements from developers and property owners as their proposed construction projects go through Knoxville/Knox County Planning for approval. The County's policy is to acquire property or easements for greenways only through voluntary donation or sale."

The document does not state a timeframe for developing the greenways identified in the study, but the Beaver Creek West Greenway segment adjacent to the development site on Couch Mill Road is listed as a high priority.

- **WALK SCORE**:

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



Appendix B shows maps and other information for the Walk Score, Bike Score, and Transit Score at the approximate development property address (12120 Couch Mill Road). The project site location is graded with a Walk Score of 1. This low score is due to the lack of sidewalks continuing to outside destinations and very few close-by amenities. This Walk Score indicates that the site is entirely dependent on vehicles for errands and travel. The closest existing sidewalk is located on the east side of Steele Road, 420 feet to the south of the intersection of Sam Lee Road and Swafford Road, and 2,075 feet away from the proposed development site. The site is graded with a Bike Score of 8, which means there is minimal bike infrastructure but is somewhat bikeable. The site is given a Transit Score of zero.

- **TRANSIT SERVICES**:

The City of Knoxville has a network of public transit opportunities offered by Knoxville Area Transit (KAT). Bus service is not available in this area, and the overall KAT bus system map is in Appendix C. The closest public transit bus stop is 8.0 miles away at Parkwest Medical Center off Sherrill Boulevard and is Route 16, "Cedar Bluff Connector". It operates on weekdays and weekends, and this route map is also included in Appendix C. Other transit services in the area include the East Tennessee Human Resource Agency (ETHRA) and the Community Action Committee (CAC), which provides transportation services when requested.

PROJECT DESCRIPTION

- **LOCATION AND SITE PLAN:**

The proposed plan layout designed by Batson, Himes, Norvell, and Poe is shown in Figure 3. The development property of 131.2 +/- acres will be a subdivision of an existing parcel containing nearly 370 acres. The plan shows road stub-outs to the south to the remaining 370-acre parent parcel, but this is for speculative purposes only. The remaining property to the south is not for sale, and there are no plans for development.

The residential development will have two entrances and are labeled as the Proposed East and West Entrances. The Proposed East Entrance will be located on Couch Mill Road, 300 feet to the west of the existing intersection of Couch Mill Road at Sam Lee Road. The Proposed West Entrance will be located 982 feet to the west of the Proposed East Entrance and 300 feet to the east of Dusty Way (private).

View of Northern Portion of Site – Near Proposed East Entrance Location (Looking Southwest)

The single-family detached lots will average between 7,000 – 15,000 square feet (~ 0.15 acre - 0.35 acre) in size, with a few lots near ¾ of an acre. Each home will have a garage and driveway, and the townhouses will also have individual driveways. The townhouse lots will average around 5,500 square feet (0.12 acre). Sidewalks will be provided on one side of the internal roads in the development. The subdivision design shows 15 common areas in the development with a total area of 33.54 acres. Some of the common areas will incorporate stormwater controls, and others will contain amenity features for the subdivision residents.

The schedule for completion of the Couch Mill Road Subdivision 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 incredible 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 seven years (2028).

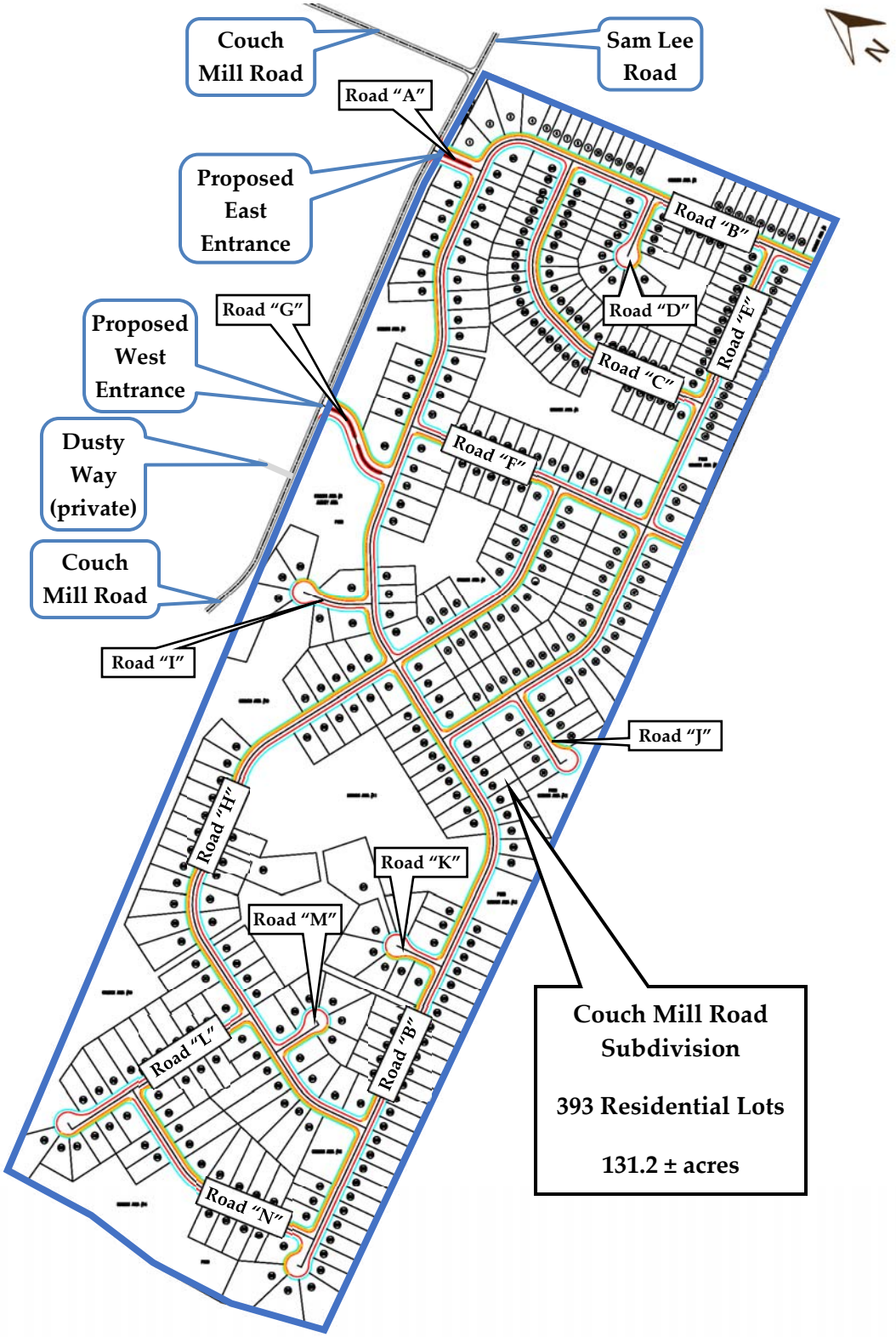


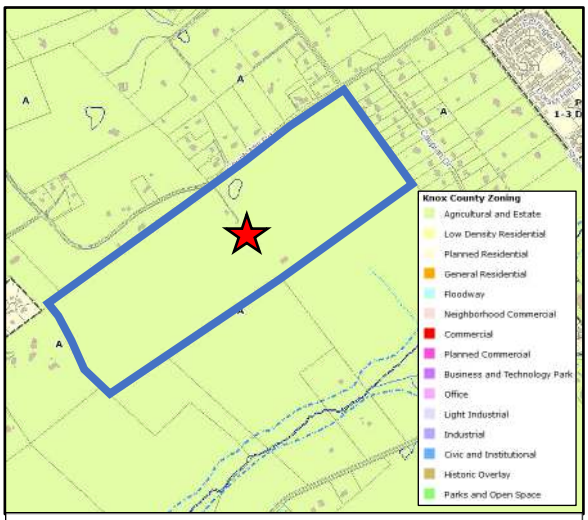
Figure 3
Proposed Plan Layout
Couch Mill Road Subdivision

Not to Scale

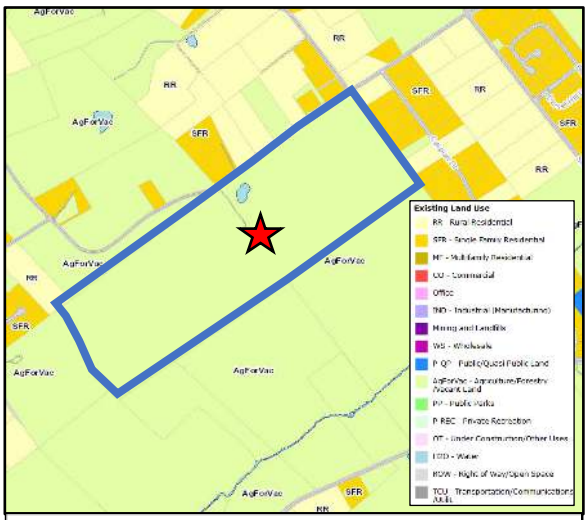
- **PROPOSED USES AND ZONING REQUIREMENTS:**

The Couch Mill Road Subdivision property is currently zoned Agricultural (A). The developer has recently requested the property to be changed to Planned Residential (PR) zoning with up to three units per acre. The most recent published online KGIS zoning map is provided in Appendix D. The Planned Residential (PR) zone allows for various land uses primarily within the residential realm. Uses permitted in this zone include single-family dwellings, duplexes, and multi-dwelling structures and developments. The existing adjacent surrounding zoning and land uses are the following:

- The properties to the west of the development site are zoned as Agricultural (A). These properties consist of a couple of single-family houses with small farm operations and undeveloped forested land.
- All the properties to the north of the development site and Couch Mill Road are zoned as Agricultural (A). These properties consist of standalone single-family houses located on large lot sizes with open areas and forested land.
- To the east, the development property is bound by ten single-family detached houses along Caspian Drive in an existing subdivision. This subdivision, Chadwick Downs, consists of larger estate-size lots and is zoned under the Agricultural (A) designation.
- The development property will be bound to the south by three undeveloped properties consisting of forested areas and farm pasture. All the properties to the south are zoned Agricultural (A). The largest property to the south will consist of the remaining portion of the 370-acre parent parcel.



Existing Zoning Map



Existing Land Use Map

- **DEVELOPMENT DENSITY:**

Couch Mill Road Subdivision's proposed density is based on a maximum of 278 single-family detached houses and 115 multi-family attached townhouses for a total of 393 units on 131.2 acres. The density computes to 2.99 units per acre, slightly less than the proposed rezoning request of 3.0 units per acre.

- **ON-SITE CIRCULATION:**

The total length of the internal roads will be approximately 16,330 feet (3.1 miles) and designed and constructed to Knox County, TN specifications. Fourteen new internal roads shown in Figure 3 are labeled as Road "A" thru Road "N" with Road "A" comprising the Proposed East Entrance and Road "G" as the Proposed West Entrance. The entrance roads, Road "A" and Road "G", will be constructed with a boulevard typical section with a 10-foot raised center median. The internal roads will be asphalt paved and include 8" extruded concrete curbs. The lane widths will be 13 feet each for a total 26-foot pavement roadway. Concrete sidewalks are proposed on one side of each internal road in the development. The street right-of-way within the development will be 50 feet. The internal roads will be public, and Knox County will maintain the streets in the subdivision after construction.

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

Besides passenger vehicles, the new streets will also provide access for service, delivery, maintenance, and fire protection/rescue vehicles. These non-passenger vehicles will not impact roadway operations other than when they occasionally enter and exit the development. It is expected that curbside garbage collection services will be available for this residential subdivision.

The new roads will be designed and constructed to Knox County specifications and are expected to be adequate for fire protection and rescue vehicles. The subdivision's internal roadways will accommodate the larger vehicle types and residents' standard passenger vehicles.

ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

- **EXISTING TRAFFIC CONDITIONS:**

For this study, a traffic count was conducted at the intersection of Couch Mill Road at Sam Lee Road on November 9, 2021. An additional traffic count was conducted at the intersection of Sam Lee Road at Steele Road and Swafford Road on October 19, 2021, by National Data & Surveying Services for Knox County Engineering. The data from this count for Knox County Engineering was obtained for this study.

The manual traffic counts were conducted to tabulate the morning and afternoon peak periods and the travel directions during the peak periods. Local county public schools were in session when the traffic counts were conducted. Based on the traffic volumes collected, the AM and PM peak hours were observed at 7:15 – 8:15 am and 3:30 – 4:30 pm at both intersections.

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

- At the intersection of Couch Mill Road at Sam Lee Road, several school buses were observed during the traffic count. Most of the southbound traffic on Couch Mill Road was observed turning left towards the east on Sam Lee Road. Very few southbound vehicles were observed turning right towards the west, and these vehicles were primarily school buses and delivery trucks on a defined route. Likewise, very few eastbound vehicles on Couch Mill Road turned left northbound onto Couch Mill Road at Sam Lee Road.
- One bicyclist was observed in the early afternoon traveling west at the intersection of Couch Mill Road and Sam Lee Road. This bicyclist was observed returning eastbound approximately 30 minutes later in the opposite direction. No pedestrians were observed at this intersection during the traffic count.
- The National Data & Surveying Services traffic count at the intersection of Sam Lee Road at Steele Road and Swafford Road noted one bicyclist in the late afternoon heading westbound on Sam Lee Road. No pedestrians were observed at this intersection during the traffic count.

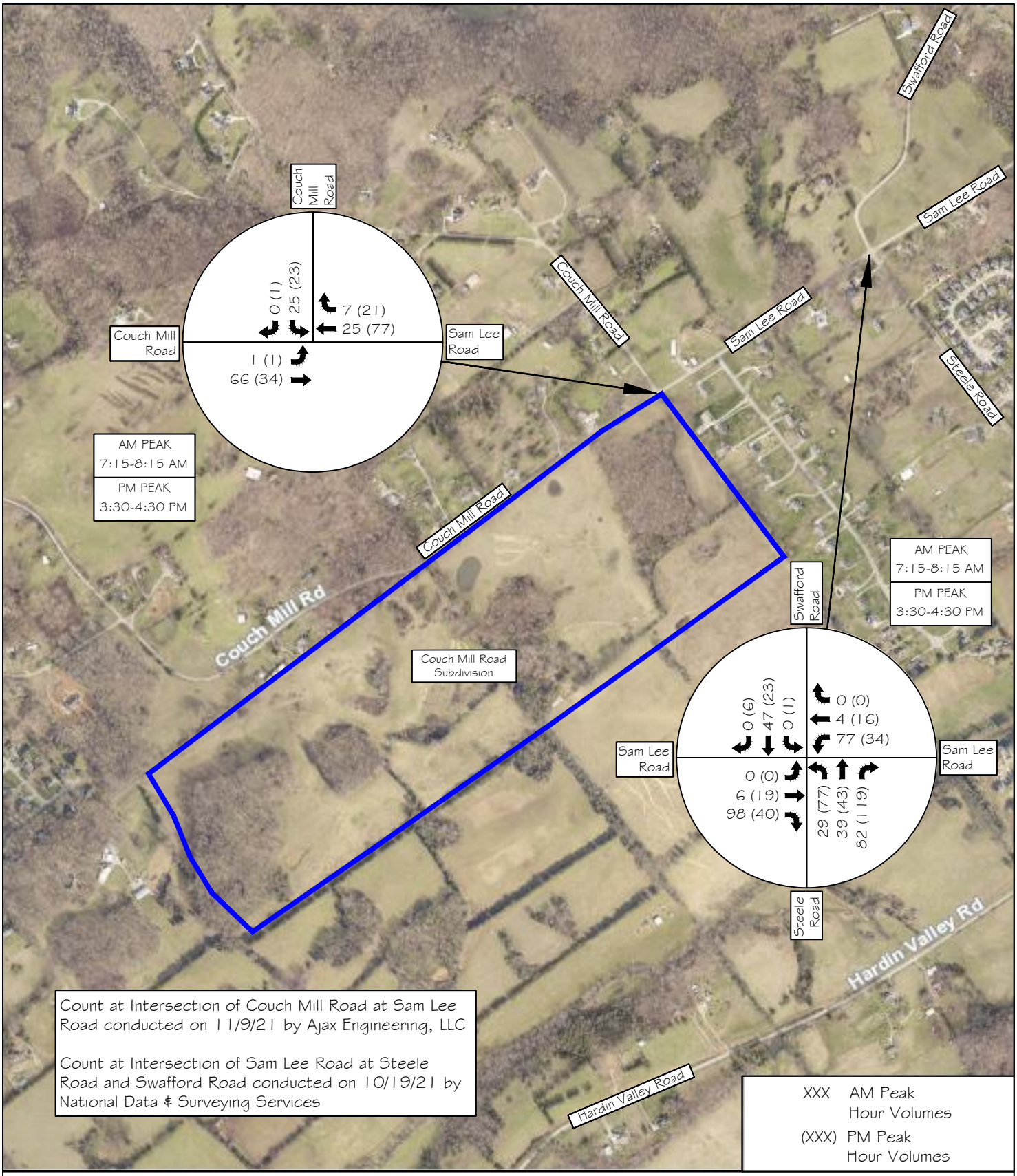


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FIGURE 4

Couch Mill Road Subdivision

2021 Peak Hour Traffic Volumes - EXISTING TRAFFIC CONDITIONS

Capacity analyses were undertaken to determine the Level of Service (LOS) for the intersections for the existing 2021 traffic volumes shown in Figure 4. The capacity analyses were calculated following the Highway Capacity Manual (HCM) methods and utilizing Synchro Traffic Software (Version 8).

Methodology:

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

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

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

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

Intersection capacity results from the existing 2021 peak hour traffic are shown in Table 3. The intersections in the table are shown with a LOS designation, delay (in seconds), and v/c ratio (volume/capacity) for the AM and PM peak hours. Appendix F includes the worksheets for the existing 2021 peak hour capacity analyses.

As shown in Table 3, all the traffic movements at the existing intersections are calculated in the current conditions to operate with good to average LOS and vehicle delays.

TABLE 2
LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS

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

Source: Highway Capacity Manual, 6th Edition

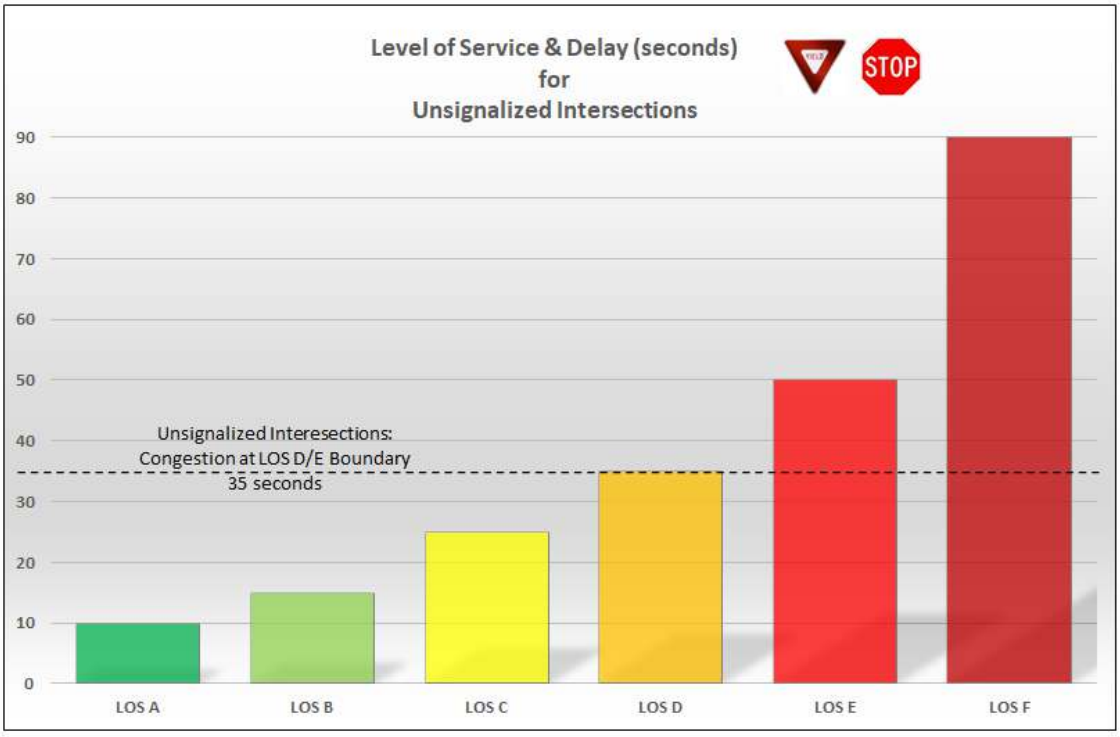


TABLE 3
2021 INTERSECTION CAPACITY ANALYSIS RESULTS - EXISTING CONDITIONS

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
Sam Lee Road at Steele Road and Swafford Road	Unsignalized	Northbound Left/Thru/Right	A	7.5	0.029	A	7.5	0.059
		Eastbound Left/Thru/Right	A	9.5	0.122	B	10.9	0.111
		Westbound Left/Thru/Right	B	13.7	0.213	B	14.9	0.209
		Southbound Left/Thru/Right	A	0.0	-	A	7.8	0.003
Couch Mill Road at Sam Lee Road	Unsignalized	Eastbound Left/Thru	A	7.3	0.003	A	7.5	0.003
		Southbound Left/Right	A	9.7	0.040	A	9.8	0.041

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2010 intersection methodology

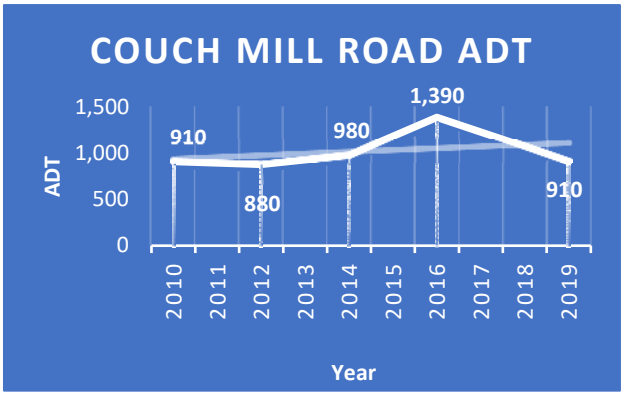
[a] Level of Service

[b] Average Delay (sec/vehicle)

[c] Volume-to-Capacity Ratio

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

Horizon year traffic conditions represent the projected traffic volumes in the study area without the proposed project being developed (no-build option). As previously stated, the build-out and full occupancy for this proposed development is assumed will occur by 2028. This horizon year corresponds to seven years for this development to reach full capacity and occupancy.



According to the nearby Knoxville TPO count station, traffic growth on Couch Mill Road has been flat over the past ten years (2010-2019). An increase in traffic volumes was recorded on Couch Mill Road in 2016, but the most recent tabulation in 2019 showed a subsequent decrease in traffic volumes, resulting in the same daily traffic volume as recorded in 2010. For this study, a +2% annual growth rate was assumed to consider any future development in the area, potential rising travel volumes, and a reasonable estimate to analyze the projected horizon year traffic volumes for the AM and PM peak hours at the studied intersections in the year 2028.

Capacity analyses were undertaken to determine the projected LOS in 2028 for the intersections, and the results are shown in Table 4. Figure 5 shows the projected horizon year traffic volumes at the intersections in 2028 during the AM and PM peak hours without the project.

TABLE 4
2028 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITHOUT THE PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
Sam Lee Road at Steele Road and Swafford Road	STOP Unsignalized	Northbound Left/Thru/Right	A	7.5	0.034	A	7.5	0.068
		Eastbound Left/Thru/Right	A	9.7	0.144	B	11.5	0.137
		Westbound Left/Thru/Right	C	15.3	0.270	C	17.0	0.269
		Southbound Left/Thru/Right	A	0.0	-	A	7.9	0.003
Couch Mill Road at Sam Lee Road	STOP Unsignalized	Eastbound Left/Thru	A	7.3	0.003	A	7.5	0.003
		Southbound Left/Right	A	9.9	0.048	B	10.1	0.048

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2010 intersection methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

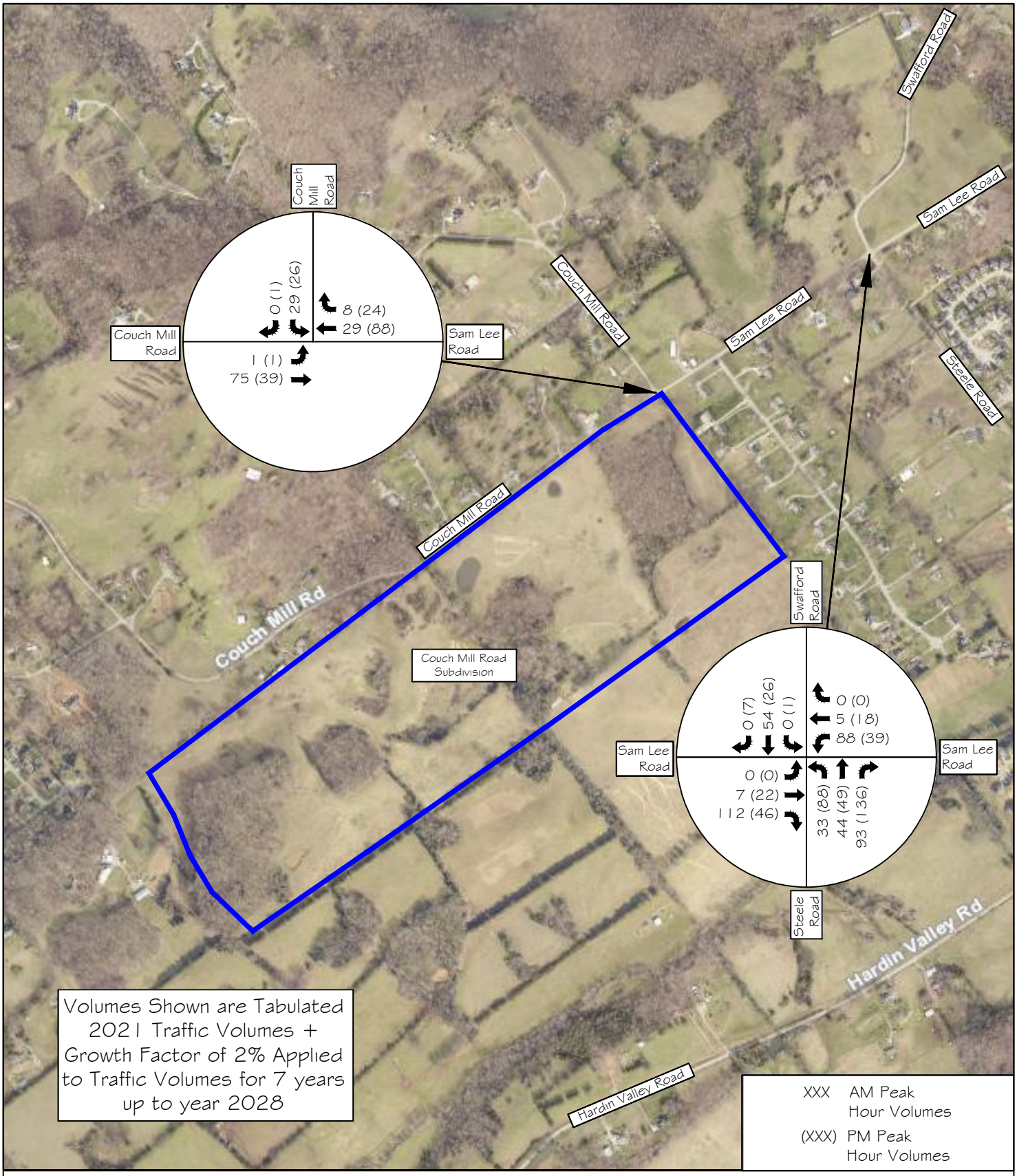


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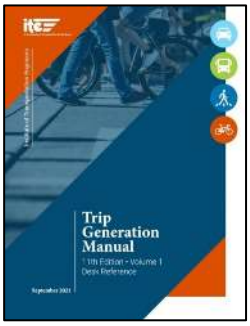
FIGURE 5

Couch Mill Road Subdivision

2028 Peak Hour Traffic Volumes - PROJECTED HORIZON YEAR TRAFFIC (WITHOUT THE PROJECT)

- **TRIP GENERATION:**



For the Couch Mill Road Subdivision, the estimated amount of traffic that the 278 single-family detached houses will generate was calculated based on equations provided by the Trip Generation Manual, 11th Edition, a publication of the Institute of Transportation Engineers (ITE). A generated trip is a single or one-direction vehicle movement that enters or exits the study site.

The estimated amount of traffic that the 115 multi-family attached townhouses will generate was calculated based on Knoxville/Knox County Planning equations. These equations were developed from local studies to estimate apartment (and townhouse) trip generation in the surrounding area and were published in December 1999. For Knox County, this is the preferred rate to use for apartments and townhouses. The data and calculations for the proposed land uses are shown in Appendix G. A summary of this information is presented in the following table:

TABLE 5
TRIP GENERATION FOR THE COUCH MILL ROAD SUBDIVISION
278 Single-Family Detached Homes and 115 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	278	2,585	26%	74%		63%	37%	
				49	140	189	164	96	260
Local Trip Rate	Multi-Family Attached Townhouses	115	1,082	22%	78%		55%	45%	
				13	48	61	48	39	87
Total New Volume Site Trips			**3,667**	**62**	**188**	**250**	**212**	**135**	**347**

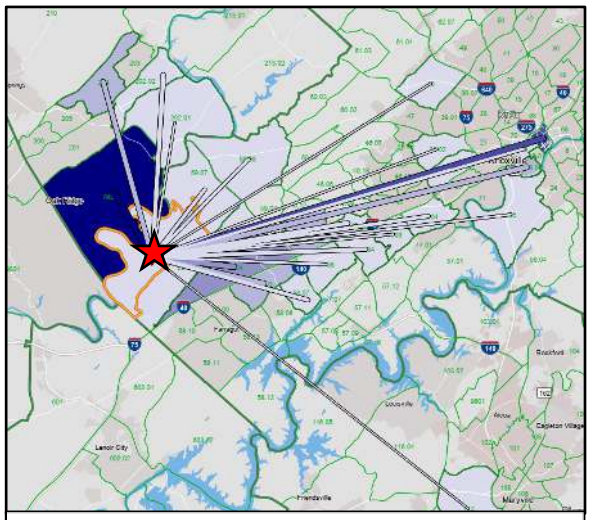
ITE Trip Generation Manual, 11th Edition and Local Trip Rates
Trips calculated by using Fitted Curve Equations

For the proposed residential development, with 278 single-family detached houses and 115 multi-family attached townhouses, it is estimated that 62 vehicles will enter and 188 will exit, for a total of 250 generated trips during the AM peak hour in the year 2028. Similarly, it is estimated that 212 vehicles will enter and 135 will exit, for a total of 347 generated trips during the PM peak hour in the year 2028. The calculated trips generated for an average weekday are 3,667 vehicles for the proposed development. No trip reductions were included in the analysis.

- **TRIP DISTRIBUTION AND ASSIGNMENT:**

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

The percentages assumed and shown in Figure 6 are based on several sources and judgments. The first source is based on the traffic count results collected at the existing intersections nearby the proposed development site and the existing observed directions of travel.



2019 Census Bureau Work-Based Trips to & from Census Tract 59.06

The second source for projected trip distribution is based on work-related trips in the local area. Work-based trips will be a significant driver of generated trips by the development, and these trips are more likely to travel to and from the north and east. This assertion is based on data from the United States Bureau website for Census Tract 59.06, where the development property is located. Based on 2019 (latest available) census data and as shown in Appendix H, most work-based trips in the surrounding area correspond to Oak Ridge, Oak Ridge National Labs (ORNL), downtown Knoxville (including the University of Tennessee), and West Knoxville.

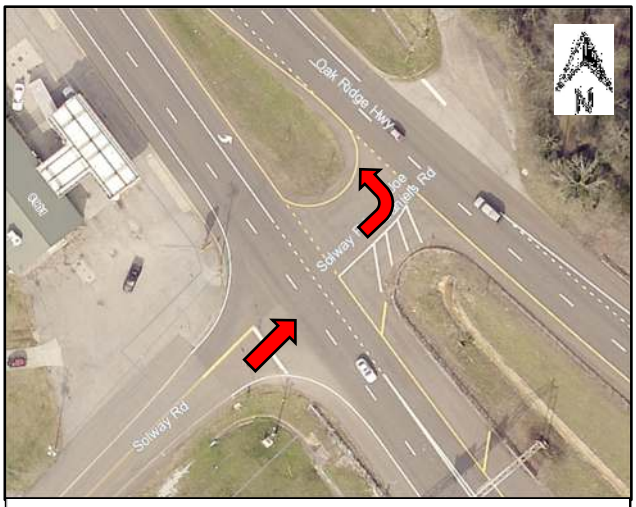
In addition to employment centers, some generated traffic will travel to and from various public and private elementary, middle, and high schools. This subdivision will be zoned for Hardin Valley Elementary, Middle, and High School (Academy). These schools are located 1.5 - 2 miles away by roadway to the southeast near Steele Road and Hardin Valley Road and will be a second major impetus of external trip-making.

The Knox County Schools Transportation Department has developed Parental Responsibility Zones (PRZ) to determine whether students are offered transportation services to and from school. According to the Knox County School system, the PRZ is defined as being 1.5 miles for grades 6 – 12 and 1.0 miles for grades K – 5 from the point where the students' parcel is accessed and the point where the busses unload at the school. Even though this proposed subdivision is

close to the larger PRZ limit of 1.5 miles, it is not believed that any of the Couch Mill Road Subdivision houses will be measured within this zone. All school-age children in the subdivision will be able to utilize this service if desired.

The US Census data shows that many future Couch Mill Road Subdivision residents will likely travel to and from the north for employment in Oak Ridge and Anderson County, especially at the ORNL. Current residents in the Couch Mill Road area who travel to (and from) the north have two main alternatives: accessing Pellissippi Parkway first by traveling on Steele Road and then traveling eastbound on Hardin Valley Road, or by accessing Pellissippi Parkway first by traveling on Sam Lee Road or Swafford Road then traveling north on Solway Road. Solway Road terminates to the north at the Pellissippi Parkway/Oak Ridge Highway (SR 62) interchange. Each alternative route towards the north is frequently hampered by travel delays in peak periods and has potential safety issues.

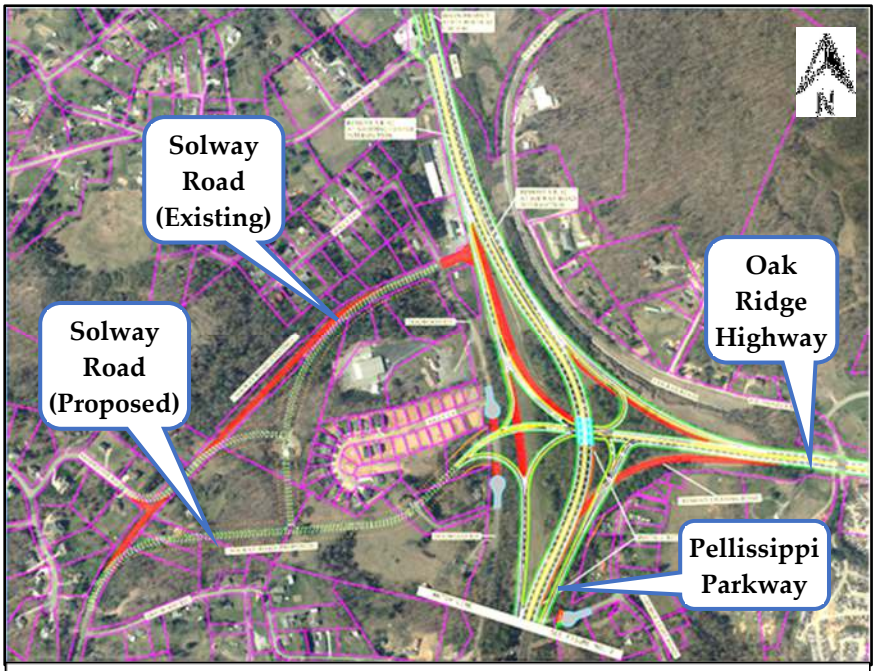
Current residents that travel to the east towards Pellissippi Parkway via Steele Road and Hardin Valley Road from the Couch Mill Road area experience considerable vehicle delays, especially during the Hardin Valley public school arrival and dismissal periods. Traffic associated with commercial development and Pellissippi State Community College near the Pellissippi Parkway at Hardin Valley Road interchange also contributes to travel delays. Residents traveling on Sam Lee Road or Swafford Road to Solway Road and then to the Pellissippi Parkway interchange at Solway experience vehicle delays and safety issues. Sam Lee Road and Swafford Road have challenging road geometry, and Solway Road terminates at the Pellissippi Parkway/Oak Ridge Highway interchange with unfavorable conditions for northbound motorists. This interchange requires motorists on Solway Road heading north to cross and turn at two heavily traveled highways.



Travel to the North - Solway Road at Pellissippi Parkway at Oak Ridge Highway Interchange

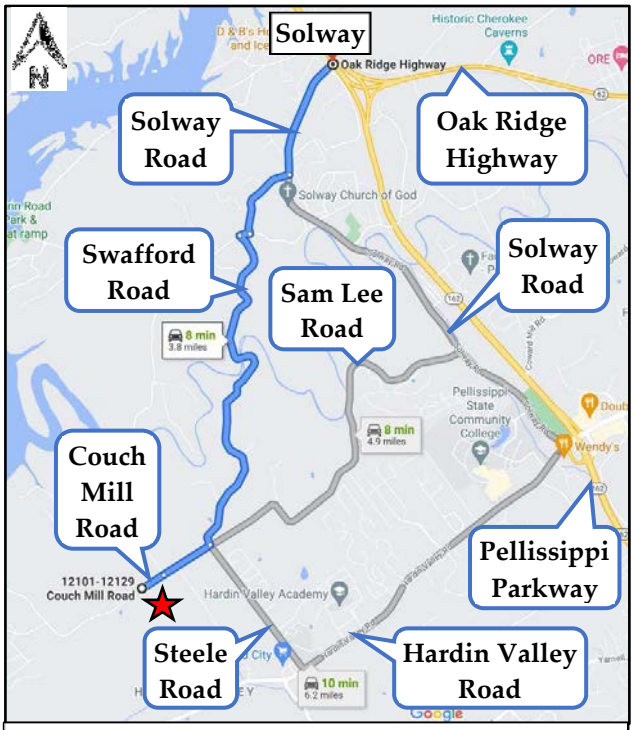
The Tennessee Department of Transportation (TDOT) is currently in the design stage to improve the interchange of Pellissippi Parkway/Oak Ridge Highway in Solway. This project is slated to also improve Solway Road by tying the roadway directly into the new interchange. This project will greatly enhance safety and improve traffic flow for motorists traveling to and from the north

via Solway Road. This improvement will also potentially entice more residents from the Couch Mill Road and Hardin Valley area to utilize Solway Road to travel to and from the north and subsequently reduce a minor amount of traffic at the Pellissippi Parkway/Hardin Valley Road interchange. Mike Conger, PE, with Knoxville/Knox County Planning, provided an image of a preliminary TDOT layout of the new Solway interchange and is shown below. This layout is subject to change due to the many physical and operational constraints in the interchange area. For purposes of this study, this new interchange is reasonably expected to be fully re-constructed and opened by 2028, which is the same horizon year assumed for the Couch Mill Road Subdivision.



TDOT Preliminary Layout of New Solway Interchange

Overall, this study assumed 5% of Couch Mill Road Subdivision residents would travel to and from the west on Couch Mill Road, and the vast majority, 95%, would travel to and from the east on Couch Mill Road and Sam Lee Road. At the intersection of Sam Lee Road at Steele Road and Swafford Road, 10% is assumed will travel to/from Swafford Road, 15% on Sam Lee Road, and the remaining 70% on Steele Road. The distribution of traffic shown in Figure 6 at the proposed Couch Mill Road Subdivision entrances is based on the proposed internal layout. It was assumed that 65% of the (253 out of the 390) houses would have quicker and shorter outside access via the Proposed West Entrance. This percentage corresponds to all the house lots along and to the south and west of Road "F". Thus, the entering and exiting traffic at the proposed entrances to and from the east is portioned to 40% at the Proposed East Entrance and 55% at the Proposed West Entrance.



**Google Map Routing –
Couch Mill Road to Solway**

Of the 95% of generated traffic in 2028, 20% was assigned to and from the north via the improved Solway interchange of Pellissippi Parkway at Oak Ridge Highway. This 20% is based on the US Census data, which showed nearly 20% of existing residents in the nearby area travel to Oak Ridge, ORNL, and Anderson County for work purposes. This existing trip distribution to and from the north is expected to mirror the future residents of the Couch Mill Road Subdivision. Of this 20%, 10% of trips are assigned to Swafford Road, and the other 10% is assigned to Sam Lee Road. An additional 5% is assigned to Sam Lee Road to account for potential eastbound travel by the future residents to the Pellissippi State Community College entrance on Solway Road. It also considers residents using Sam Lee Road as an alternate eastbound route to travel to the Hardin Valley Road at Pellissippi Parkway interchange to avoid traffic on Hardin Valley Road. Swafford Road currently does not experience as much traffic as Sam Lee Road but is expected to increase in the future. This expectation is due to the shorter route Swafford Road provides, and the anticipation that the Sam Lee Road corridor will experience more traffic congestion as the large Hayden Hill Subdivision on Sam Lee Road to the east fully develops. Also, a significant apartment development is currently being constructed to the east of the Sam Lee Road at Solway Road intersection. This apartment development is expected to increase vehicle delays at this intersection and also persuade more Couch Mill Road Subdivision residents to use Swafford Road.

Most (70%) of the Couch Mill Road Subdivision traffic is assumed and assigned to Steele Road. This assignment takes into account travel to the Hardin Valley public schools, eastward travel on Hardin Valley Road towards Pellissippi Parkway, and travel to the south via Hardin Valley Road to North Campbell Station Road. North Campbell Station Road provides access to Interstate 40 and 75 further to the west than Pellissippi Parkway provides and offers access to Farragut, the popular Turkey Creek development to the south, and other attractors. Figure 7 shows the traffic assignment of the computed trips generated by the development (Table 5) and applied to the intersection movements based on the assumed distribution of trips shown in Figure 6.

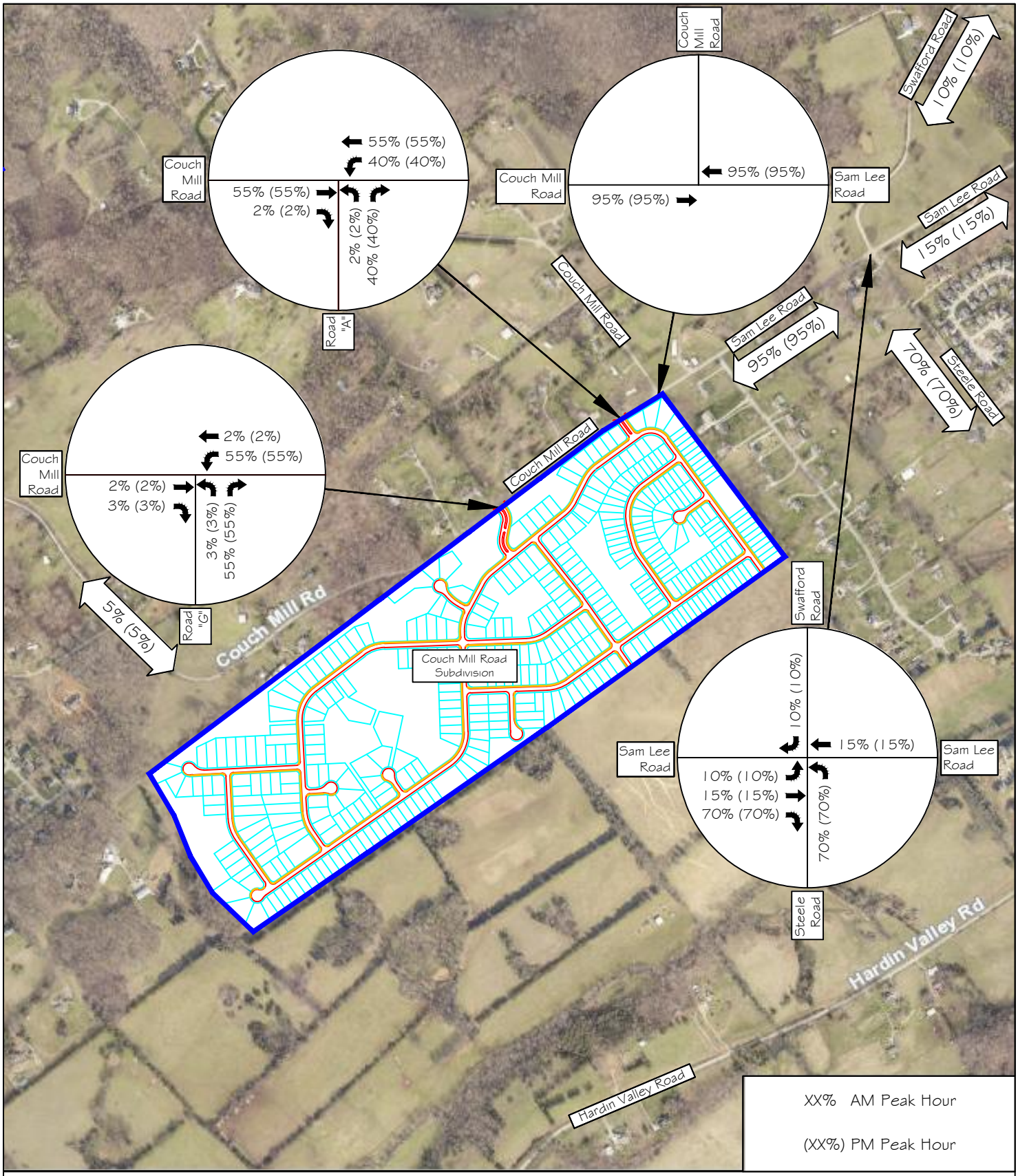


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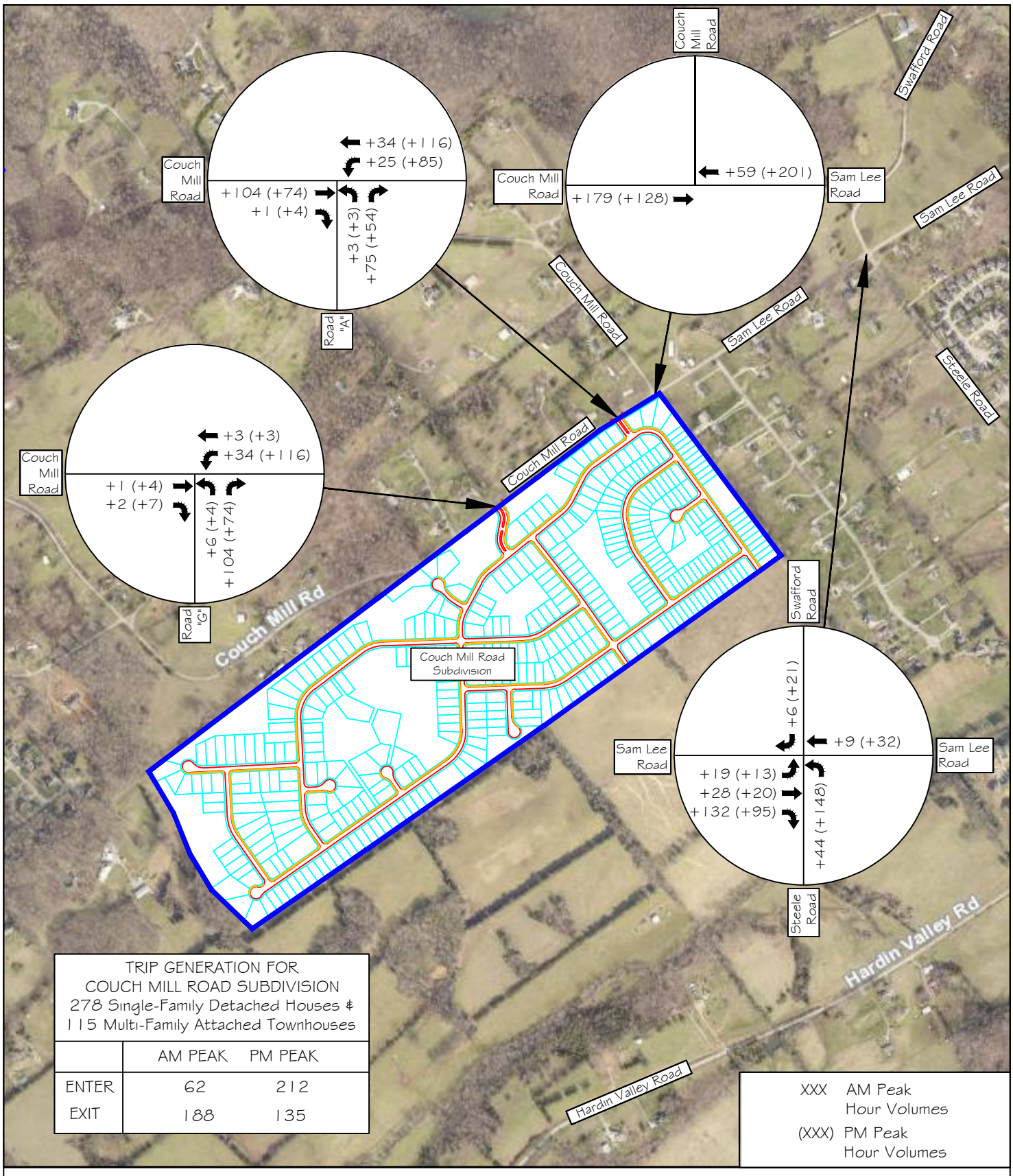
FIGURE 6

Couch Mill Road Subdivision

Directional Distribution of Generated Traffic during AM and PM Peak Hour



TRIP GENERATION FOR
COUCH MILL ROAD SUBDIVISION
278 Single-Family Detached Houses &
115 Multi-Family Attached Townhouses

	AM PEAK	PM PEAK
ENTER	62	212
EXIT	188	135

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

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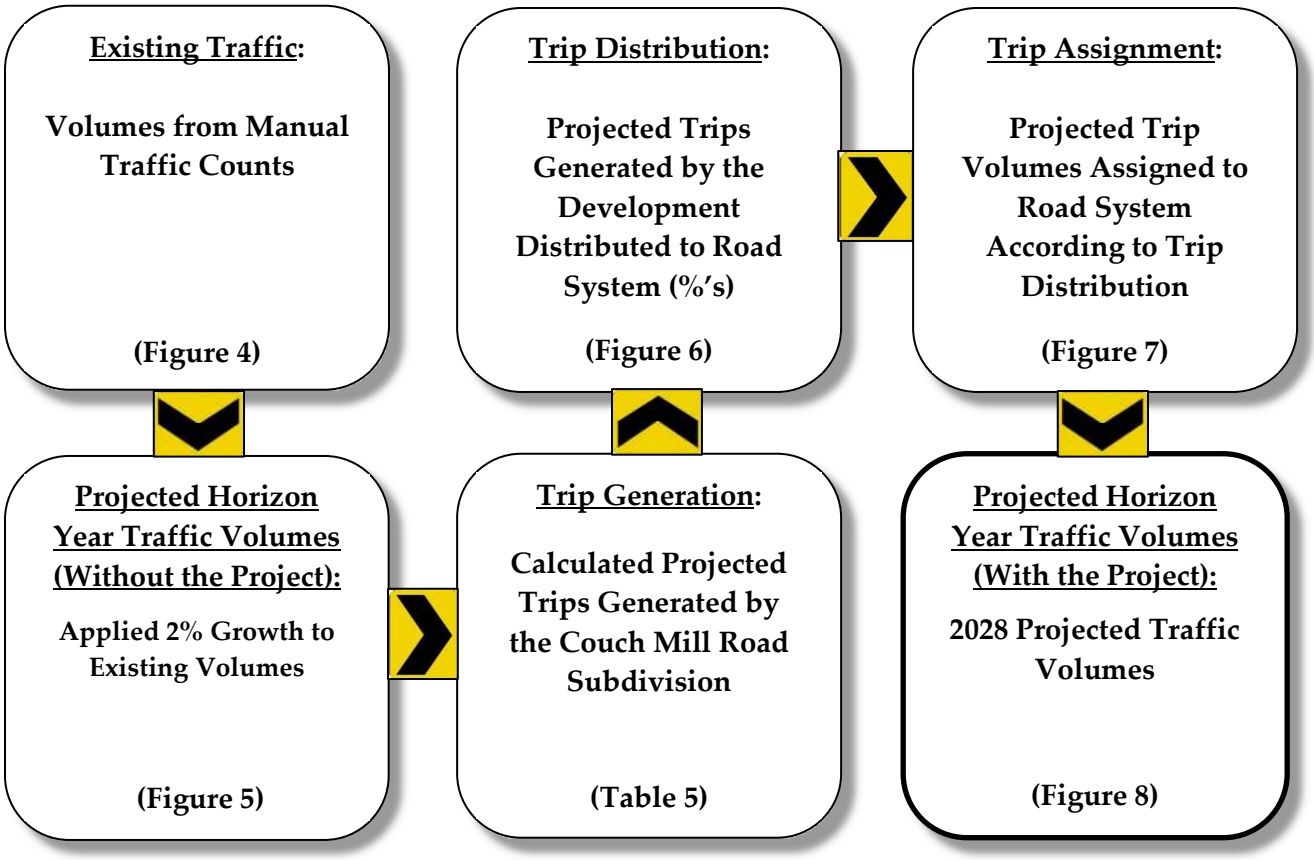
FIGURE 7

Couch Mill Road Subdivision

Traffic Assignment of Generated Traffic during AM and PM Peak Hour

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

Overall, several additive steps were taken to estimate the total projected horizon year traffic volumes at the studied intersections when the Couch Mill Road Subdivision development is entirely constructed and occupied by 2028. The steps are illustrated below for clarity:



The calculated peak hour traffic (Table 5) generated by the Couch Mill Road Subdivision development was added to the 2028 horizon year traffic (Figure 5) by following the predicted trip distributions and assignments (Figures 6 and 7). This procedure was completed to obtain the total projected traffic volumes when the proposed development is fully built out and occupied in 2028. Figure 8 shows the projected 2028 AM and PM peak hour volumes with the generated development traffic at the studied intersections.

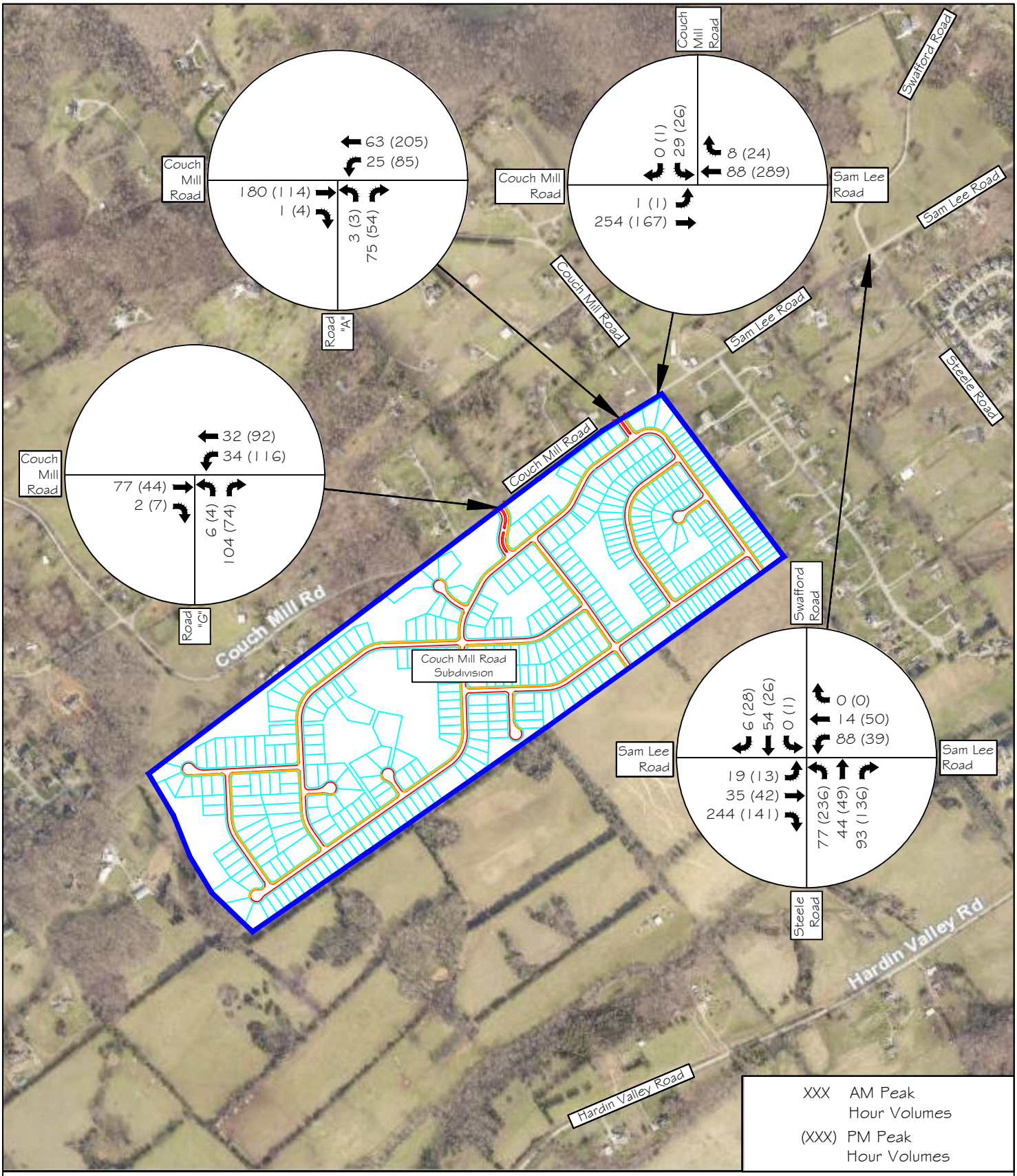


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FIGURE 8

Couch Mill Road Subdivision

2028 Peak Hour Traffic Volumes - PROJECTED HORIZON YEAR TRAFFIC (WITH THE PROJECT)

Capacity analyses were conducted to determine the projected LOS for vehicles at the studied intersections with the development traffic in 2028. Appendix F includes the worksheets for these capacity analyses. As expected, the additional traffic generated from the proposed development increased the calculated vehicle delays in the projected 2028 conditions at the existing intersections. However, all intersections are shown with reasonable LOS and vehicle delays except for the westbound approach of Sam Lee Road at Steele Road and Swafford Road. In the projected 2028 PM peak hour conditions, the westbound approach of Sam Lee Road at this intersection is shown with LOS F and a v/c ratio of 1.017. The projected 2028 peak hour capacity results for the intersections with the project can be seen in Table 6 for the AM and PM peak hours.

A summary of the Sam Lee Road at Steele Road and Swafford Road and Couch Mill Road at Sam Lee Road intersection analysis results are presented in Tables 7a and 7b. These tables provide a side-by-side summary and comparison of the intersections for the following: 2021 existing conditions, projected conditions in the year 2028 without the project and projected conditions in the year 2028 with the project. The proposed intersections created by the new subdivision entrances are not included in these summaries since they exist only in the projected conditions.

TABLE 6
2028 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITH THE PROJECT)

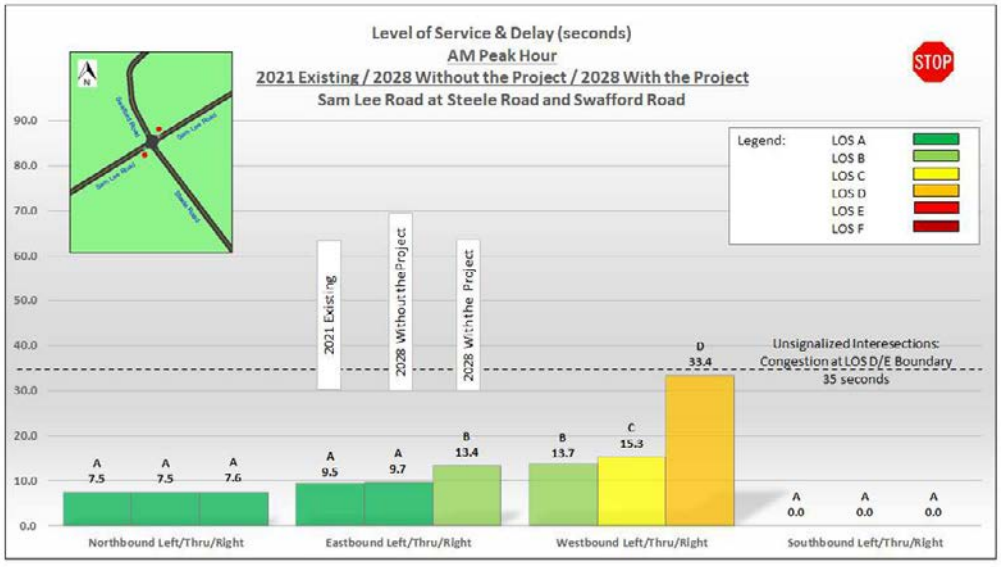
INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
Sam Lee Road at Steele Road and Swafford Road	STOP Unsignalized	Northbound Left/Thru/Right	A	7.6	0.079	A	8.0	0.188
		Eastbound Left/Thru/Right	B	13.4	0.436	C	24.3	0.576
		Westbound Left/Thru/Right	D	33.4	0.546	F	131.4	1.017
		Southbound Left/Thru/Right	A	0.0	-	A	7.9	0.003
Couch Mill Road at Sam Lee Road	STOP Unsignalized	Eastbound Left/Thru	A	7.5	0.003	A	8.1	0.003
		Southbound Left/Right	B	14.2	0.087	C	16.0	0.099
Couch Mill Road at Proposed East Entrance (Road "A")	STOP Unsignalized	Northbound Left/Right	B	10.0	0.108	A	9.5	0.073
		Westbound Left/Thru	A	7.7	0.021	A	7.6	0.065
Couch Mill Road at Proposed West Entrance (Road "G")	STOP Unsignalized	Northbound Left/Right	A	9.4	0.129	A	9.1	0.089
		Westbound Left/Thru	A	7.5	0.025	A	7.5	0.083

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2010 intersection methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

TABLE 7a
INTERSECTION CAPACITY ANALYSIS SUMMARY
SAM LEE ROAD AT STEELE ROAD AND SWAFFORD ROAD STOP

LOCATION / PEAK HOUR MOVEMENT	2021 EXISTING			2028 WITHOUT THE PROJECT			2028 WITH THE PROJECT		
	LOS[a]	Delay[b]	v/c[c]	LOS[a]	Delay[b]	v/c[c]	LOS[a]	Delay[b]	v/c[c]
AM Peak									
Northbound Left/Thru/Right	A	7.5	0.029	A	7.5	0.034	A	7.6	0.079
Eastbound Left/Thru/Right	A	9.5	0.122	A	9.7	0.144	B	13.4	0.436
Westbound Left/Thru/Right	B	13.7	0.213	C	15.3	0.270	D	33.4	0.546
Southbound Left/Thru/Right	A	0.0	-	A	0.0	-	A	0.0	-
PM Peak									
Northbound Left/Thru/Right	A	7.5	0.059	A	7.5	0.068	A	8.0	0.188
Eastbound Left/Thru/Right	B	10.9	0.111	B	11.5	0.137	C	24.3	0.576
Westbound Left/Thru/Right	B	14.9	0.209	C	17.0	0.269	F	131.4	1.017
Southbound Left/Thru/Right	A	7.8	0.003	A	7.9	0.003	A	7.9	0.003

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2010 intersection methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio



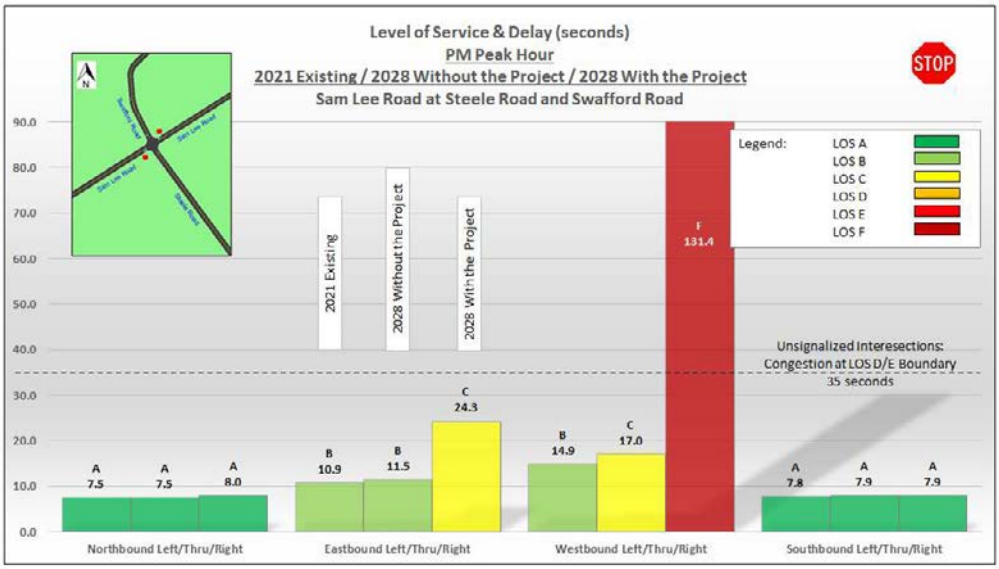
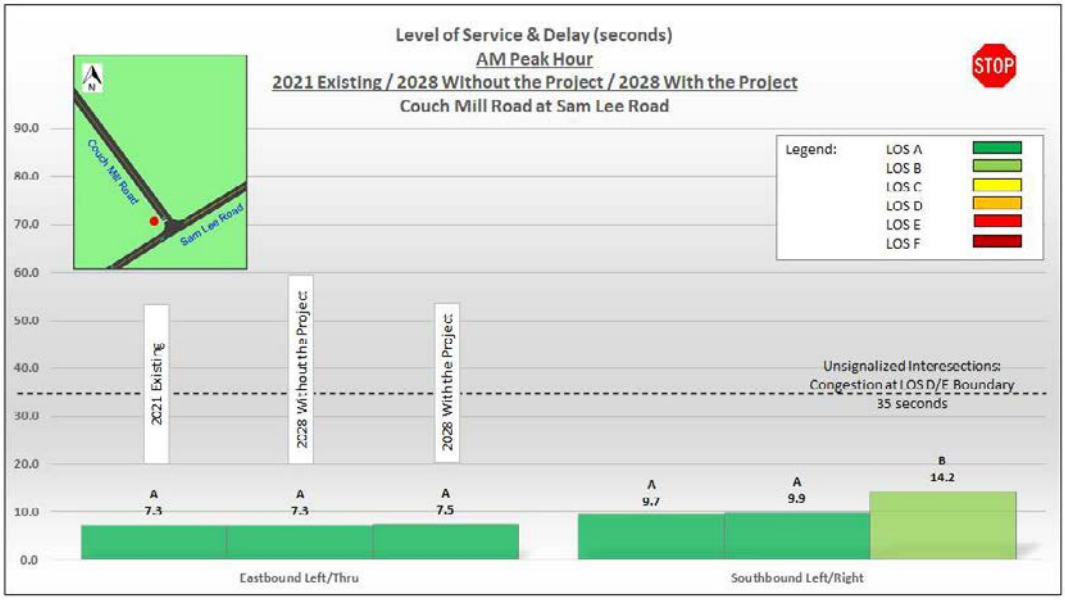
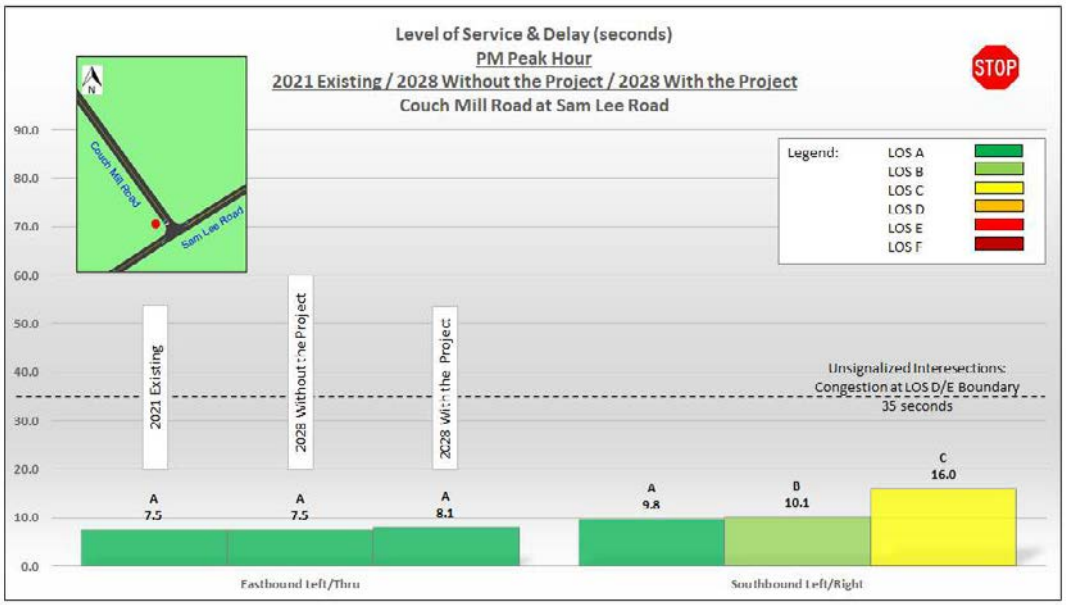


TABLE 7b
INTERSECTION CAPACITY ANALYSIS SUMMARY
COUCH MILL ROAD AT SAM LEE ROAD

LOCATION / PEAK HOUR MOVEMENT	2021 EXISTING			2028 WITHOUT THE PROJECT			2028 WITH THE PROJECT		
	LOS[a]	Delay[b]	v/c[c]	LOS[a]	Delay[b]	v/c[c]	LOS[a]	Delay[b]	v/c[c]
AM Peak									
Eastbound Left/Thru	A	7.3	0.003	A	7.3	0.003	A	7.5	0.003
Southbound Left/Right	A	9.7	0.040	A	9.9	0.048	B	14.2	0.087
PM Peak									
Eastbound Left/Thru	A	7.5	0.003	A	7.5	0.003	A	8.1	0.003
Southbound Left/Right	A	9.8	0.041	B	10.1	0.048	C	16.0	0.099

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2010 intersection methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume to Capacity Ratio





- **POTENTIAL TRANSPORTATION SAFETY ISSUES:**

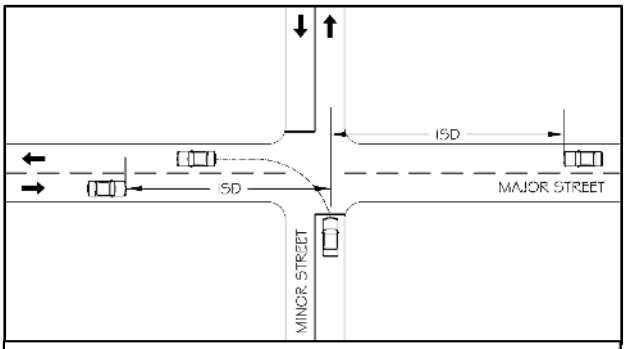
The study area was investigated for potential existing and future safety issues when the development is completed. A couple of features of the adjacent transportation system are discussed in the following pages.

EVALUATION OF SIGHT DISTANCE

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

Methodology:

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



Intersection Sight Distance Diagram

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

The development is proposing two entrances on Couch Mill Road. With a posted speed limit of 30-mph on Couch Mill Road, the required ISD is 300 feet based on Knox County's policy of requiring 10 feet of sight distance per 1-mph of speed.

Based on a posted speed limit of 30-mph on Couch Mill Road and the respective existing road grades at the entrance locations, the SSD is calculated to be the following:

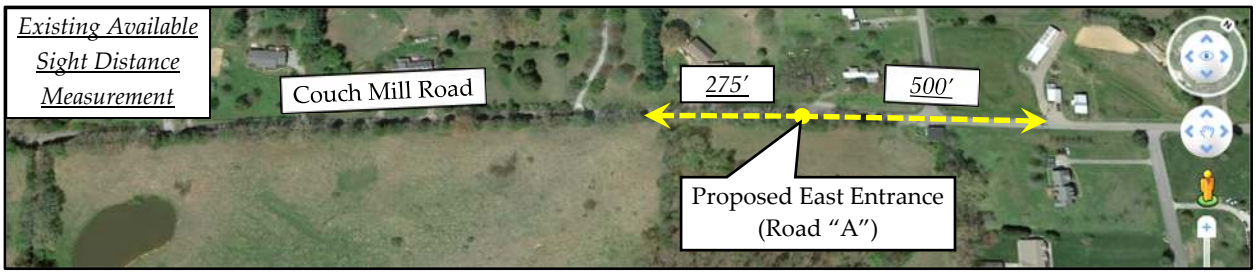
- At the Proposed East Entrance (Road "A"), with Couch Mill Road having a 1% road grade (downhill towards west): 195 feet looking west and 200 feet looking east
- At the Proposed West Entrance (Road "G"), with Couch Mill Road having a 4% road grade (downhill towards east): 210 feet looking west and 190 feet looking east

Visual observations of the sight distances at the proposed East and West Entrances on Couch Mill Road were undertaken. It appears that the intersection sight distances from both Proposed Entrances will be adequate looking to the east. The measured sight distances looking to the west at both Proposed Entrance locations are marginal. The measured sight distance looking to the west from the Proposed East Entrance is currently hampered by vegetation on the south side of Couch Mill Road along the existing farm fencing. It is assumed that this vegetation will be cleared for construction and will allow a sight distance greater than 300 feet. At the Proposed West Entrance, the sight distance to the west is limited by the existing vertical curve on Couch Mill Road located near Dusty Way (private).

Using a Nikon Laser Rangefinder at the Proposed Entrance locations, the ISD was visually estimated to be the following:

- At the Proposed East Entrance (Road "A"): 275 feet west and 500 feet looking east
- At the Proposed West Entrance (Road "G"): 300 feet west and 800 feet looking east

The site designer should verify that the required sight distances at these Proposed Entrances are provided to ensure safe operations. Images of the existing sight distances at the Proposed Entrance locations are presented below, labeled with the required ISD and SSD and the rangefinder measured sight distances.

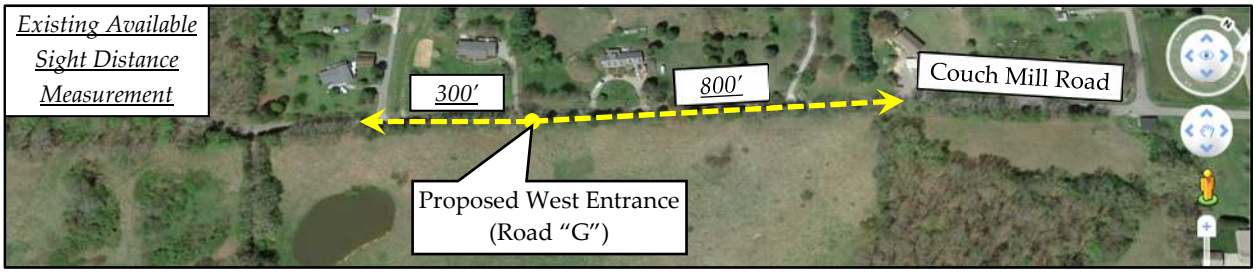


View of Sight Distance on Couch Mill Road at the Proposed East Entrance (Road "A") (Looking Southwest)

View of Sight Distance on Couch Mill Road at the Proposed East Entrance (Road "A") (Looking Northeast)

View of Sight Distance on Couch Mill Road at the Proposed West Entrance (Road "G") (Looking Southwest)

View of Sight Distance on Couch Mill Road at the Proposed West Entrance (Road "G") (Looking Northeast)



EVALUATION OF TURN LANE THRESHOLDS

An evaluation of the need for separate turn entering lanes into the development in the projected 2028 conditions was conducted for the Proposed Entrances on Couch Mill Road. An evaluation was also conducted for the intersection of Sam Lee Road at Steele Road and Swafford Road in the existing and projected 2028 conditions. The intersection of Sam Lee Road at Steele Road and Swafford Road only evaluated the need for turn lanes on the Steele Road approach since the Swafford Road approach has minimal left and right-turning volumes and the Sam Lee Road approaches operate under stop control.

The criteria used for this turn lane evaluation is 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 Couch Mill Road, separate westbound or eastbound entering turn lanes are not warranted at the Proposed Entrances based on the projected 2028 AM and PM peak hour traffic volumes. The worksheets for these evaluations are provided in Appendix I.

With a posted speed limit of 30-mph on Steele Road, separate northbound left or right-turn lanes are not warranted at the intersection with Sam Lee Road and Swafford Road based on the existing and projected 2028 AM and PM peak hour traffic volumes. The worksheets for these evaluations are provided in Appendix I.

CONCLUSIONS & RECOMMENDATIONS

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

1 **Sam Lee Road at Steele Road and Swafford Road**: The results of the projected level of service calculations for the Sam Lee Road at Steele Road and Swafford Road intersection in the year 2028 were determined to be adequate with respect to vehicle delays. The exception is the Sam Lee Road westbound approach, which is projected to operate at LOS D and F in the 2028 AM and PM peak hours, respectively.

This intersection currently operates with Steele Road and Swafford Road operating freely with the east and west approaches of Sam Lee Road operating under stop control.

Due to the considerable projected 2028 vehicle delays on the westbound approach of Sam Lee Road at the intersection, an additional analysis was conducted with the intersection operating under All-Way Stop Control (AWSC). This type of control would force southbound motorists on Swafford Road and northbound motorists on Steele Road to stop instead of operating freely as currently operating. Modifying this intersection would allow for the Sam Lee Road westbound approach to operate with fewer vehicle delays. However, this benefit for the westbound approach would come at the expense of the higher traveled northbound approach of Steele Road, particularly during the PM peak hour. The analysis showed that the intersection operating under AWSC in the projected 2028 conditions resulted in the following:

TABLE 8
2028 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITH THE PROJECT) - ALL-WAY STOP CONTROL (AWSC)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
Sam Lee Road at Steele Road and Swafford Road	STOP Unsignalized	Northbound Left/Thru/Right	B	12.3	0.440	D	32.9	0.870
		Eastbound Left/Thru/Right	B	11.7	0.440	B	12.6	0.397
		Westbound Left/Thru/Right	B	10.5	0.236	B	12.2	0.299
		Southbound Left/Thru/Right	A	9.9	0.177	B	10.1	0.167

Note: All analyses were calculated in Synchro 8 software and reported using HCM 2010 intersection methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

As a result of this outcome, the intersection was investigated whether installing AWSC is warranted and a potential solution to combat the projected high vehicle delays on the Sam Lee Road westbound approach. The evaluation was based on the criteria outlined in the Manual on Uniform Traffic Control Devices 2009 (MUTCD) produced by the Federal Highway Administration. The MUTCD defines the standards for all traffic control devices on public roads, including pavement markings, signage, and traffic signals. The MUTCD also includes criteria standards for the installation of traffic signals and AWSC. The criteria from the MUTCD (Section 2B.07) for implementing AWSC is as follows (MUTCD text in blue):

Multi-way stop control can be useful as a safety measure at intersections if certain traffic conditions exist. Safety concerns associated with multi-way stops include pedestrians, bicyclists, and all road users expecting other road users to stop. Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal.

The decision to install multi-way stop control should be based on an engineering study. The following criteria should be considered in the engineering study for a multi-way Stop Sign installation:

A. Where traffic control signals are justified, multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.

Response: A traffic signal is not planned at this intersection and is not warranted based on the low traffic volumes.

B. Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.

Response: Knox County Engineering stated that there were three vehicle crashes from 2016-2020. Thus, based on this data, the intersection does not meet that standard.

C. Minimum volumes:
   1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours

of an average day; and

2. The combined vehicular, pedestrian, and bicycle volumes entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; and
3. If the 85th percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 3.

Response: The projected 2028 traffic volumes at the intersection do not fully meet the above criteria. This result is confirmed in a multi-stop warrant evaluation spreadsheet shown in Appendix K. Appendix K also includes a spreadsheet developed and used to calculate the hourly projected 2028 volumes at the intersection for an 8-hour period that includes the proposed subdivision-generated traffic. The 85th percentile speeds are assumed to be less than 40 mph since all the approaches have a posted speed limit of 30-mph.

4. Where no single criterion is satisfied, but where Criteria B, C.1 and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.

Response: These criteria are not met based on the projected volumes and the crash history.

Other criteria that may be considered in an engineering study include:

A. The need to control left-turn conflicts;

Response: Left-turn conflicts do not appear to be a significant factor at this intersection.

B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;

Response: This intersection was not observed to have any pedestrian volumes.

C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required

to stop.

Response: Intersection sight distance at this intersection appears to be sufficient based on visual inspection.

D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.

Response: No significant existing operational issues were observed at the intersection.

Therefore, the evaluation for the projected 2028 conditions determined that the intersection will not fully meet warrants for AWSC and would not be appropriate for installation. Installing AWSC without meeting the specified MUTCD warrants can result in several harmful impacts. Studies indicate that installing AWSC for intersections that do not meet MUTCD warrants can experience poor stop compliance from motorists and may contribute to motorists increasing vehicle speeds before and after the intersection to make up for "lost-time".

A vehicle queue analysis was conducted to further investigate the intersection as-is in the 2028 projected conditions without modifications. An additional software program was used to determine the projected vehicle queues at the intersection. 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.

The 95th percentile vehicle queue length 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 vehicle queue lengths were calculated from the SimTraffic software.

The calculated vehicle queue results averaged the outcome obtained during ten traffic simulations in the SimTraffic software. The 95th percentile vehicle queue lengths at the intersection operating under existing two-way stop conditions in 2028 are shown in Table 9 and Appendix L.

TABLE 9
VEHICLE QUEUE SUMMARY -
2028 AM AND PM PEAK HOUR TRAFFIC VOLUMES

INTERSECTION	APPROACH/ MOVEMENT	95th PERCENTILE QUEUE LENGTH	
		AM PEAK HOUR	PM PEAK HOUR
Sam Lee Road at Steele Road and Swafford Road	Northbound Left/Thru/Right	24'	54'
	Eastbound Left/Thru/Right	95'	86'
	Westbound Left/Thru/Right	61'	60'
	Southbound Left/Thru/Right	-	3'

95th percentile queues were calculated in SimTraffic 8 software

Ultimately, after investigation, this intersection is not recommended to be converted to AWSC based on the current 2028 projections presented in this study. While the calculations show a v/c ratio greater than 1 with a LOS F in the projected 2028 PM peak hour, the actual vehicle queues on the Sam Lee Road westbound approach are expected to be reasonable, with at most, 2 – 3 vehicles in a queue at any one time.

Due to the ongoing and rapid suburbanization of the Hardin Valley area combined with other large and undeveloped property tracts remaining near this intersection, Knox County should consider the possibility of converting this intersection to a roundabout in the future. The existing land around this intersection is relatively flat and is undeveloped on the north side. To the south, property acquisition from two existing single-family house owners would be required but has areas not currently occupied by structures or driveways.

2 **Couch Mill Road at Sam Lee Road:** No specific recommendations are offered for this intersection based on the study analyses and results.

3 **Couch Mill Road/Sam Lee Road:** The proposed plan layout shows two new entrances constructed on Couch Mill Road, with most of the generated traffic expected to occur on Couch Mill Road and Sam Lee Road to the east of the development.

3a) Knox County Engineering has published an informal minimum standard relating Average Daily Traffic (ADT) versus road widths. A graph of this minimum standard is shown in Appendix J, and this standard is more related to traffic safety and operations more so than actual road capacity.

The pavement road width measurements conducted for this study showed an average width of approximately 19 feet from the Proposed West Entrance location on Couch Mill Road to the intersection of Sam Lee Road at Steele Road and Swafford Road. Based on a measured road width of 19 feet and the Knox County standard, the maximum allowable ADT would be 3,000 vehicles per day. The existing ADT in 2019 was 910 vehicles. The projected amount of additional daily traffic that the Couch Mill Road Subdivision will contribute between the development site and the intersection of Sam Lee Road at Steele Road and Swafford Road is expected to be 3,484 vehicles per day (3,667 x 95% of residents are expected to travel to and from the east of the subdivision = 3,484 vehicles/day). Adding the existing ADT volumes with the projected trips results in nearly 4,500 vehicles per day. An ADT of 4,500 would indicate that the road width between the proposed subdivision and the intersection of Sam Lee Road at Steele Road and Swafford Road would need to be widened to 21 feet along the entire route. Providing a road width of 21 feet would be appropriate for up to 5,000 vehicles per day based on Knox County's ADT/road width minimum standard.

Following Knox County's standard, Couch Mill Road and Sam Lee Road are recommended to be widened 1 to 3 feet up to a 21-foot width for approximately 3,050 feet between the Couch Mill Road Subdivision Proposed West Entrance and the intersection of Sam Lee at Steele Road and Swafford Road.

3b) Based on the analysis methods presented in the Highway Capacity Manual, the Florida Department of Transportation (FDOT) developed LOSPLAN, a group of software evaluation tools that provides computational methods for analyzing freeways, highways, and arterials road sections. The software provides conceptual level planning results for determining roadway facilities' capacity and LOS. For this report, this software is regarded to be appropriate for use in this level of study.

Various factors are used to calculate the actual "real world" capacity of a roadway. In almost all cases, the actual roadway capacity is reduced as more heavy vehicles comprise the traffic flow, road grades increase, and other aspects are considered. For 2-lane highway segments in the software, FDOT has set the maximum amount of vehicle flow in developed areas at 1,650 vehicles per hour per lane (vphpl). In this study, values were inputted in the FDOT software to ensure a conservative analysis of Couch Mill Road and Sam Lee Road. The analysis included Couch Mill Road and Sam Lee Road's segment between the proposed development and the intersection of Sam Lee Road at Steele Road and Swafford Road for a total length of 0.6 miles. The major inputs in the software were the following:

- assumed a free-flow speed of 40 mph
- an AADT (Average Annual Daily Traffic) of 4,557 vehicles in 2028
- 2% heavy truck traffic
- Left turn/blockage impact is present due to the lack of left-turn storage bays
- Rolling terrain
- 0% no passing zones present

The AADT of 4,558 vehicles in 2028 was calculated from the ADT volume of 910 vehicles on Couch Mill Road near the project site reported by the Knoxville TPO in 2019, adjusting it upwards with 2% growth up to 2028 and adding the daily volumes generated by the proposed Couch Mill Road Subdivision to and from the east. The additional daily traffic volumes on Couch Mill Road generated by the proposed development were calculated by multiplying the 3,667 total daily generated trips by 95%, which is the assumed distribution of travel to and from the east on Couch Mill Road.

Based on these factors and other inputs, the Level of Service for this segment of Couch Mill Road and Sam Lee Road is calculated to be LOS B in 2028. This result was based on the projected conditions when the proposed Couch Mill Road Subdivision is fully built-out and occupied in 2028. The results from the software are shown in Appendix J.

Thus, it can be stated that the additional trips generated by the proposed project would not unreasonably impair traffic flow along Couch Mill Road through the adjacent Planned Growth Area based on a planning-level capacity analysis.

4 **Proposed Entrances on Couch Mill Road:** The proposed plan layout shows two entrances on Couch Mill Road. The intersections created by the entrances at Road "A" and Road "G" are calculated to operate with excellent LOS and short vehicle delays. A single exiting lane is adequate for these entrances. As discussed previously, separate entering left and right-turn lanes are not warranted at either the Proposed East or West Entrance.

Proposed East Entrance – Road "A"

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

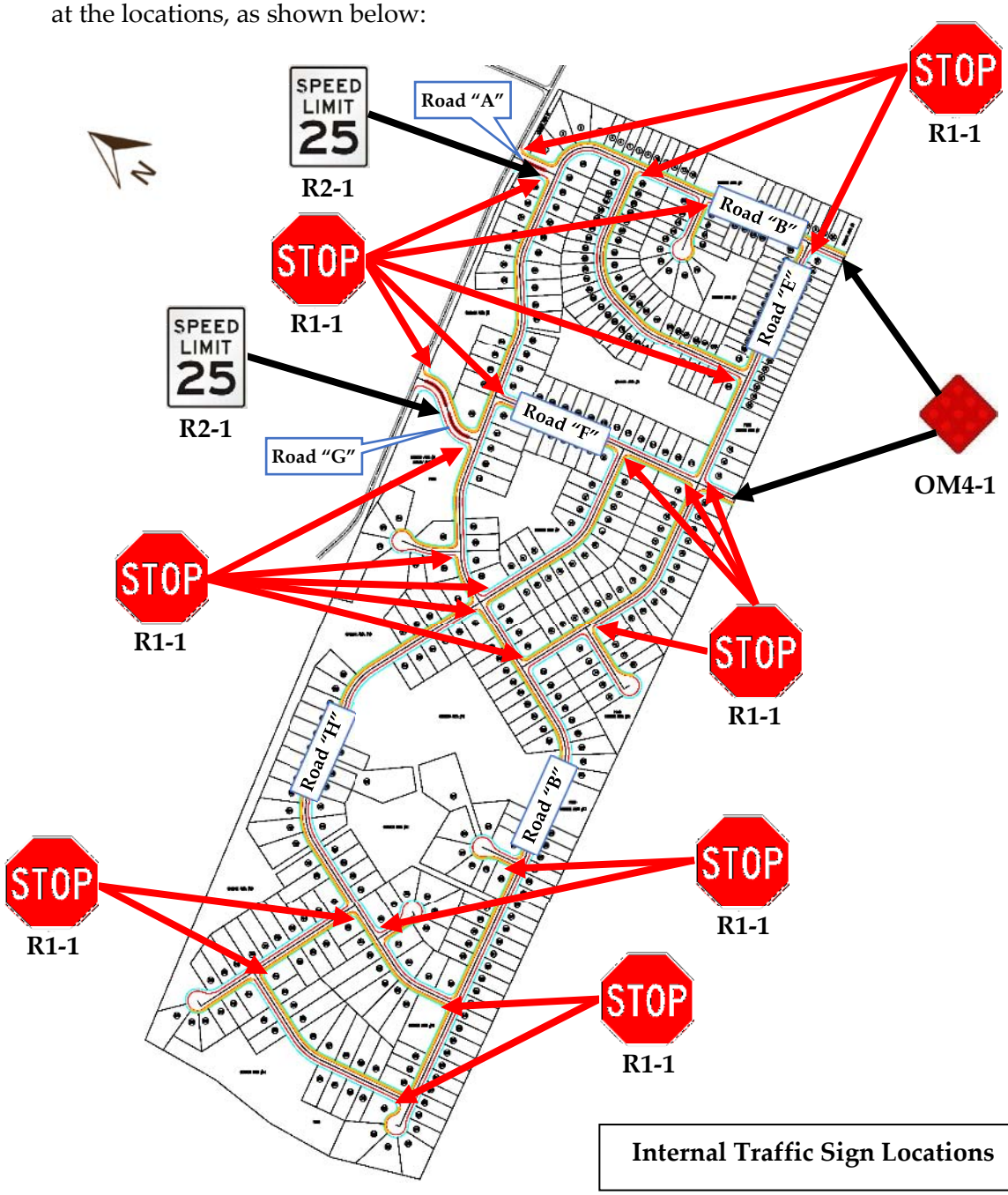
Proposed West Entrance – Road "G"

4b) Intersection sight distance at the Proposed Entrance approaches must not be impacted by future landscaping, signage, or existing vegetation. Based on a posted speed limit of 30-mph on Couch Mill Road, the required ISD is 300 feet looking in each direction at both entrances, and the SSD is calculated to be 195 feet looking west and 200 feet looking east at the Proposed East Entrance (Road "A"). At the Proposed West Entrance (Road "G"), the calculated SSD is 210 feet looking west and 190 feet looking east. A visual inspection determined that these sight distances are available with caveats. The site designer must ensure that the required sight distances are available and provided in the design plans.

5 **Couch Mill Road Subdivision Internal Roads:** The proposed plan layout shows fourteen new public roads constructed within the development, as shown below and Figure 3.

5a) It is recommended that 25-mph Speed Limit Signs (R2-1) be posted near the beginning of Road "A" (Proposed East Entrance) and Road "G" (Proposed West Entrance) within the development. End of roadway signage (OM4-1) should be installed at the southern end of Road "B" and Road "F".

5b) Stop Signs (R1-1) with 24" white stop bars and other traffic signage should be installed at the locations, as shown below:



Internal Traffic Sign Locations

It is recommended that the Road "H" approaches at Road "B" and the Road "F" approaches at Road "E" operate under stop control at the 4-way intersection. A four-way stop for all approaches at these intersections would not be warranted unless sight distance is an issue.

5c) Sight distance at the new internal intersections in the development must not be impacted by new signage, future landscaping, parked vehicles, or other structures. With a proposed internal speed limit of 25-mph, the internal intersection sight distance requirement is 250 feet, and the stopping sight distance required is 155 feet for a level road grade. The site designer should ensure that internal sight distance lengths are met and account for other designed internal road grades.

5d) All drainage grates and covers for the residential development need to be pedestrian and bicycle safe.

5e) Sidewalks should have appropriate ADA-compliant curbed ramps at intersection corners, and the sidewalks are recommended to be 5 feet minimum in width to meet Knox County regulations. White crosswalks should be marked on the road pavement where pedestrians are expected to cross.

5f) The United States Postal Service (USPS) has implemented updated delivery guidelines in new residential subdivisions. If directed by the local post office, the site designer should include a parking area within the development for a centralized mail delivery center.

Centralized USPS Delivery Center

5g) Traffic calming measures might be needed for this development. Several roads within the development have long and straight road segments. The development's possible need for traffic calming measures should be coordinated with Knox County Engineering and Public Works during the detailed design phase.

5h) Lots in the subdivision should not directly access Couch Mill Road.

5i) Knox County has recently completed a greenway study and showed Couch Mill Road as a route for a new greenway connecting Hardin Valley to Powell. The developer should discuss with Knox County if this potential greenway path is desirable or feasible to implement on the edge of the development property along Couch Mill Road.

5j) All internal and external road and intersection elements should be designed to AASHTO, TDOT, and Knox County specifications and guidelines to ensure proper operations.

APPENDIX A

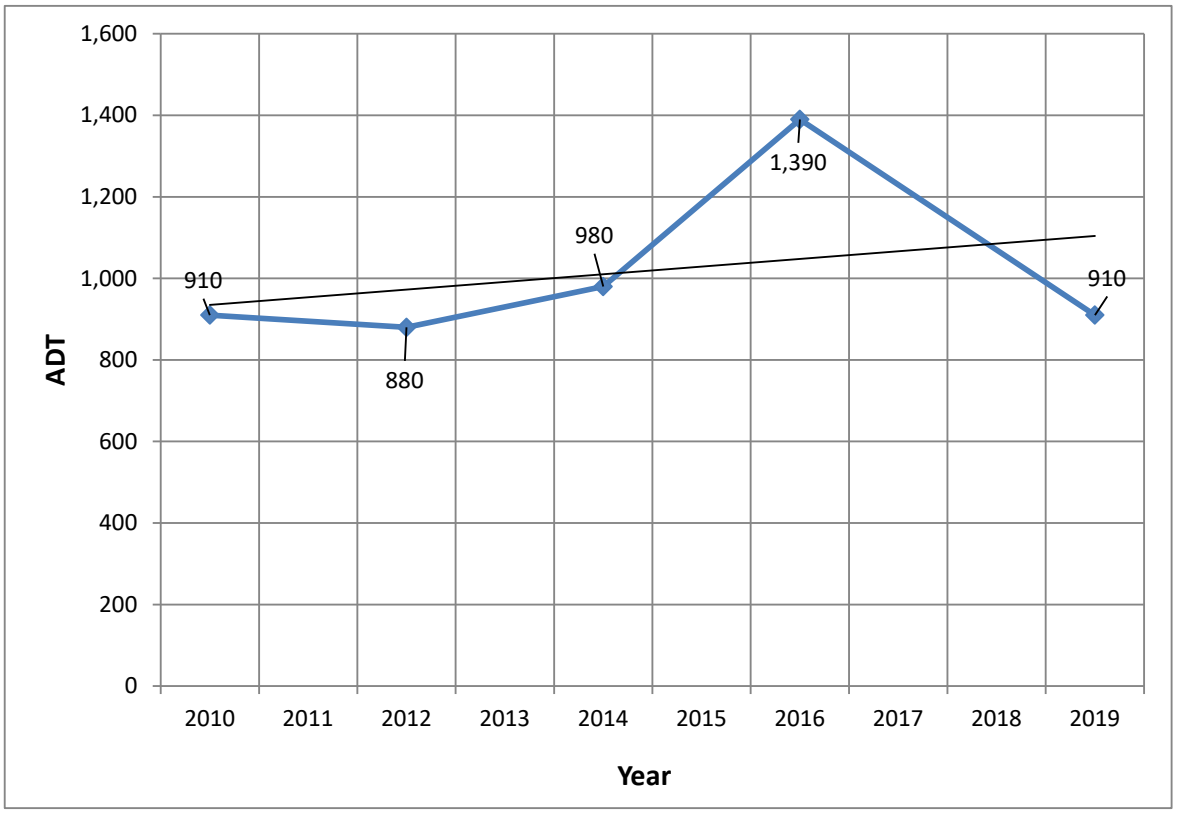
HISTORICAL TRAFFIC COUNT DATA

Historical Traffic Counts

Organization: Knoxville TPO
Station ID #: 093M342
Location: Couch Mill Road, west of Steele Road

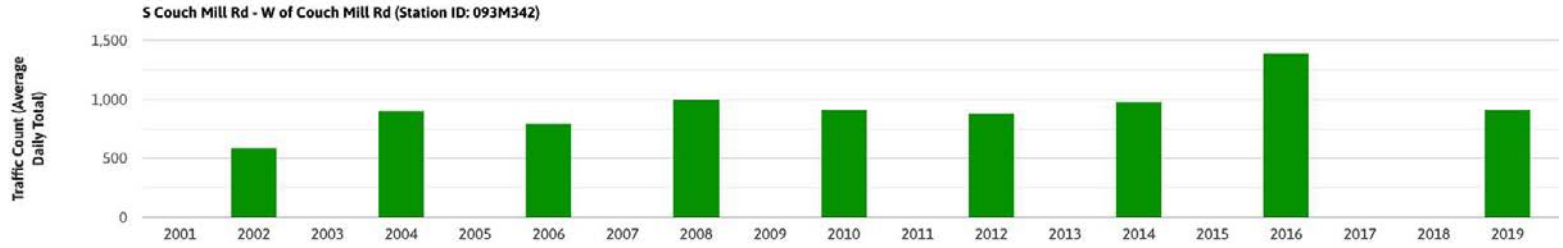
YEAR	ADT
2009	-
2010	910
2011	-
2012	880
2013	-
2014	980
2015	-
2016	1,390
2017	-
2018	-
2019	910

Trendline



2010 - 2019 Growth Rate = 0.0%
Average Annual Growth Rate = 0.0%

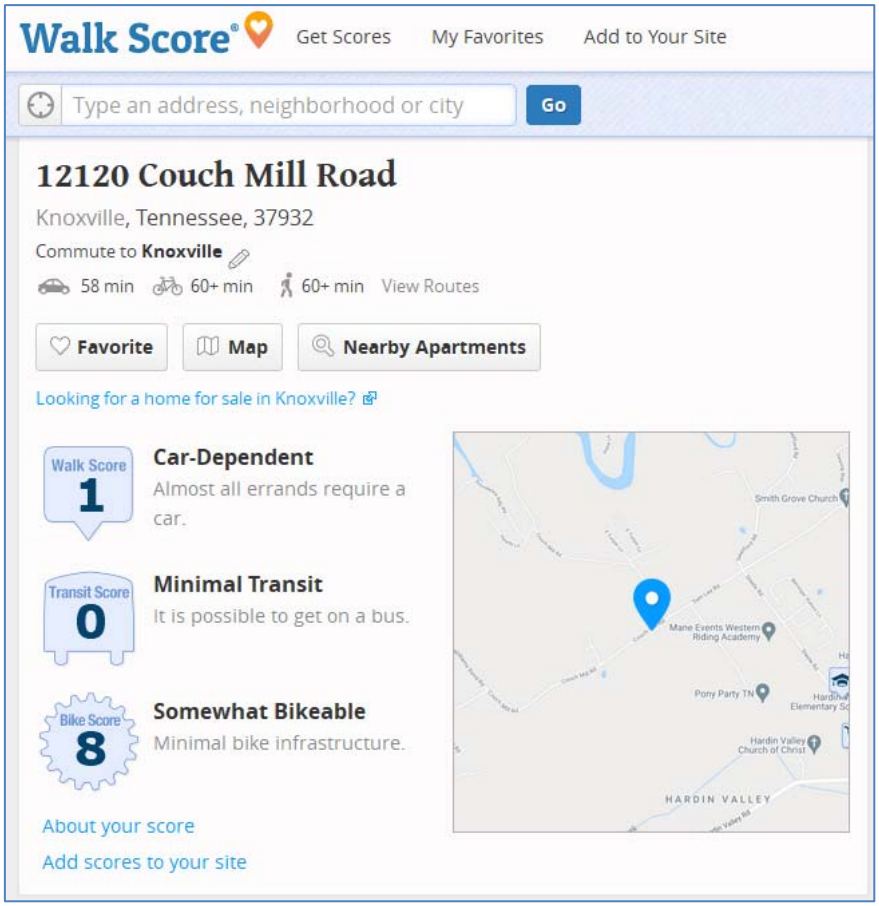

Hewitt Ln
Couch Mill Rd
Turpin Ln
Sam Lee Rd
Williams Bend Rd
George Miller Ln
S Couch Mill Rd
Caspian Dr
Steele Rd
Conner Creek
Find address or place


S Couch Mill Rd - W of Couch Mill Rd (Station ID: 093M342)
Traffic Count (Average Daily Total)
1,500
1,000
500
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019

APPENDIX B

WALK SCORE

WALKSCORE
(from walkscore.com)



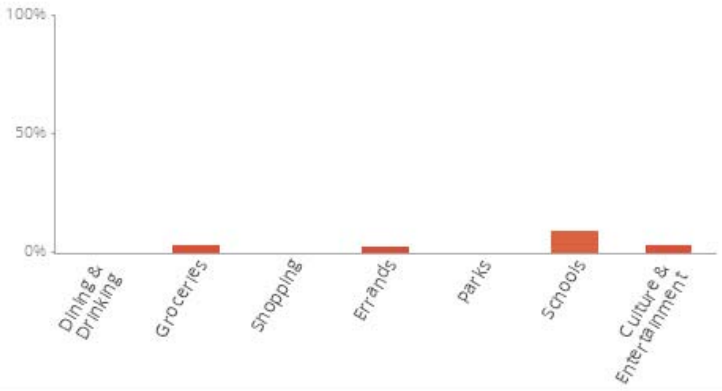
Scores for 12120 Couch Mill Road

Walk Score 1 | Bike Score 8

Walk Score | Transit Score | Bike Score

Score Details | What is Walk Score

The Walk Score for 12120 Couch Mill Road is based on the following categories.



Scores for 12120 Couch Mill Road

Walk Score 1 | Bike Score 8

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 12120 Couch Mill Road

Walk Score	Transit Score	Bike Score

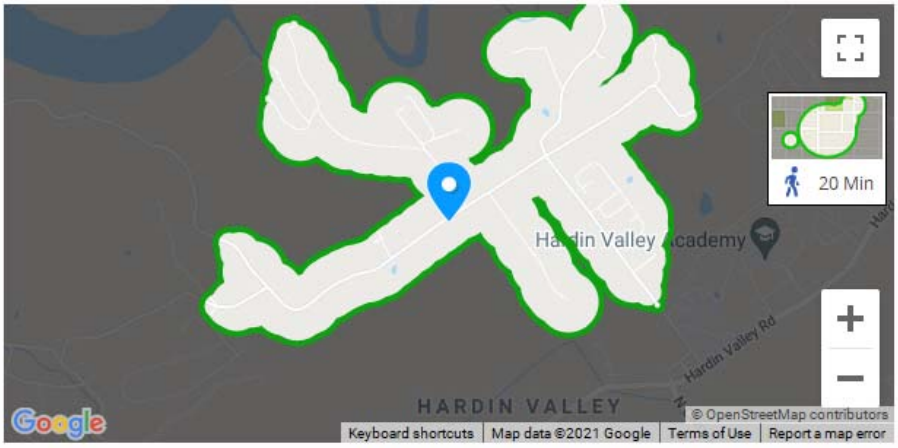
Bike Score measures whether an area is good for biking based on bike lanes and trails, hills, road connectivity, and destinations.

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 12120 Couch Mill Road.



What's Nearby

Restaurants: Marco's Pizza 1.9mi

Coffee: Starbucks 3.7mi

Bars: Big Kahuna Wings 5.1mi

Groceries: Food City .9mi

Parks: Guinn Road Park 1.9mi

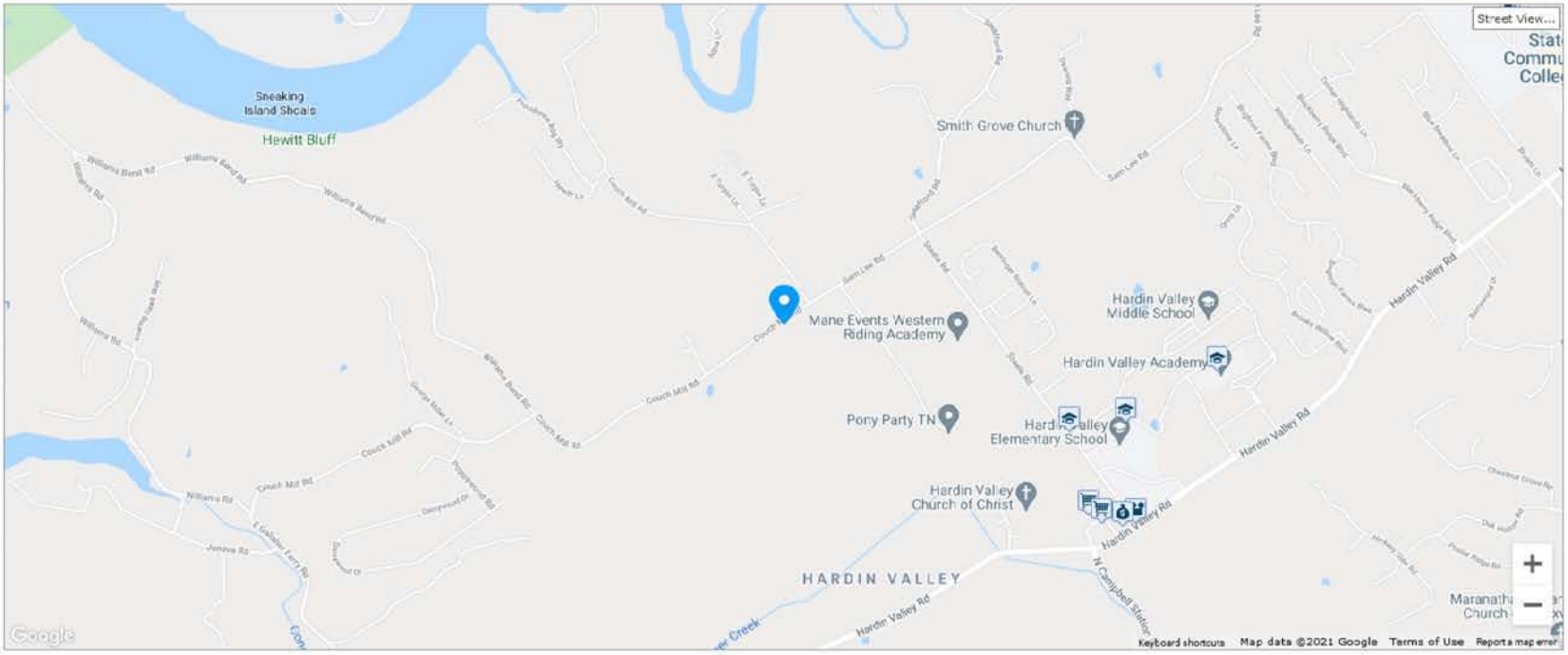
Schools: Hardin Valley Middle School .7mi

Shopping: Pellissipai State College Book... 1.8mi

Entertainment: Redbox 1mi

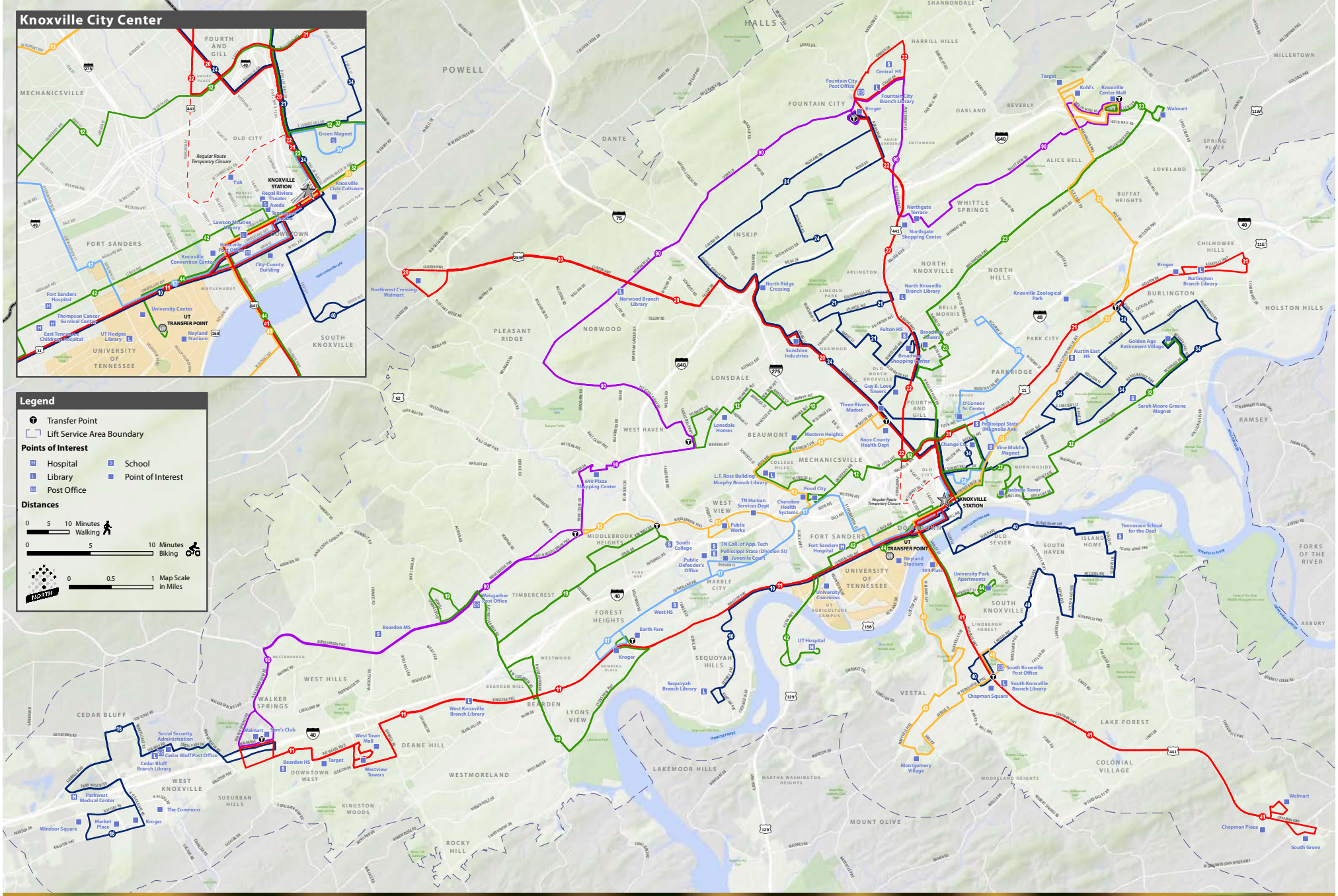
Errands: U.S. Bank Branch .9mi

Search Nearby:



APPENDIX C

KNOXVILLE AREA TRANSIT MAP AND INFORMATION



FARE INFORMATION

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

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

REDUCED FARE INFORMATION

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

BUS STOPS ONLY!

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

KAT HOLIDAYS

KAT buses do not run on the following holidays:

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

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

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

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

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

16 CEDAR BLUFF CONNECTOR

(Weekdays and Saturdays)

Legend

- Route Timepoint
- Transfer Point
- Bus Stop

Points of Interest

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

N W E S

0 0.25 0.5 Miles

Map revised: 02.21

16 CEDAR BLUFF CONNECTOR

(Weekdays and Saturdays)

SERVES:

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

kat KNOXVILLE AREA TRANSIT

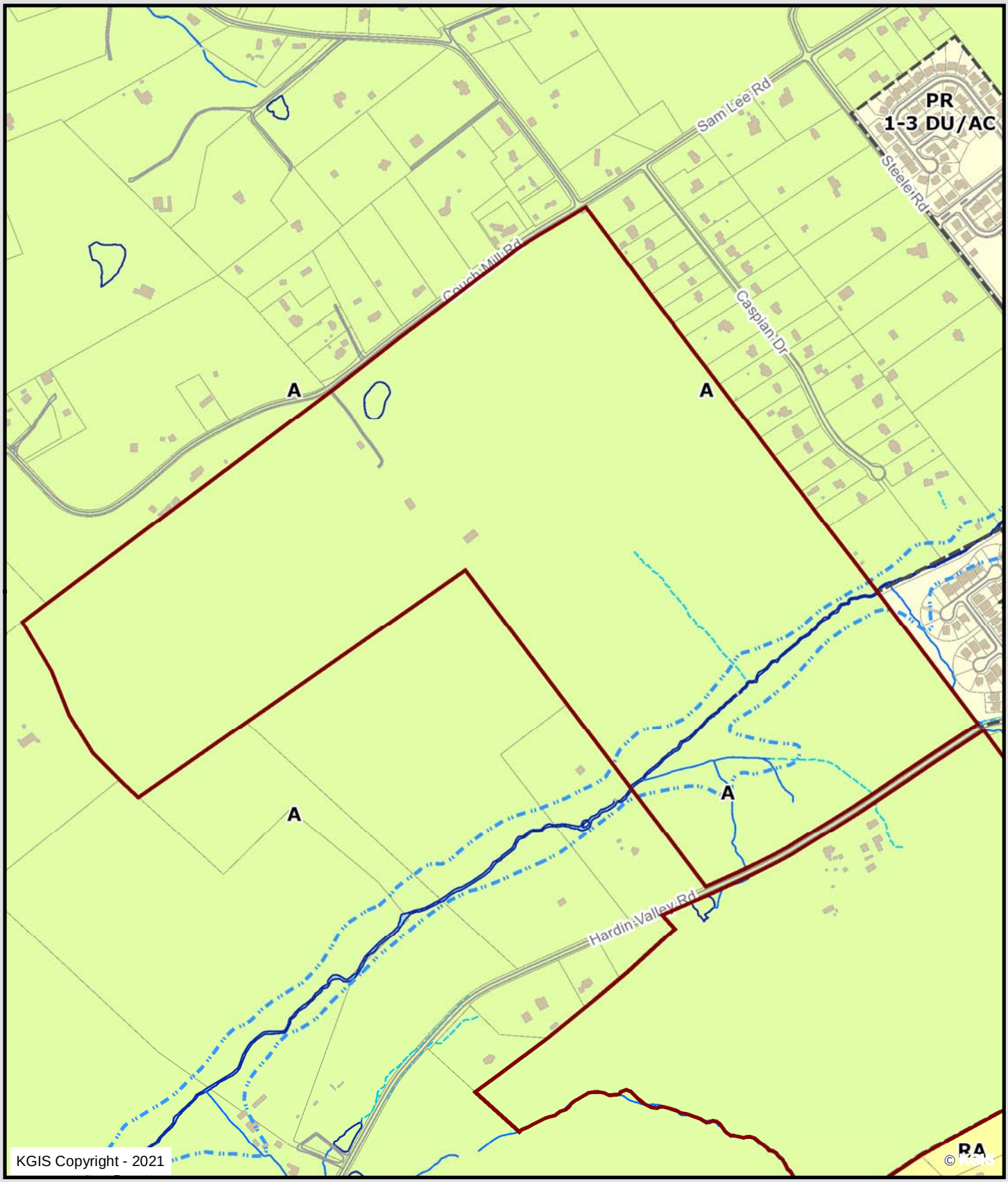
Information Updated: February 1, 2021

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

Need help reading this schedule?
Need other general information on how to ride?
Visit www.katbus.com or call 865-637-3000

APPENDIX D

ZONING MAP



Existing Zoning Map

Couch Mill Road Subdivision

Knoxville - Knox County - KUB Geographic Information System

Printed: 11/16/2021 at 4:10:51 PM

0 390 780 1,560

ft

APPENDIX E

MANUAL TRAFFIC COUNT DATA

National Data & Surveying Services Intersection Turning Movement Count

Location: Swafford Rd/Steele Rd & Sam Lee Rd
City: Knoxville
Control: 2-Way Stop(EB/WB)

Project ID: 21-190057-001
Date: 10/19/2021

Data - Total

NS/EW Streets: Swafford Rd/Steele Rd | Swafford Rd/Steele Rd | Sam Lee Rd | Sam Lee Rd

AM

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
7:00 AM	1	3	6	0	0	12	0	0	0	1	23	0	9	2	0	0	57
7:15 AM	5	6	6	0	0	10	0	0	0	2	26	0	26	1	0	0	82
7:30 AM	4	12	28	0	0	23	0	0	0	1	26	0	17	0	0	0	111
7:45 AM	9	14	26	0	0	6	0	0	0	2	20	0	15	2	0	0	94
8:00 AM	11	7	22	0	0	8	0	0	0	1	26	0	19	1	0	0	95
8:15 AM	10	8	13	0	0	3	2	0	0	2	18	0	13	4	0	0	73
8:30 AM	7	4	9	0	0	5	0	0	2	0	11	0	1	0	0	1	40
8:45 AM	6	5	13	0	0	2	1	0	1	0	12	0	4	0	0	0	44
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	53	59	123	0	0	69	3	0	3	9	162	0	104	10	0	1	596
APPROACH %'s :	22.55%	25.11%	52.34%	0.00%	0.00%	95.83%	4.17%	0.00%	1.72%	5.17%	93.10%	0.00%	90.43%	8.70%	0.00%	0.87%	
PEAK HR :	07:15 AM - 08:15 AM																TOTAL
PEAK HR VOL :	29	39	82	0	0	47	0	0	0	6	98	0	77	4	0	0	382
PEAK HR FACTOR :	0.659	0.696	0.732	0.000	0.000	0.511	0.000	0.000	0.000	0.750	0.942	0.000	0.740	0.500	0.000	0.000	0.860
	0.765				0.511				0.929				0.750				

NOON

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
11:00 AM	9	2	2	0	0	0	1	0	0	1	9	0	1	0	0	0	25
11:15 AM	10	5	2	0	0	2	0	0	3	0	9	0	5	1	0	0	37
11:30 AM	8	1	5	0	0	3	2	0	0	0	10	0	2	0	0	0	31
11:45 AM	7	6	3	0	0	3	0	0	0	1	8	0	6	0	0	0	34
12:00 PM	11	4	5	0	0	3	1	0	1	2	14	0	4	3	0	0	48
12:15 PM	11	5	5	0	0	1	0	0	0	0	7	0	2	2	1	0	34
12:30 PM	12	3	2	0	0	3	1	0	0	2	4	0	0	1	1	0	29
12:45 PM	9	8	4	0	0	3	2	0	0	1	11	0	3	2	0	0	43
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	77	34	28	0	0	18	7	0	4	7	72	0	23	9	2	0	281
APPROACH %'s :	55.40%	24.46%	20.14%	0.00%	0.00%	72.00%	28.00%	0.00%	4.82%	8.43%	86.75%	0.00%	67.65%	26.47%	5.88%	0.00%	
PEAK HR :	12:00 PM - 01:00 PM																TOTAL
PEAK HR VOL :	43	20	16	0	0	10	4	0	1	5	36	0	9	8	2	0	154
PEAK HR FACTOR :	0.896	0.625	0.800	0.000	0.000	0.833	0.500	0.000	0.250	0.625	0.643	0.000	0.563	0.667	0.500	0.000	0.802
	0.940				0.700				0.618				0.679				

PM

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
2:00 PM	10	2	6	0	0	2	0	0	1	1	13	0	4	0	1	0	40
2:15 PM	10	3	3	0	0	6	0	0	0	1	15	1	15	4	0	0	58
2:30 PM	11	7	9	0	1	3	1	0	0	3	11	0	9	2	0	0	57
2:45 PM	7	6	9	0	0	6	0	0	0	2	5	0	10	4	0	0	49
3:00 PM	19	2	12	0	1	6	0	0	0	3	10	0	4	2	0	0	59
3:15 PM	9	1	3	0	0	3	1	0	0	1	10	0	13	5	0	0	46
3:30 PM	16	8	39	1	1	7	2	0	0	2	9	0	17	5	0	0	107
3:45 PM	23	18	50	0	0	4	0	0	0	4	8	0	6	7	0	0	120
4:00 PM	19	7	17	0	0	3	3	0	0	6	12	0	6	2	0	0	75
4:15 PM	19	10	13	0	0	9	1	0	0	7	11	0	5	2	0	0	77
4:30 PM	12	10	12	0	0	2	2	0	0	2	12	0	8	2	0	0	62
4:45 PM	14	2	4	0	0	4	2	0	1	1	12	0	8	3	0	0	51
5:00 PM	21	6	4	0	0	4	2	0	0	4	24	0	9	2	0	0	76
5:15 PM	23	9	10	0	0	5	0	0	0	2	18	0	7	1	0	0	75
5:30 PM	19	3	10	0	0	2	0	0	1	5	16	0	1	1	0	0	58
5:45 PM	28	4	5	0	0	5	3	0	0	1	19	0	5	4	0	0	74
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	260	98	206	1	3	71	17	0	3	45	205	1	127	46	1	0	1084
APPROACH %'s :	46.02%	17.35%	36.46%	0.18%	3.30%	78.02%	18.68%	0.00%	1.18%	17.72%	80.71%	0.39%	72.99%	26.44%	0.57%	0.00%	
PEAK HR :	03:30 PM - 04:30 PM																TOTAL
PEAK HR VOL :	77	43	119	1	1	23	6	0	0	19	40	0	34	16	0	0	379
PEAK HR FACTOR :	0.837	0.597	0.595	0.250	0.250	0.639	0.500	0.000	0.000	0.679	0.833	0.000	0.500	0.571	0.000	0.000	0.790
	0.659				0.750				0.819				0.568				

National Data & Surveying Services Intersection Turning Movement Count

Location: Swafford Rd/Steele Rd & Sam Lee Rd
City: Knoxville
Control: 2-Way Stop(EB/WB)

Project ID: 21-190057-001
Date: 10/19/2021

Data - Cars

NS/EW Streets: Swafford Rd/Steele Rd | Swafford Rd/Steele Rd | Sam Lee Rd | Sam Lee Rd

AM

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
7:00 AM	1	3	6	0	0	12	0	0	0	1	23	0	8	2	0	0	56
7:15 AM	4	5	6	0	0	9	0	0	0	2	25	0	25	1	0	0	77
7:30 AM	3	12	28	0	0	23	0	0	0	1	25	0	17	0	0	0	109
7:45 AM	9	13	24	0	0	6	0	0	0	1	18	0	15	2	0	0	88
8:00 AM	10	7	21	0	0	8	0	0	0	1	25	0	19	1	0	0	92
8:15 AM	10	8	11	0	0	3	1	0	0	2	17	0	12	4	0	0	68
8:30 AM	6	4	9	0	0	5	0	0	2	0	11	0	1	0	0	1	39
8:45 AM	6	3	13	0	0	1	1	0	1	0	12	0	4	0	0	0	41
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	49	55	118	0	0	67	2	0	3	8	156	0	101	10	0	1	570
APPROACH %'s :	22.07%	24.77%	53.15%	0.00%	0.00%	97.10%	2.90%	0.00%	1.80%	4.79%	93.41%	0.00%	90.18%	8.93%	0.00%	0.89%	
PEAK HR :	07:15 AM - 08:15 AM																TOTAL
PEAK HR VOL :	26	37	79	0	0	46	0	0	0	5	93	0	76	4	0	0	366
PEAK HR FACTOR :	0.650	0.712	0.705	0.000	0.000	0.500	0.000	0.000	0.000	0.625	0.930	0.000	0.760	0.500	0.000	0.000	0.839
	0.772				0.500				0.907				0.769				

NOON

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
11:00 AM	9	2	2	0	0	0	0	0	0	1	9	0	0	0	0	0	23
11:15 AM	9	5	2	0	0	2	0	0	2	0	9	0	5	1	0	0	35
11:30 AM	8	1	4	0	0	3	1	0	0	0	10	0	2	0	0	0	29
11:45 AM	7	5	3	0	0	3	0	0	0	1	7	0	5	0	0	0	31
12:00 PM	10	4	3	0	0	2	1	0	0	2	14	0	4	3	0	0	43
12:15 PM	8	5	4	0	0	0	0	0	0	0	7	0	1	2	1	0	28
12:30 PM	12	3	2	0	0	3	1	0	0	2	4	0	0	1	1	0	29
12:45 PM	9	6	4	0	0	2	2	0	0	1	10	0	2	2	0	0	38
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	72	31	24	0	0	15	5	0	2	7	70	0	19	9	2	0	256
APPROACH %'s :	56.69%	24.41%	18.90%	0.00%	0.00%	75.00%	25.00%	0.00%	2.53%	8.86%	88.61%	0.00%	63.33%	30.00%	6.67%	0.00%	
PEAK HR :	12:00 PM - 01:00 PM																TOTAL
PEAK HR VOL :	39	18	13	0	0	7	4	0	0	5	35	0	7	8	2	0	138
PEAK HR FACTOR :	0.813	0.750	0.813	0.000	0.000	0.583	0.500	0.000	0.000	0.625	0.625	0.000	0.438	0.667	0.500	0.000	0.802
	0.921				0.688				0.625				0.607				

PM

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
2:00 PM	10	2	6	0	0	2	0	0	1	1	12	0	3	0	1	0	38
2:15 PM	10	3	3	0	0	6	0	0	0	1	14	1	11	3	0	0	52
2:30 PM	11	5	6	0	1	3	1	0	0	3	10	0	8	2	0	0	50
2:45 PM	7	6	9	0	0	5	0	0	0	2	5	0	10	4	0	0	48
3:00 PM	18	2	11	0	1	6	0	0	0	3	10	0	4	2	0	0	57
3:15 PM	8	1	2	0	0	3	1	0	0	1	10	0	12	5	0	0	43
3:30 PM	15	8	39	1	1	7	2	0	0	1	8	0	16	5	0	0	103
3:45 PM	22	17	48	0	0	4	0	0	0	4	8	0	6	7	0	0	116
4:00 PM	19	7	16	0	0	3	3	0	0	6	10	0	6	2	0	0	72
4:15 PM	19	10	13	0	0	9	1	0	0	7	10	0	4	2	0	0	75
4:30 PM	12	10	11	0	0	2	2	0	0	1	12	0	8	2	0	0	60
4:45 PM	14	2	4	0	0	4	2	0	1	1	12	0	7	3	0	0	50
5:00 PM	20	6	4	0	0	4	2	0	0	4	23	0	9	2	0	0	74
5:15 PM	23	9	10	0	0	5	0	0	0	2	18	0	7	1	0	0	75
5:30 PM	19	3	10	0	0	2	0	0	1	5	13	0	1	1	0	0	55
5:45 PM	28	4	5	0	0	5	3	0	0	1	18	0	5	4	0	0	73
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	255	95	197	1	3	70	17	0	3	43	193	1	117	45	1	0	1041
APPROACH %'s :	46.53%	17.34%	35.95%	0.18%	3.33%	77.78%	18.89%	0.00%	1.25%	17.92%	80.42%	0.42%	71.78%	27.61%	0.61%	0.00%	
PEAK HR :	03:30 PM - 04:30 PM																TOTAL
PEAK HR VOL :	75	42	116	1	1	23	6	0	0	18	36	0	32	16	0	0	366
PEAK HR FACTOR :	0.852	0.618	0.604	0.250	0.250	0.639	0.500	0.000	0.000	0.643	0.900	0.000	0.500	0.571	0.000	0.000	0.789
	0.672				0.750				0.794				0.571				

National Data & Surveying Services Intersection Turning Movement Count

Location: Swafford Rd/Steele Rd & Sam Lee Rd
City: Knoxville
Control: 2-Way Stop(EB/WB)

Project ID: 21-190057-001
Date: 10/19/2021

Data - HT

NS/EW Streets: Swafford Rd/Steele Rd | Swafford Rd/Steele Rd | Sam Lee Rd | Sam Lee Rd

AM

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
7:15 AM	1	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	5
7:30 AM	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
7:45 AM	0	1	2	0	0	0	0	0	0	1	2	0	0	0	0	0	6
8:00 AM	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	3
8:15 AM	0	0	2	0	0	0	1	0	0	0	1	0	1	0	0	0	5
8:30 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:45 AM	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	4	4	5	0	0	2	1	0	0	1	6	0	3	0	0	0	26
APPROACH %'s :	30.77%	30.77%	38.46%	0.00%	0.00%	66.67%	33.33%	0.00%	0.00%	14.29%	85.71%	0.00%	100.00%	0.00%	0.00%	0.00%	
PEAK HR :	07:15 AM - 08:15 AM																TOTAL
PEAK HR VOL :	3	2	3	0	0	1	0	0	0	1	5	0	1	0	0	0	16
PEAK HR FACTOR :	0.750	0.500	0.375	0.000	0.000	0.250	0.000	0.000	0.000	0.250	0.625	0.000	0.250	0.000	0.000	0.000	0.667
	0.667				0.250				0.500				0.250				

NOON

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
11:00 AM	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2
11:15 AM	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
11:30 AM	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2
11:45 AM	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	3
12:00 PM	1	0	2	0	0	1	0	0	1	0	0	0	0	0	0	0	5
12:15 PM	3	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	6
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	2	0	0	0	1	0	0	0	0	1	0	1	0	0	0	5
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	5	3	4	0	0	3	2	0	2	0	2	0	4	0	0	0	25
APPROACH %'s :	41.67%	25.00%	33.33%	0.00%	0.00%	60.00%	40.00%	0.00%	50.00%	0.00%	50.00%	0.00%	100.00%	0.00%	0.00%	0.00%	
PEAK HR :	12:00 PM - 01:00 PM																TOTAL
PEAK HR VOL :	4	2	3	0	0	3	0	0	1	0	1	0	2	0	0	0	16
PEAK HR FACTOR :	0.333	0.250	0.375	0.000	0.000	0.750	0.000	0.000	0.250	0.000	0.250	0.000	0.500	0.000	0.000	0.000	0.667
	0.563				0.750				0.500				0.500				

PM

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
2:00 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2
2:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	4	1	0	0	6
2:30 PM	0	2	3	0	0	0	0	0	0	0	1	0	1	0	0	0	7
2:45 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
3:00 PM	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
3:15 PM	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	3
3:30 PM	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	4
3:45 PM	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4
4:00 PM	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	3
4:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2
4:30 PM	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
5:00 PM	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
5:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	5	3	9	0	0	1	0	0	0	2	12	0	10	1	0	0	43
APPROACH %'s :	29.41%	17.65%	52.94%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	14.29%	85.71%	0.00%	90.91%	9.09%	0.00%	0.00%	
PEAK HR :	03:30 PM - 04:30 PM																TOTAL
PEAK HR VOL :	2	1	3	0	0	0	0	0	0	1	4	0	2	0	0	0	13
PEAK HR FACTOR :	0.500	0.250	0.375	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.500	0.000	0.500	0.000	0.000	0.000	0.813
	0.375								0.625				0.500				

National Data & Surveying Services Intersection Turning Movement Count

Location: Swafford Rd/Steele Rd & Sam Lee Rd
City: Knoxville
Control: 2-Way Stop(EB/WB)

Project ID: 21-190057-001
Date: 10/19/2021

Data - Bikes

NS/EW Streets: Swafford Rd/Steele Rd | Swafford Rd/Steele Rd | Sam Lee Rd | Sam Lee Rd

AM

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APPROACH %'s :																	
PEAK HR :	07:15 AM - 08:15 AM																TOTAL
PEAK HR VOL :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PEAK HR FACTOR :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

NOON

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APPROACH %'s :																	
PEAK HR :	12:00 PM - 01:00 PM																TOTAL
PEAK HR VOL :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PEAK HR FACTOR :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

PM

	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
APPROACH %'s :													0.00%	100.00%	0.00%	0.00%	
PEAK HR :	03:30 PM - 04:30 PM																TOTAL
PEAK HR VOL :	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PEAK HR FACTOR :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

National Data & Surveying Services Intersection Turning Movement Count

Location: Swafford Rd/Steele Rd & Sam Lee Rd
City: Knoxville
Project ID: 21-190057-001
Date: 10/19/2021

Data - Pedestrians (Crosswalks)

NS/EW Streets:	Swafford Rd/Steele Rd		Swafford Rd/Steele Rd		Sam Lee Rd		Sam Lee Rd		
AM	NORTH LEG		SOUTH LEG		EAST LEG		WEST LEG		
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
7:00 AM	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
TOTAL VOLUMES :	0	0	0	0	0	0	0	0	0
APPROACH %'s :									
PEAK HR :	07:15 AM - 08:15 AM								TOTAL
PEAK HR VOL :	0	0	0	0	0	0	0	0	0
PEAK HR FACTOR :									

NOON	NORTH LEG		SOUTH LEG		EAST LEG		WEST LEG		
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
11:00 AM	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
TOTAL VOLUMES :	0	0	0	0	0	0	0	0	0
APPROACH %'s :									
PEAK HR :	12:00 PM - 01:00 PM								TOTAL
PEAK HR VOL :	0	0	0	0	0	0	0	0	0
PEAK HR FACTOR :									

PM	NORTH LEG		SOUTH LEG		EAST LEG		WEST LEG		
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
2:00 PM	0	0	0	0	0	0	0	0	0
2:15 PM	0	0	0	0	0	0	0	0	0
2:30 PM	0	0	0	0	0	0	0	0	0
2:45 PM	0	0	0	0	0	0	0	0	0
3:00 PM	0	0	0	0	0	0	0	0	0
3:15 PM	0	0	0	0	0	0	0	0	0
3:30 PM	0	0	0	0	0	0	0	0	0
3:45 PM	0	0	0	0	0	0	0	0	0
4:00 PM	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
TOTAL VOLUMES :	0	0	0	0	0	0	0	0	0
APPROACH %'s :									
PEAK HR :	03:30 PM - 04:30 PM								TOTAL
PEAK HR VOL :	0	0	0	0	0	0	0	0	0
PEAK HR FACTOR :									

Prepared by National Data & Surveying Services

Swafford Rd/Steele Rd & Sam Lee Rd

Peak Hour Turning Movement Count

ID: 21-190057-001
City: Knoxville

Day: Tuesday
Date: 10/19/2021

PEAK HOURS

AM	07:15 AM - 08:15 AM
NOON	12:00 PM - 01:00 PM
PM	03:30 PM - 04:30 PM

COUNT PERIODS

AM	7:00 AM - 09:00 AM
NOON	11:00 AM - 01:00 PM
PM	2:00 PM - 06:00 PM

SOUTHBOUND — Swafford Rd/Steele Rd

AM	0	47	0	0	39	AM
NOON	4	10	0	0	23	NOON
PM	6	23	1	0	43	PM
	0	1	0	0		

EASTBOUND — Sam Lee Rd

AM	NOON	PM	
33	55	99	
0	0	0	0
0	1	0	0
6	5	19	1
98	36	40	0
AM	NOON	PM	

WESTBOUND — Sam Lee Rd

PM	NOON	AM	
0	2	0	0
16	8	4	1
34	9	77	0
0	0	0	0
139	21	88	
PM	NOON	AM	

NORTHBOUND — Swafford Rd/Steele Rd

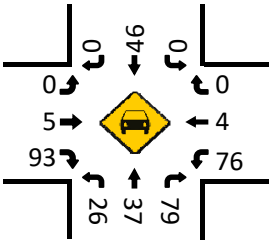
PM	98	1	77	43	119	PM
NOON	55	0	43	20	16	NOON
AM	222	0	29	39	82	AM
		0	0	1	0	

CONTROL

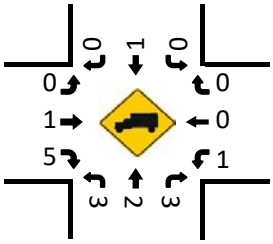
2-Way Stop(EB/WB)

TEV	382	154	379
	AM	NOON	PM
PHF	0.86	0.80	0.79

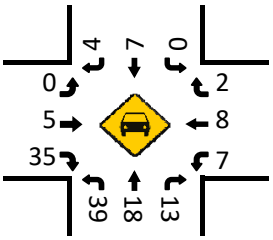
Cars (AM)



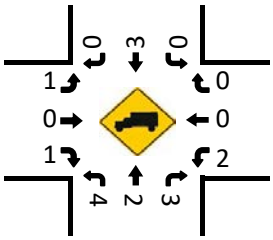
HT (AM)



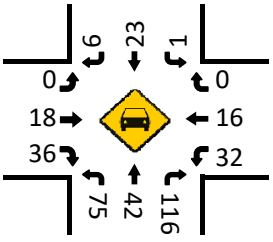
Cars (NOON)



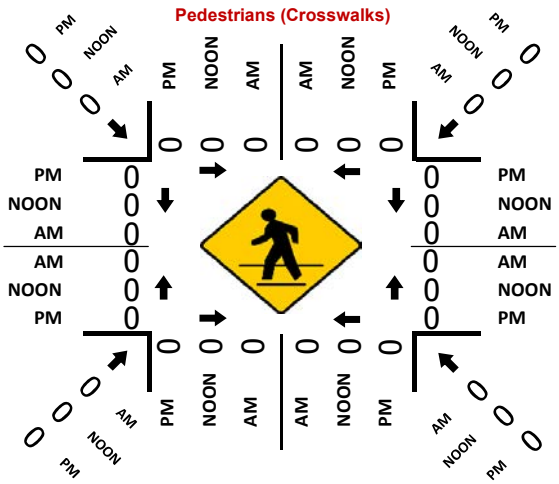
HT (NOON)



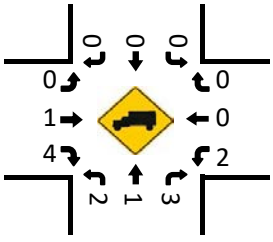
Cars (PM)



Pedestrians (Crosswalks)



HT (PM)



Project ID: 21-190057-001
Location: Swafford Rd/Steele Rd & Sam Lee Rd
City: Knoxville

Day: Tuesday
Date: 10/19/2021

Groups Printed - Cars, PU, Vans - Heavy Trucks

	Swafford Rd/Steele Rd Northbound						Swafford Rd/Steele Rd Southbound						Sam Lee Rd Eastbound						Sam Lee Rd Westbound						
Start Time	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Int. Total
7:00 AM	1	3	6	0	0	10	0	12	0	0	0	12	0	1	23	0	0	24	9	2	0	0	0	11	57
7:15 AM	5	6	6	0	0	17	0	10	0	0	0	10	0	2	26	0	0	28	26	1	0	0	0	27	82
7:30 AM	4	12	28	0	0	44	0	23	0	0	0	23	0	1	26	0	0	27	17	0	0	0	0	17	111
7:45 AM	9	14	26	0	0	49	0	6	0	0	0	6	0	2	20	0	0	22	15	2	0	0	0	17	94
Total	19	35	66	0	0	120	0	51	0	0	0	51	0	6	95	0	0	101	67	5	0	0	0	72	344
8:00 AM	11	7	22	0	0	40	0	8	0	0	0	8	0	1	26	0	0	27	19	1	0	0	0	20	95
8:15 AM	10	8	13	0	0	31	0	3	2	0	0	5	0	2	18	0	0	20	13	4	0	0	0	17	73
8:30 AM	7	4	9	0	0	20	0	5	0	0	0	5	2	0	11	0	0	13	1	0	0	1	0	2	40
8:45 AM	6	5	13	0	0	24	0	2	1	0	0	3	1	0	12	0	0	13	4	0	0	0	0	4	44
Total	34	24	57	0	0	115	0	18	3	0	0	21	3	3	67	0	0	73	37	5	0	1	0	43	252
BREAK																									
11:00 AM	9	2	2	0	0	13	0	0	1	0	0	1	0	1	9	0	0	10	1	0	0	0	0	1	25
11:15 AM	10	5	2	0	0	17	0	2	0	0	0	2	3	0	9	0	0	12	5	1	0	0	0	6	37
11:30 AM	8	1	5	0	0	14	0	3	2	0	0	5	0	0	10	0	0	10	2	0	0	0	0	2	31
11:45 AM	7	6	3	0	0	16	0	3	0	0	0	3	0	1	8	0	0	9	6	0	0	0	0	6	34
Total	34	14	12	0	0	60	0	8	3	0	0	11	3	2	36	0	0	41	14	1	0	0	0	15	127
12:00 PM	11	4	5	0	0	20	0	3	1	0	0	4	1	2	14	0	0	17	4	3	0	0	0	7	48
12:15 PM	11	5	5	0	0	21	0	1	0	0	0	1	0	0	7	0	0	7	2	2	1	0	0	5	34
12:30 PM	12	3	2	0	0	17	0	3	1	0	0	4	0	2	4	0	0	6	0	1	1	0	0	2	29
12:45 PM	9	8	4	0	0	21	0	3	2	0	0	5	0	1	11	0	0	12	3	2	0	0	0	5	43
Total	43	20	16	0	0	79	0	10	4	0	0	14	1	5	36	0	0	42	9	8	2	0	0	19	154
BREAK																									
2:00 PM	10	2	6	0	0	18	0	2	0	0	0	2	1	1	13	0	0	15	4	0	1	0	0	5	40
2:15 PM	10	3	3	0	0	16	0	6	0	0	0	6	0	1	15	1	0	17	15	4	0	0	0	19	58
2:30 PM	11	7	9	0	0	27	1	3	1	0	0	5	0	3	11	0	0	14	9	2	0	0	0	11	57
2:45 PM	7	6	9	0	0	22	0	6	0	0	0	6	0	2	5	0	0	7	10	4	0	0	0	14	49
Total	38	18	27	0	0	83	1	17	1	0	0	19	1	7	44	1	0	53	38	10	1	0	0	49	204
3:00 PM	19	2	12	0	0	33	1	6	0	0	0	7	0	3	10	0	0	13	4	2	0	0	0	6	59
3:15 PM	9	1	3	0	0	13	0	3	1	0	0	4	0	1	10	0	0	11	13	5	0	0	0	18	46
3:30 PM	16	8	39	1	0	64	1	7	2	0	0	10	0	2	9	0	0	11	17	5	0	0	0	22	107
3:45 PM	23	18	50	0	0	91	0	4	0	0	0	4	0	4	8	0	0	12	6	7	0	0	0	13	120
Total	67	29	104	1	0	201	2	20	3	0	0	25	0	10	37	0	0	47	40	19	0	0	0	59	332
4:00 PM	19	7	17	0	0	43	0	3	3	0	0	6	0	6	12	0	0	18	6	2	0	0	0	8	75
4:15 PM	19	10	13	0	0	42	0	9	1	0	0	10	0	7	11	0	0	18	5	2	0	0	0	7	77
4:30 PM	12	10	12	0	0	34	0	2	2	0	0	4	0	2	12	0	0	14	8	2	0	0	0	10	62
4:45 PM	14	2	4	0	0	20	0	4	2	0	0	6	1	1	12	0	0	14	8	3	0	0	0	11	51
Total	64	29	46	0	0	139	0	18	8	0	0	26	1	16	47	0	0	64	27	9	0	0	0	36	265
5:00 PM	21	6	4	0	0	31	0	4	2	0	0	6	0	4	24	0	0	28	9	2	0	0	0	11	76
5:15 PM	23	9	10	0	0	42	0	5	0	0	0	5	0	2	18	0	0	20	7	1	0	0	0	8	75
5:30 PM	19	3	10	0	0	32	0	2	0	0	0	2	1	5	16	0	0	22	1	1	0	0	0	2	58
5:45 PM	28	4	5	0	0	37	0	5	3	0	0	8	0	1	19	0	0	20	5	4	0	0	0	9	74
Total	91	22	29	0	0	142	0	16	5	0	0	21	1	12	77	0	0	90	22	8	0	0	0	30	283
Grand Total	390	191	357	1	0	939	3	158	27	0	0	188	10	61	439	1	0	511	254	65	3	1	0	323	1961
Apprch %	41.5	20.3	38.0	0.1	0.0		1.6	84.0	14.4	0.0	0.0		2.0	11.9	85.9	0.2	0.0		78.6	20.1	0.9	0.3	0.0		
Total %	19.9	9.7	18.2	0.1	0.0	47.9	0.2	8.1	1.4	0.0	0.0	9.6	0.5	3.1	22.4	0.1	0.0	26.1	13.0	3.3	0.2	0.1	0.0	16.5	
Cars, PU, Vans	376	181	339	1		897	3	152	24	0		179	8	58	419	1		486	237	64	3	1		305	1867
% Cars, PU, Vans	96.4	94.8	95.0	100.0		95.5	100.0	96.2	88.9	0.0		95.2	80.0	95.1	95.4	100.0		95.1	93.3	98.5	100.0	100.0		94.4	95.2
Heavy trucks	14	10	18	0		42	0	6	3	0		9	2	3	20	0		25	17	1	0	0		18	94
%Heavy trucks	3.6	5.2	5.0	0.0		4.5	0.0	3.8	11.1	0.0		4.8	20.0	4.9	4.6	0.0		4.9	6.7	1.5	0.0	0.0		5.6	4.8

Project ID: 21-190057-001
Location: Swafford Rd/Steele Rd & Sam Lee Rd
City: Knoxville

PEAK HOURS

Day: Tuesday
Date: 10/19/2021

AM

	Swafford Rd/Steele Rd Northbound					Swafford Rd/Steele Rd Southbound					Sam Lee Rd Eastbound					Sam Lee Rd Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 07:00 AM - 09:00 AM																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
7:15 AM	5	6	6	0	17	0	10	0	0	10	0	2	26	0	28	26	1	0	0	27	82
7:30 AM	4	12	28	0	44	0	23	0	0	23	0	1	26	0	27	17	0	0	0	17	111
7:45 AM	9	14	26	0	49	0	6	0	0	6	0	2	20	0	22	15	2	0	0	17	94
8:00 AM	11	7	22	0	40	0	8	0	0	8	0	1	26	0	27	19	1	0	0	20	95
Total Volume	29	39	82	0	150	0	47	0	0	47	0	6	98	0	104	77	4	0	0	81	382
% App. Total	19.3	26.0	54.7	0.0	100	0.0	100.0	0.0	0.0	100	0.0	5.8	94.2	0.0	100	95.1	4.9	0.0	0.0	100	
PHF					0.765					0.511					0.929					0.750	0.860
Cars, PU, Vans	26	37	79	0	142	0	46	0	0	46	0	5	93	0	98	76	4	0	0	80	366
% Cars, PU, Vans	89.7	94.9	96.3	0.0	94.7	0.0	97.9	0.0	0.0	97.9	0.0	83.3	94.9	0.0	94.2	98.7	100.0	0.0	0.0	98.8	95.8
Heavy trucks	3	2	3	0	8	0	1	0	0	1	0	1	5	0	6	1	0	0	0	1	16
%Heavy trucks	10.3	5.1	3.7	0.0	5.3	0.0	2.1	0.0	0.0	2.1	0.0	16.7	5.1	0.0	5.8	1.3	0.0	0.0	0.0	1.2	4.2

NOON

	Swafford Rd/Steele Rd Northbound					Swafford Rd/Steele Rd Southbound					Sam Lee Rd Eastbound					Sam Lee Rd Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 11:00 AM - 01:00 PM																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	11	4	5	0	20	0	3	1	0	4	1	2	14	0	17	4	3	0	0	7	48
12:15 PM	11	5	5	0	21	0	1	0	0	1	0	0	7	0	7	2	2	1	0	5	34
12:30 PM	12	3	2	0	17	0	3	1	0	4	0	2	4	0	6	0	1	1	0	2	29
12:45 PM	9	8	4	0	21	0	3	2	0	5	0	1	11	0	12	3	2	0	0	5	43
Total Volume	43	20	16	0	79	0	10	4	0	14	1	5	36	0	42	9	8	2	0	19	154
% App. Total	54.4	25.3	20.3	0.0	100	0.0	71.4	28.6	0.0	100	2.4	11.9	85.7	0.0	100	47.4	42.1	10.5	0.0	100	
PHF					0.940					0.700					0.618					0.679	0.802
Cars, PU, Vans	39	18	13	0	70	0	7	4	0	11	0	5	35	0	40	7	8	2	0	17	138
% Cars, PU, Vans	90.7	90.0	81.3	0.0	88.6	0.0	70.0	100.0	0.0	78.6	0.0	100.0	97.2	0.0	95.2	77.8	100.0	100.0	0.0	89.5	89.6
Heavy trucks	4	2	3	0	9	0	3	0	0	3	1	0	1	0	2	2	0	0	0	2	16
%Heavy trucks	9.3	10.0	18.8	0.0	11.4	0.0	30.0	0.0	0.0	21.4	100.0	0.0	2.8	0.0	4.8	22.2	0.0	0.0	0.0	10.5	10.4

PM

	Swafford Rd/Steele Rd Northbound					Swafford Rd/Steele Rd Southbound					Sam Lee Rd Eastbound					Sam Lee Rd Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 02:00 PM - 06:00 PM																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
3:30 PM	16	8	39	1	64	1	7	2	0	10	0	2	9	0	11	17	5	0	0	22	107
3:45 PM	23	18	50	0	91	0	4	0	0	4	0	4	8	0	12	6	7	0	0	13	120
4:00 PM	19	7	17	0	43	0	3	3	0	6	0	6	12	0	18	6	2	0	0	8	75
4:15 PM	19	10	13	0	42	0	9	1	0	10	0	7	11	0	18	5	2	0	0	7	77
Total Volume	77	43	119	1	240	1	23	6	0	30	0	19	40	0	59	34	16	0	0	50	379
% App. Total	32.1	17.9	49.6	0.4	100	3.3	76.7	20.0	0.0	100	0.0	32.2	67.8	0.0	100	68.0	32.0	0.0	0.0	100	
PHF					0.659					0.750					0.819					0.568	0.790
Cars, PU, Vans	75	42	116	1	234	1	23	6	0	30	0	18	36	0	54	32	16	0	0	48	366
% Cars, PU, Vans	97.4	97.7	97.5	100.0	97.5	100.0	100.0	100.0	0.0	100.0	0.0	94.7	90.0	0.0	91.5	94.1	100.0	0.0	0.0	96.0	96.6
Heavy trucks	2	1	3	0	6	0	0	0	0	0	0	1	4	0	5	2	0	0	0	2	13
%Heavy trucks	2.6	2.3	2.5	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	5.3	10.0	0.0	8.5	5.9	0.0	0.0	0.0	4.0	3.4

TRAFFIC COUNT DATA

Major Street: Sam Lee Road (WB) and Couch Mill Road (EB) 11/9/2021 (Tuesday)
Minor Street: Couch Mill Road (SB) Partly Cloudy/Cool
Traffic Control: Stop Sign on SB Couch Mill Road Conducted by: Ajax Engineering

	Couch Mill Road		Sam Lee Road		Couch Mill Road			
TIME	SOUTHBOUND		WESTBOUND		EASTBOUND		VEHICLE	PEAK
BEGIN	LT	RT	THRU	RT	LT	THRU	TOTAL	HOUR
7:00 AM	5	1	1	1	0	14	22	
7:15 AM	8	0	6	1	0	21	36	**7:15 AM - 8:15 AM**
7:30 AM	5	0	6	4	1	17	33	
7:45 AM	7	0	4	1	0	14	26	
8:00 AM	5	0	9	1	0	14	29	
8:15 AM	2	0	10	3	1	6	22	
8:30 AM	2	0	3	2	0	7	14	
8:45 AM	4	0	5	1	0	10	20	
TOTAL	38	1	44	14	2	103	202	
2:00 PM	5	0	14	5	0	6	30	
2:15 PM	2	0	9	1	0	6	18	
2:30 PM	2	1	8	4	0	9	24	
2:45 PM	3	0	8	4	0	12	27	
3:00 PM	2	1	7	3	0	5	18	
3:15 PM	6	0	9	4	0	12	31	
3:30 PM	7	0	15	8	0	8	38	**3:30 PM - 4:30 PM**
3:45 PM	7	1	22	7	0	9	46	
4:00 PM	5	0	16	3	0	10	34	
4:15 PM	4	0	24	3	1	7	39	
4:30 PM	2	0	10	4	1	8	25	
4:45 PM	1	0	23	3	0	12	39	
5:00 PM	6	1	14	4	0	11	36	
5:15 PM	7	0	8	8	0	17	40	
5:30 PM	3	0	15	9	0	14	41	
5:45 PM	2	0	11	4	0	20	37	
TOTAL	64	4	213	74	2	166	523	

2021 AM Peak Hour 7:15 AM - 8:15 AM

	Couch Mill Road		Sam Lee Road		Couch Mill Road	
TIME	SOUTHBOUND		WESTBOUND		EASTBOUND	
BEGIN	LT	RT	THRU	RT	LT	THRU
7:15 AM	8	0	6	1	0	21
7:30 AM	5	0	6	4	1	17
7:45 AM	7	0	4	1	0	14
8:00 AM	5	0	9	1	0	14
TOTAL	**25**	**0**	**25**	**7**	**1**	**66**
PHF	**0.78**	**-**	**0.69**	**0.44**	**0.25**	**0.79**

2021 PM Peak Hour 3:30 PM - 4:30 PM

	Couch Mill Road		Sam Lee Road		Couch Mill Road	
TIME	SOUTHBOUND		WESTBOUND		EASTBOUND	
BEGIN	LT	RT	THRU	RT	LT	THRU
3:30 PM	7	0	15	8	0	8
3:45 PM	7	1	22	7	0	9
4:00 PM	5	0	16	3	0	10
4:15 PM	4	0	24	3	1	7
TOTAL	**23**	**1**	**77**	**21**	**1**	**34**
PHF	**0.82**	**0.25**	**0.80**	**0.66**	**0.25**	**0.85**

APPENDIX F

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 8)

EXISTING CONDITIONS

Intersection	
Int Delay, s/veh	5.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	6	98	77	4	0	29	39	82	0	47	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	75	94	74	50	90	66	70	73	90	51	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	8	104	104	8	0	44	56	112	0	92	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	296	348	92	348	292	112	92	0	0	168	0	0
Stage 1	92	92	-	200	200	-	-	-	-	-	-	-
Stage 2	204	256	-	148	92	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	656	576	965	607	619	941	1503	-	-	1410	-	-
Stage 1	915	819	-	802	736	-	-	-	-	-	-	-
Stage 2	798	696	-	855	819	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	633	557	965	522	599	941	1503	-	-	1410	-	-
Mov Cap-2 Maneuver	633	557	-	522	599	-	-	-	-	-	-	-
Stage 1	885	819	-	776	712	-	-	-	-	-	-	-
Stage 2	763	673	-	755	819	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.5	13.7	1.5	0
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1503	-	-	917	527	1410	-	-
HCM Lane V/C Ratio	0.029	-	-	0.122	0.213	-	-	-
HCM Control Delay (s)	7.5	0	-	9.5	13.7	0	-	-
HCM Lane LOS	A	A	-	A	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.4	0.8	0	-	-

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	66	25	7	25	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	1	-	10	-
Peak Hour Factor	25	79	69	44	78	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	84	36	16	32	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	52	0	-	0	136	44
Stage 1	-	-	-	-	44	-
Stage 2	-	-	-	-	92	-
Critical Hdwy	4.1	-	-	-	8.4	7.2
Critical Hdwy Stg 1	-	-	-	-	7.4	-
Critical Hdwy Stg 2	-	-	-	-	7.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1567	-	-	-	799	1019
Stage 1	-	-	-	-	960	-
Stage 2	-	-	-	-	890	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1567	-	-	-	797	1019
Mov Cap-2 Maneuver	-	-	-	-	797	-
Stage 1	-	-	-	-	960	-
Stage 2	-	-	-	-	887	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	9.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1567	-	-	-	797
HCM Lane V/C Ratio	0.003	-	-	-	0.04
HCM Control Delay (s)	7.3	0	-	-	9.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	5.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	19	40	34	16	0	77	43	119	1	23	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	68	83	50	57	90	84	60	59	25	64	50
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	28	48	68	28	0	92	72	202	4	36	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	420	507	42	444	412	173	48	0	0	273	0	0
Stage 1	50	50	-	356	356	-	-	-	-	-	-	-
Stage 2	370	457	-	88	56	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	544	468	1029	524	530	871	1559	-	-	1290	-	-
Stage 1	963	853	-	661	629	-	-	-	-	-	-	-
Stage 2	650	568	-	920	848	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	491	433	1029	448	491	871	1559	-	-	1290	-	-
Mov Cap-2 Maneuver	491	433	-	448	491	-	-	-	-	-	-	-
Stage 1	895	850	-	614	584	-	-	-	-	-	-	-
Stage 2	575	528	-	846	845	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.9	14.9	1.9	0.6
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1559	-	-	684	460	1290	-	-
HCM Lane V/C Ratio	0.059	-	-	0.111	0.209	0.003	-	-
HCM Control Delay (s)	7.5	0	-	10.9	14.9	7.8	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0.4	0.8	0	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	34	77	21	23	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	1	-	10	-
Peak Hour Factor	25	85	80	66	82	25
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	40	96	32	28	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	128	0	-	0	160	112
Stage 1	-	-	-	-	112	-
Stage 2	-	-	-	-	48	-
Critical Hdwy	4.1	-	-	-	8.4	7.2
Critical Hdwy Stg 1	-	-	-	-	7.4	-
Critical Hdwy Stg 2	-	-	-	-	7.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1470	-	-	-	765	918
Stage 1	-	-	-	-	862	-
Stage 2	-	-	-	-	954	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1470	-	-	-	763	918
Mov Cap-2 Maneuver	-	-	-	-	763	-
Stage 1	-	-	-	-	862	-
Stage 2	-	-	-	-	951	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	9.8
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1470	-	-	-	779
HCM Lane V/C Ratio	0.003	-	-	-	0.041
HCM Control Delay (s)	7.5	0	-	-	9.8
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

PROJECTED HORIZON YEAR (WITHOUT THE PROJECT)

Intersection	
Int Delay, s/veh	6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	7	112	88	5	0	33	44	93	0	54	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	75	94	74	50	90	66	70	73	90	51	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	9	119	119	10	0	50	63	127	0	106	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	338	396	106	397	333	127	106	0	0	190	0	0
Stage 1	106	106	-	227	227	-	-	-	-	-	-	-
Stage 2	232	290	-	170	106	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	616	541	948	563	587	923	1485	-	-	1384	-	-
Stage 1	900	807	-	776	716	-	-	-	-	-	-	-
Stage 2	771	672	-	832	807	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	590	520	948	471	565	923	1485	-	-	1384	-	-
Mov Cap-2 Maneuver	590	520	-	471	565	-	-	-	-	-	-	-
Stage 1	866	807	-	747	689	-	-	-	-	-	-	-
Stage 2	731	646	-	719	807	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.7	15.3	1.6	0
HCM LOS	A	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1485	-	-	895	477	1384	-	-
HCM Lane V/C Ratio	0.034	-	-	0.144	0.27	-	-	-
HCM Control Delay (s)	7.5	0	-	9.7	15.3	0	-	-
HCM Lane LOS	A	A	-	A	C	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	1.1	0	-	-

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	75	29	8	29	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	1	-	10	-
Peak Hour Factor	25	79	69	44	78	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	95	42	18	37	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	60	0	-	0	154	51
Stage 1	-	-	-	-	51	-
Stage 2	-	-	-	-	103	-
Critical Hdwy	4.1	-	-	-	8.4	7.2
Critical Hdwy Stg 1	-	-	-	-	7.4	-
Critical Hdwy Stg 2	-	-	-	-	7.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1556	-	-	-	773	1008
Stage 1	-	-	-	-	949	-
Stage 2	-	-	-	-	875	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1556	-	-	-	771	1008
Mov Cap-2 Maneuver	-	-	-	-	771	-
Stage 1	-	-	-	-	949	-
Stage 2	-	-	-	-	872	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	9.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1556	-	-	-	771
HCM Lane V/C Ratio	0.003	-	-	-	0.048
HCM Control Delay (s)	7.3	0	-	-	9.9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	5.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	22	46	39	18	0	88	49	136	1	26	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	68	83	50	57	90	84	60	59	25	64	50
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	32	55	78	32	0	105	82	231	4	41	14

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	478	578	48	506	469	197	55	0	0	312	0	0
Stage 1	56	56	-	406	406	-	-	-	-	-	-	-
Stage 2	422	522	-	100	63	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	498	427	1021	477	492	844	1550	-	-	1248	-	-
Stage 1	956	848	-	622	598	-	-	-	-	-	-	-
Stage 2	609	531	-	906	842	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	440	390	1021	394	449	844	1550	-	-	1248	-	-
Mov Cap-2 Maneuver	440	390	-	394	449	-	-	-	-	-	-	-
Stage 1	875	845	-	569	547	-	-	-	-	-	-	-
Stage 2	525	486	-	822	839	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.5	17	1.9	0.5
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1550	-	-	640	408	1248	-	-
HCM Lane V/C Ratio	0.068	-	-	0.137	0.269	0.003	-	-
HCM Control Delay (s)	7.5	0	-	11.5	17	7.9	0	-
HCM Lane LOS	A	A	-	B	C	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0.5	1.1	0	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	39	88	24	26	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	1	-	10	-
Peak Hour Factor	25	85	80	66	82	25
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	46	110	36	32	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	146	0	-	0	182	128
Stage 1	-	-	-	-	128	-
Stage 2	-	-	-	-	54	-
Critical Hdwy	4.1	-	-	-	8.4	7.2
Critical Hdwy Stg 1	-	-	-	-	7.4	-
Critical Hdwy Stg 2	-	-	-	-	7.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1448	-	-	-	734	895
Stage 1	-	-	-	-	841	-
Stage 2	-	-	-	-	945	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1448	-	-	-	732	895
Mov Cap-2 Maneuver	-	-	-	-	732	-
Stage 1	-	-	-	-	841	-
Stage 2	-	-	-	-	942	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	10.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1448	-	-	-	747
HCM Lane V/C Ratio	0.003	-	-	-	0.048
HCM Control Delay (s)	7.5	0	-	-	10.1
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

PROJECTED HORIZON YEAR (WITH THE PROJECT)

Intersection	
Int Delay, s/veh	11.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	19	35	244	88	14	0	77	44	93	0	54	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	75	94	74	50	90	66	70	73	90	51	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	47	260	119	28	0	117	63	127	0	106	7

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	483	533	109	622	473	127	113	0	0	190	0	0
Stage 1	109	109	-	360	360	-	-	-	-	-	-	-
Stage 2	374	424	-	262	113	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	494	453	945	399	490	923	1476	-	-	1384	-	-
Stage 1	896	805	-	658	626	-	-	-	-	-	-	-
Stage 2	647	587	-	743	802	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	438	412	945	246	446	923	1476	-	-	1384	-	-
Mov Cap-2 Maneuver	438	412	-	246	446	-	-	-	-	-	-	-
Stage 1	815	805	-	599	570	-	-	-	-	-	-	-
Stage 2	560	534	-	508	802	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.4	33.4	2.9	0
HCM LOS	B	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1476	-	-	751	269	1384	-	-
HCM Lane V/C Ratio	0.079	-	-	0.436	0.546	-	-	-
HCM Control Delay (s)	7.6	0	-	13.4	33.4	0	-	-
HCM Lane LOS	A	A	-	B	D	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	2.2	3	0	-	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	254	88	8	29	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	1	-	10	-
Peak Hour Factor	25	79	69	44	78	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	322	128	18	37	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	146	0	-	0	467	137
Stage 1	-	-	-	-	137	-
Stage 2	-	-	-	-	330	-
Critical Hdwy	4.1	-	-	-	8.4	7.2
Critical Hdwy Stg 1	-	-	-	-	7.4	-
Critical Hdwy Stg 2	-	-	-	-	7.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1448	-	-	-	430	883
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	610	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1448	-	-	-	429	883
Mov Cap-2 Maneuver	-	-	-	-	429	-
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	608	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	14.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1448	-	-	-	429
HCM Lane V/C Ratio	0.003	-	-	-	0.087
HCM Control Delay (s)	7.5	0	-	-	14.2
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Intersection	
Int Delay, s/veh	2.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	180	1	25	63	3	75
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	90	90	69	90	90
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	228	1	28	91	3	83

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	229	0	375	228
Stage 1	-	-	-	-	228	-
Stage 2	-	-	-	-	147	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1351	-	630	816
Stage 1	-	-	-	-	815	-
Stage 2	-	-	-	-	885	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1351	-	616	816
Mov Cap-2 Maneuver	-	-	-	-	616	-
Stage 1	-	-	-	-	815	-
Stage 2	-	-	-	-	866	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	10
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	806	-	-	1351	-
HCM Lane V/C Ratio	0.108	-	-	0.021	-
HCM Control Delay (s)	10	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0.1	-

Intersection	
Int Delay, s/veh	4.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	77	2	34	32	6	104
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	90	90	69	90	90
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	97	2	38	46	7	116

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	100	0	221	99
Stage 1	-	-	-	-	99	-
Stage 2	-	-	-	-	122	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1505	-	772	962
Stage 1	-	-	-	-	930	-
Stage 2	-	-	-	-	908	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1505	-	752	962
Mov Cap-2 Maneuver	-	-	-	-	752	-
Stage 1	-	-	-	-	930	-
Stage 2	-	-	-	-	884	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.3	9.4
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	948	-	-	1505	-
HCM Lane V/C Ratio	0.129	-	-	0.025	-
HCM Control Delay (s)	9.4	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0.1	-

Intersection	
Int Delay, s/veh	27.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	13	42	141	39	50	0	236	49	136	1	26	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	68	83	50	57	90	84	60	59	25	64	50
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	62	170	78	88	0	281	82	231	4	41	56

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	880	951	69	951	864	197	97	0	0	312	0	0
Stage 1	77	77	-	759	759	-	-	-	-	-	-	-
Stage 2	803	874	-	192	105	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	268	260	994	240	292	844	1496	-	-	1248	-	-
Stage 1	932	831	-	399	415	-	-	-	-	-	-	-
Stage 2	377	367	-	810	808	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	154	198	994	125	223	844	1496	-	-	1248	-	-
Mov Cap-2 Maneuver	154	198	-	125	223	-	-	-	-	-	-	-
Stage 1	713	829	-	305	317	-	-	-	-	-	-	-
Stage 2	209	281	-	620	806	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	24.3	131.4	3.8	0.3
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1496	-	-	427	163	1248	-	-
HCM Lane V/C Ratio	0.188	-	-	0.576	1.017	0.003	-	-
HCM Control Delay (s)	8	0	-	24.3	131.4	7.9	0	-
HCM Lane LOS	A	A	-	C	F	A	A	-
HCM 95th %tile Q(veh)	0.7	-	-	3.5	8.1	0	-	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	167	289	24	26	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	1	-	10	-
Peak Hour Factor	25	85	80	66	82	25
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	196	361	36	32	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	398	0	-	0	583	379
Stage 1	-	-	-	-	379	-
Stage 2	-	-	-	-	204	-
Critical Hdwy	4.1	-	-	-	8.4	7.2
Critical Hdwy Stg 1	-	-	-	-	7.4	-
Critical Hdwy Stg 2	-	-	-	-	7.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1172	-	-	-	346	605
Stage 1	-	-	-	-	564	-
Stage 2	-	-	-	-	746	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1172	-	-	-	345	605
Mov Cap-2 Maneuver	-	-	-	-	345	-
Stage 1	-	-	-	-	564	-
Stage 2	-	-	-	-	743	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	16
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1172	-	-	-	362
HCM Lane V/C Ratio	0.003	-	-	-	0.099
HCM Control Delay (s)	8.1	0	-	-	16
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Intersection	
Int Delay, s/veh	2.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	114	4	85	205	3	54
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	85	90	90	80	90	90
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	134	4	94	256	3	60

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	139	0	581	136
Stage 1	-	-	-	-	136	-
Stage 2	-	-	-	-	445	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1457	-	479	918
Stage 1	-	-	-	-	895	-
Stage 2	-	-	-	-	650	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1457	-	443	918
Mov Cap-2 Maneuver	-	-	-	-	443	-
Stage 1	-	-	-	-	895	-
Stage 2	-	-	-	-	601	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	9.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	869	-	-	1457	-
HCM Lane V/C Ratio	0.073	-	-	0.065	-
HCM Control Delay (s)	9.5	-	-	7.6	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.2	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	44	7	116	92	4	74
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	85	90	90	80	90	90
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	52	8	129	115	4	82

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	60	0	429	56
Stage 1	-	-	-	-	56	-
Stage 2	-	-	-	-	373	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1556	-	587	1016
Stage 1	-	-	-	-	972	-
Stage 2	-	-	-	-	701	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1556	-	535	1016
Mov Cap-2 Maneuver	-	-	-	-	535	-
Stage 1	-	-	-	-	972	-
Stage 2	-	-	-	-	639	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	971	-	-	1556	-
HCM Lane V/C Ratio	0.089	-	-	0.083	-
HCM Control Delay (s)	9.1	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.3	-

Intersection	
Intersection Delay, s/veh	11.5
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	19	35	244	0	88	14	0	0	77	44	93
Peak Hour Factor	0.92	0.90	0.75	0.94	0.92	0.74	0.50	0.90	0.92	0.66	0.70	0.73
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	21	47	260	0	119	28	0	0	117	63	127
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	11.7	10.5	12.3
HCM LOS	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	36%	6%	86%	0%
Vol Thru, %	21%	12%	14%	90%
Vol Right, %	43%	82%	0%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	214	298	102	60
LT Vol	77	19	88	0
Through Vol	44	35	14	54
RT Vol	93	244	0	6
Lane Flow Rate	307	327	147	113
Geometry Grp	1	1	1	1
Degree of Util (X)	0.441	0.44	0.234	0.176
Departure Headway (Hd)	5.173	4.843	5.738	5.618
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	697	743	624	637
Service Time	3.209	2.881	3.783	3.664
HCM Lane V/C Ratio	0.44	0.44	0.236	0.177
HCM Control Delay	12.3	11.7	10.5	9.9
HCM Lane LOS	B	B	B	A
HCM 95th-tile Q	2.3	2.3	0.9	0.6

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	0	54	6
Peak Hour Factor	0.92	0.90	0.51	0.90
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	0	106	7
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	9.9
HCM LOS	A

Lane

Intersection	
Intersection Delay, s/veh	23.2
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	13	42	141	0	39	50	0	0	236	49	136
Peak Hour Factor	0.92	0.90	0.68	0.83	0.92	0.50	0.57	0.90	0.92	0.84	0.60	0.59
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	62	170	0	78	88	0	0	281	82	231
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	12.6	12.2	32.9
HCM LOS	B	B	D

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	56%	7%	44%	2%
Vol Thru, %	12%	21%	56%	47%
Vol Right, %	32%	72%	0%	51%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	421	196	89	55
LT Vol	236	13	39	1
Through Vol	49	42	50	26
RT Vol	136	141	0	28
Lane Flow Rate	593	246	166	101
Geometry Grp	1	1	1	1
Degree of Util (X)	0.867	0.394	0.295	0.164
Departure Headway (Hd)	5.265	5.765	6.415	5.876
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	682	620	555	604
Service Time	3.326	3.848	4.506	3.976
HCM Lane V/C Ratio	0.87	0.397	0.299	0.167
HCM Control Delay	32.9	12.6	12.2	10.1
HCM Lane LOS	D	B	B	B
HCM 95th-tile Q	10.2	1.9	1.2	0.6

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	1	26	28
Peak Hour Factor	0.92	0.25	0.64	0.50
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	4	41	56
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	10.1
HCM LOS	B

Lane

APPENDIX G

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)

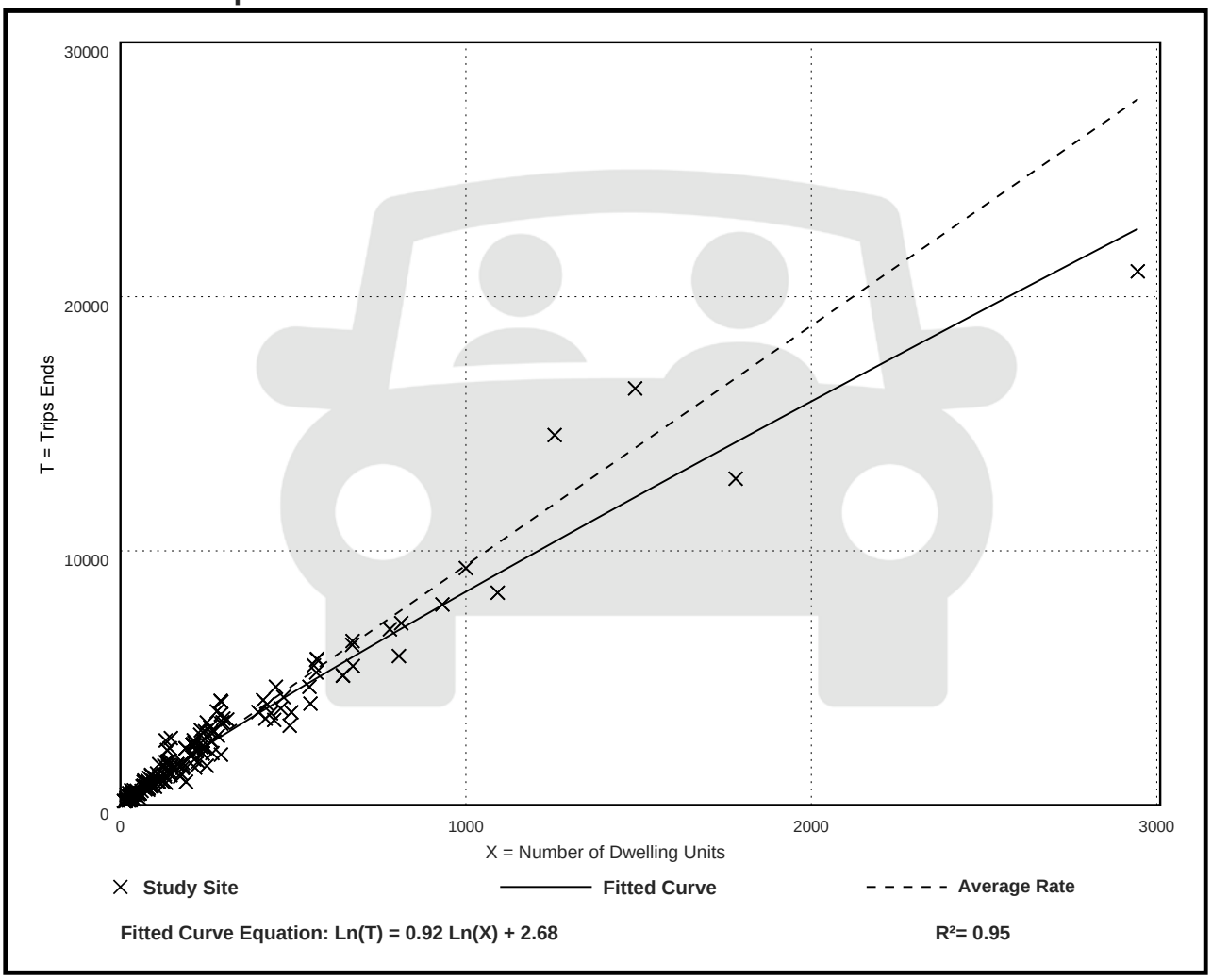
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

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

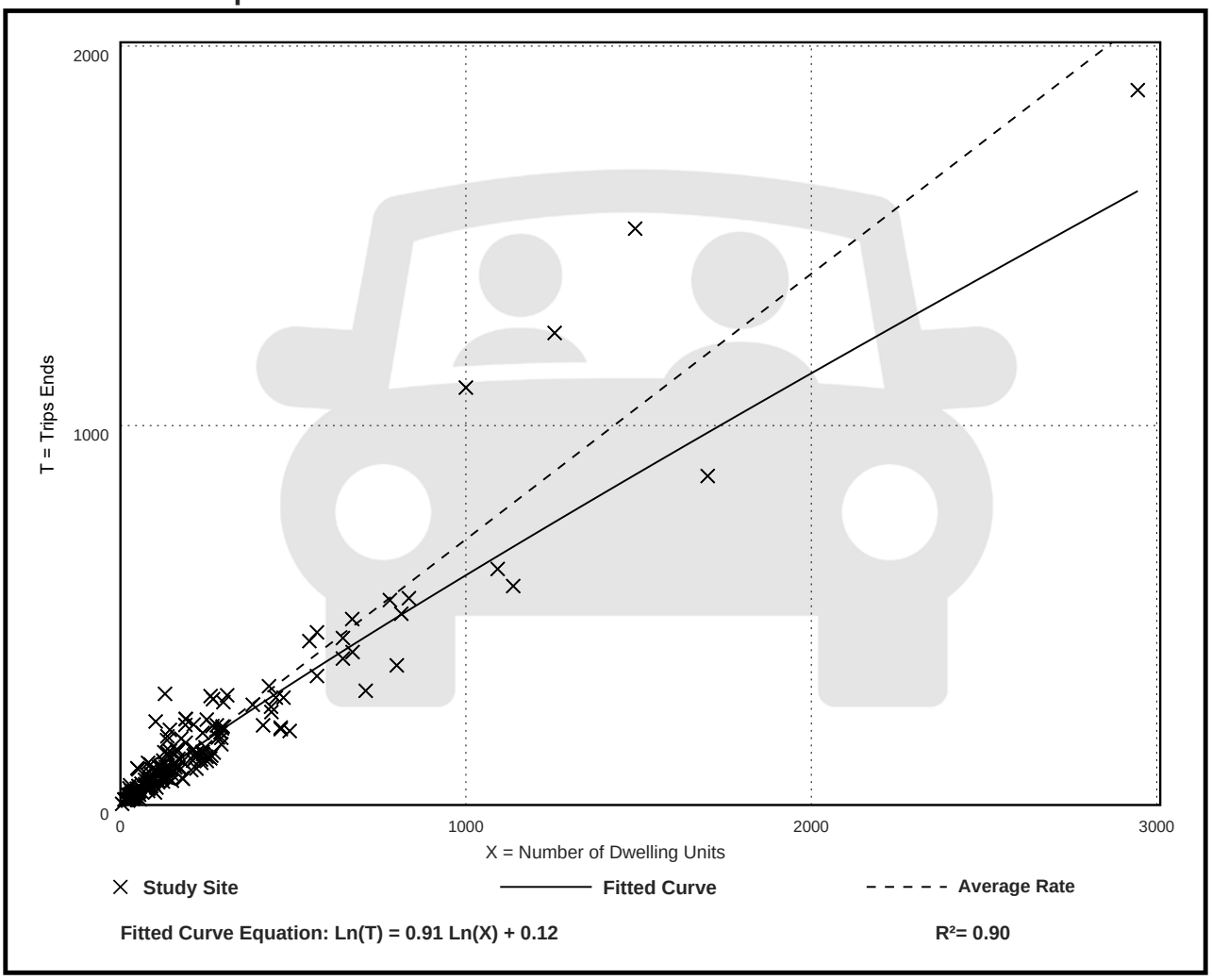
Single-Family Detached Housing
(210)

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



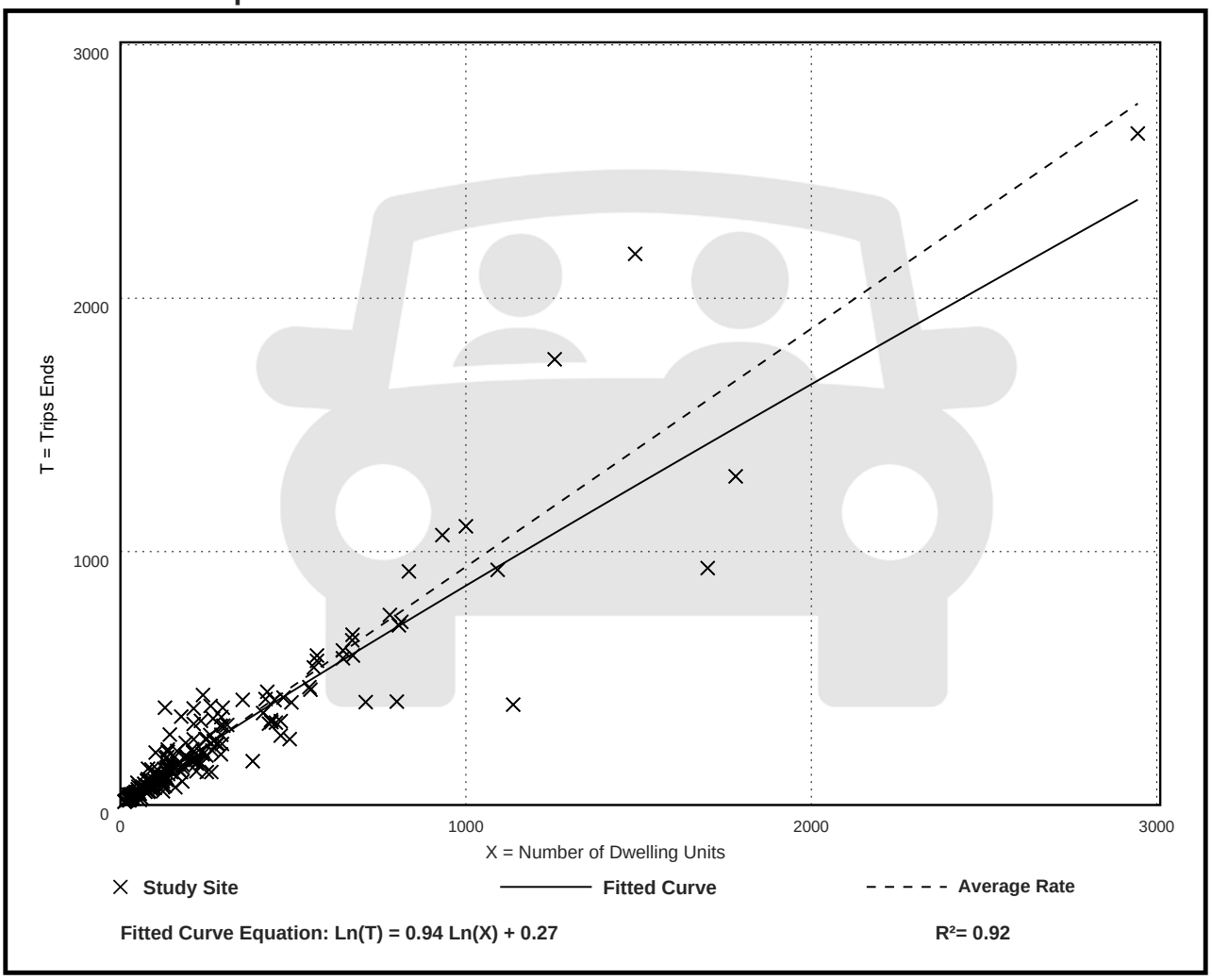
Single-Family Detached Housing
(210)

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



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

R^2= 0.92

Local Apartment
Trip Generation Study

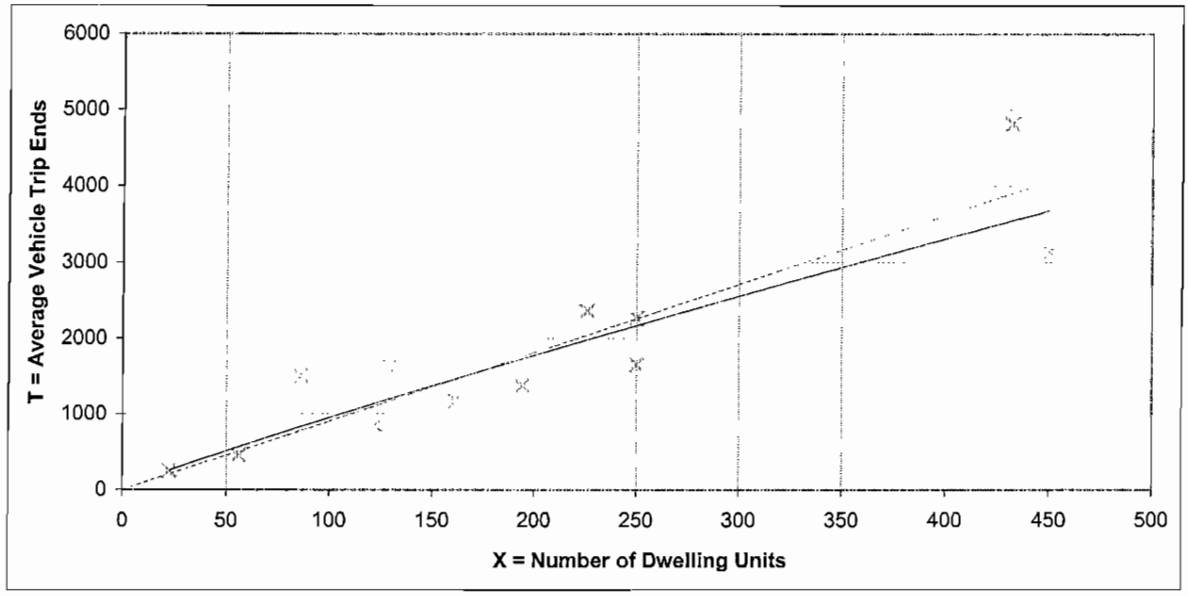
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

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

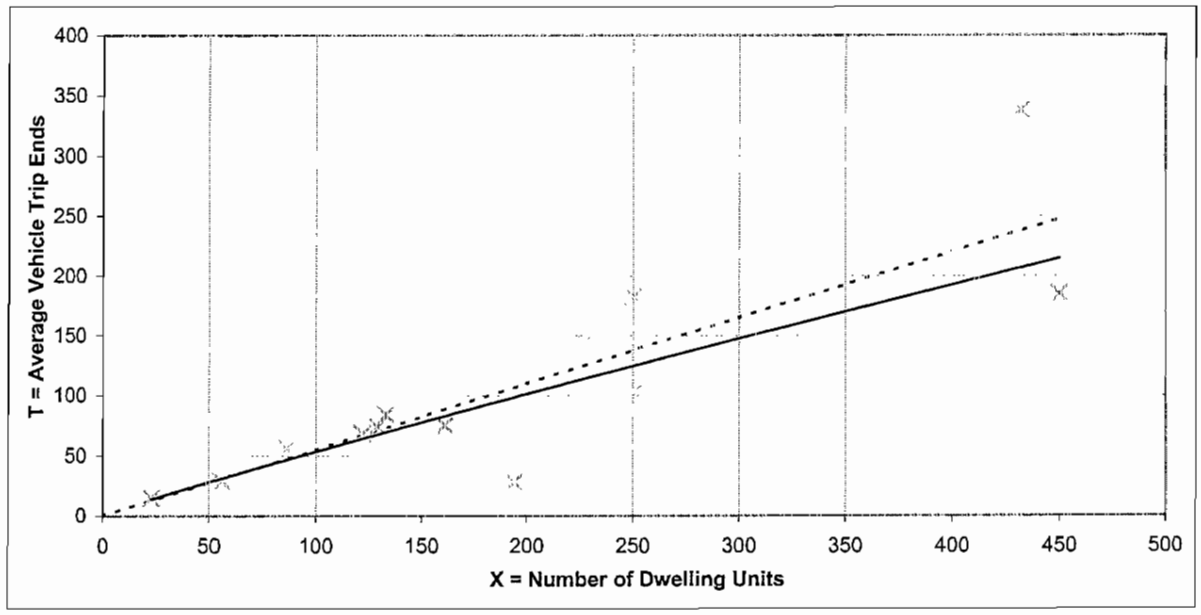
Local Apartment
Trip Generation Study

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

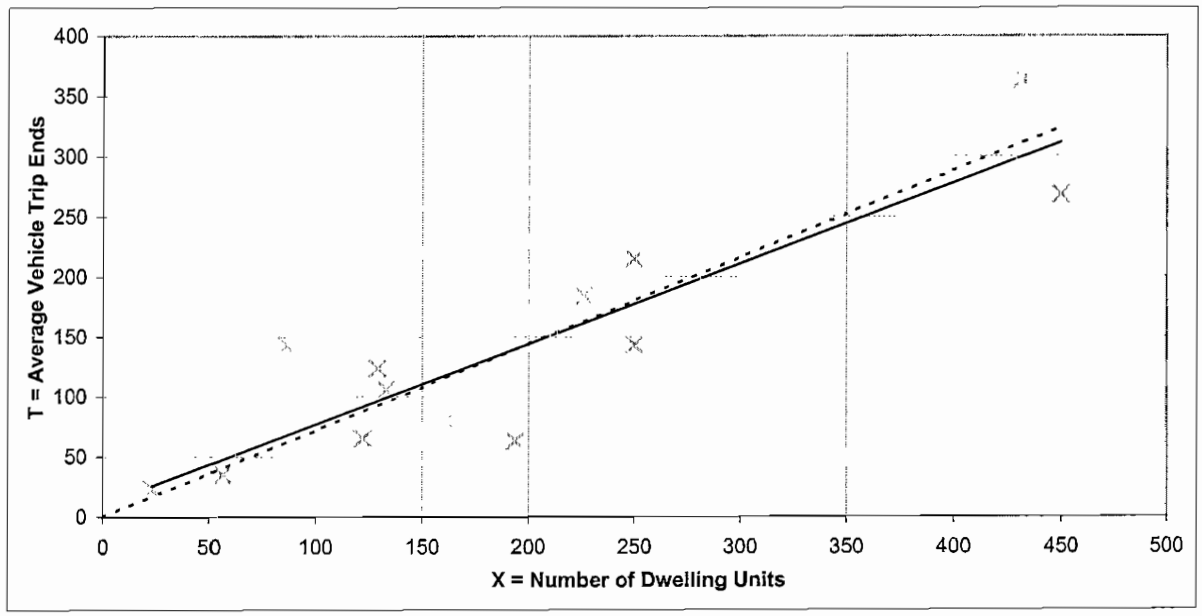
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

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 COUCH MILL ROAD SUBDIVISION

278 Single-Family Detached Homes and 115 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	278	2,585	26%	74%		63%	37%	
				49	140	189	164	96	260
Local Trip Rate	Multi-Family Attached Townhouses	115	1,082	22%	78%		55%	45%	
				13	48	61	48	39	87
Total New Volume Site Trips			**3,667**	**62**	**188**	**250**	**212**	**135**	**347**

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

Trips calculated by using Fitted Curve Equations

TRIP GENERATION FOR THE COUCH MILL ROAD SUBDIVISION

278 Single-Family Detached Houses

278 Residential Houses = X

Weekday:

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

Ln(T) = 0.92 * 5.63 + 2.68

Ln(T) = 7.86

T = 2,585 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 * 6 + 0.12

Ln(T) = 5.24

T = 189 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 * 5.63 + 0.27

Ln(T) = 5.56

T = 260 trips

TRIP GENERATION FOR THE COUCH MILL ROAD SUBDIVISION

115 Multi-Family Attached Townhouses

115 Residential Houses = X

Weekday:

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

T = 15 * 71.21

T = 1,082 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T = 0.758 * 80

T = 61 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

T = 0.669 * 115 + 10.07

T = 87 trips

APPENDIX H

2019 CENSUS BUREAU DATA

OnTheMap

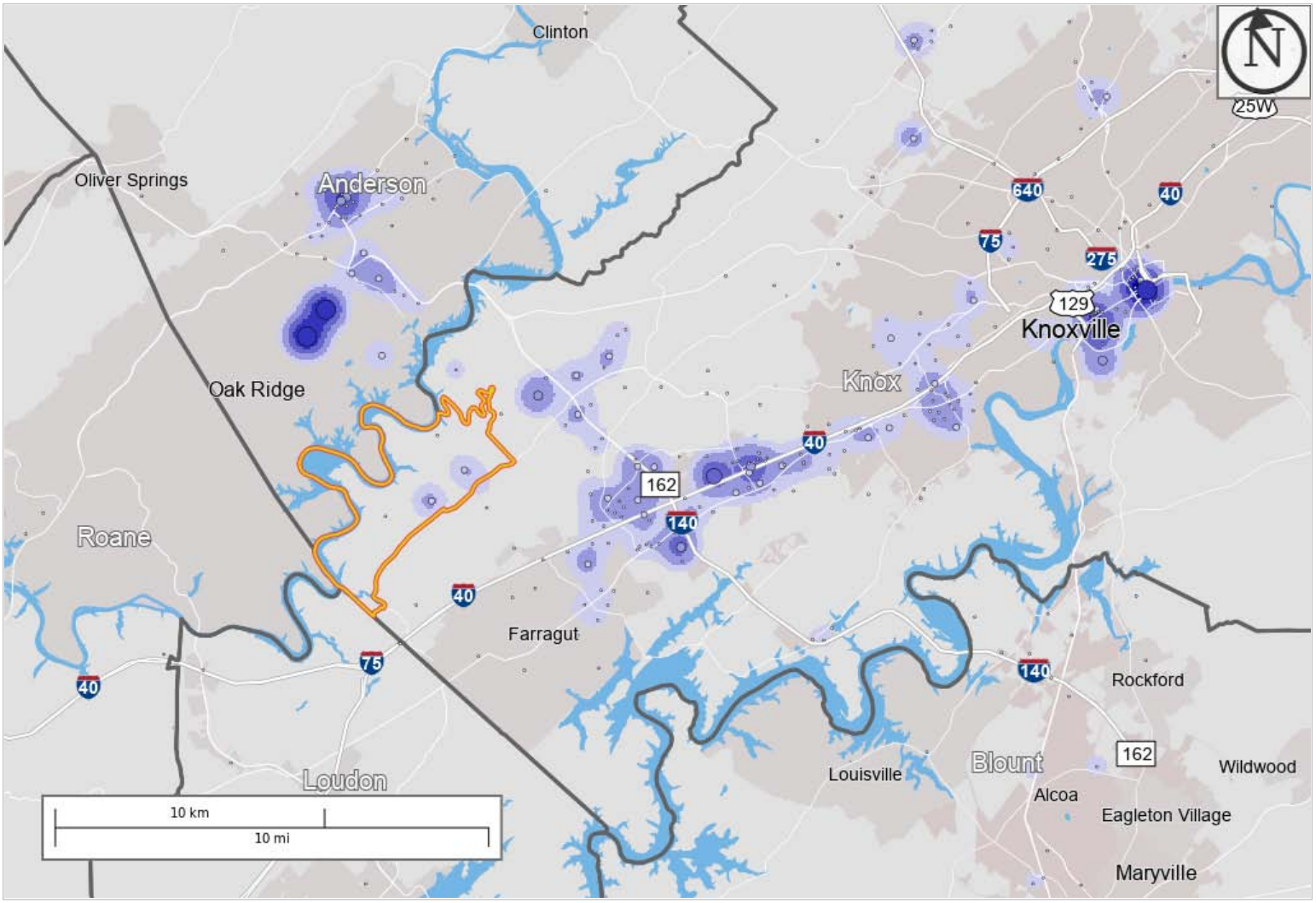
Distance/Direction Report - Home to Work

All Jobs for All Workers in 2019

Created by the U.S. Census Bureau's OnTheMap https://onthemap.ces.census.gov on 11/16/2021

Counts and Density of Work Locations for All Jobs in Home Selection Area in 2019

All Workers



Map Legend

Job Density [Jobs/Sq. Mile]

- 5 - 12
- 13 - 34
- 35 - 70
- 71 - 121
- 122 - 187

Job Count [Jobs/Census Block]

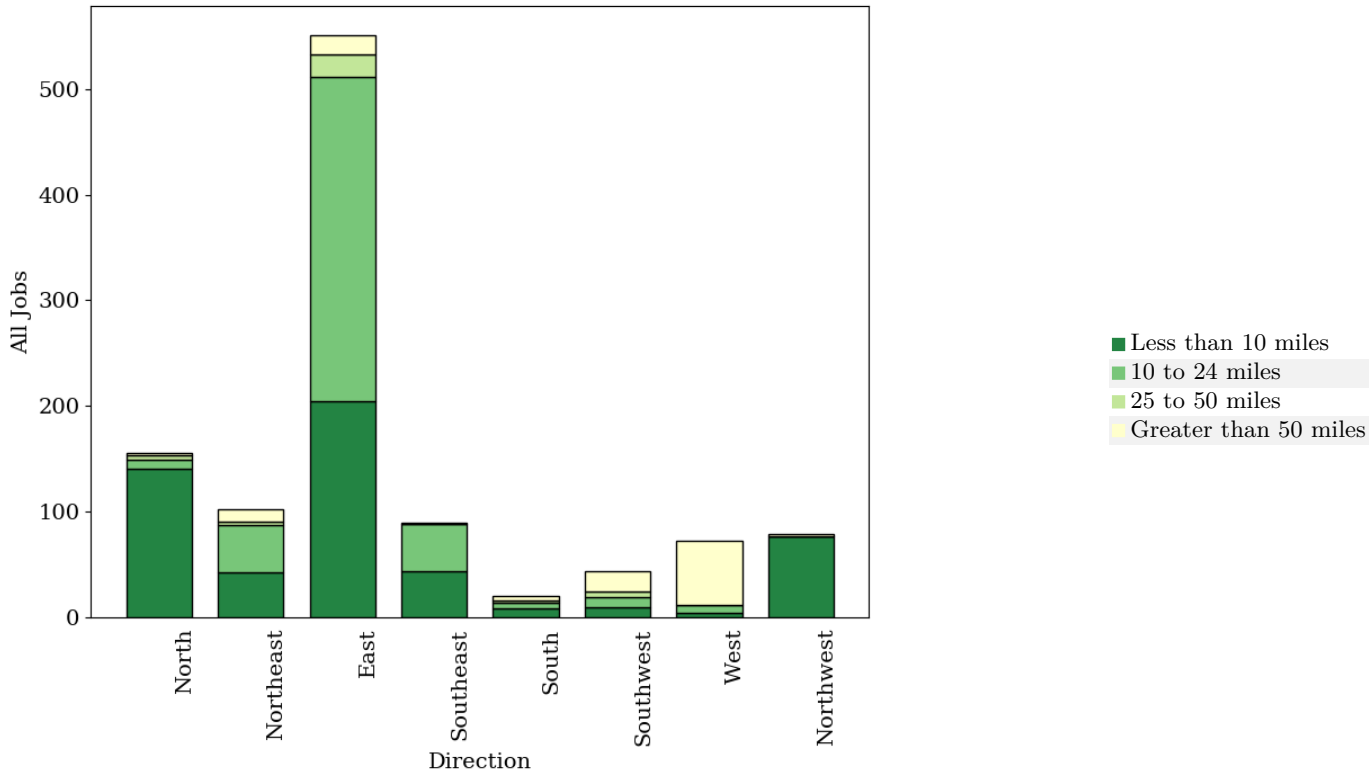
- 1 - 3
- 4 - 10
- 11 - 22
- 23 - 38
- 39 - 60

Selection Areas

- Analysis Selection

All Jobs for All Workers in 2019

Distance and Direction from Home Census Block to Work Census Block, Living in Selection Area



All Jobs for All Workers in 2019

Distance from Home Census Block to Work Census Block, Living in Selection Area

Distance	2019 Count	2019 Share
Total All Jobs	1,112	100.0
Less than 10 miles	529	47.6
10 to 24 miles	427	38.4
25 to 50 miles	36	3.2
Greater than 50 miles	120	10.8

Additional Information

Analysis Settings

Analysis Type	Distance/Direction
Selection area as	Home
Year(s)	2019
Job Type	All Jobs
Selection Area	59.06 (Knox, TN) from Census Tracts
Selected Census Blocks	31
Analysis Generation Date	11/16/2021 18:02 - OnTheMap 6.8.1
Code Revision	5a28dab6722a45c1d92e7074a4e03e8be2a8ecad
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 OnTheMap

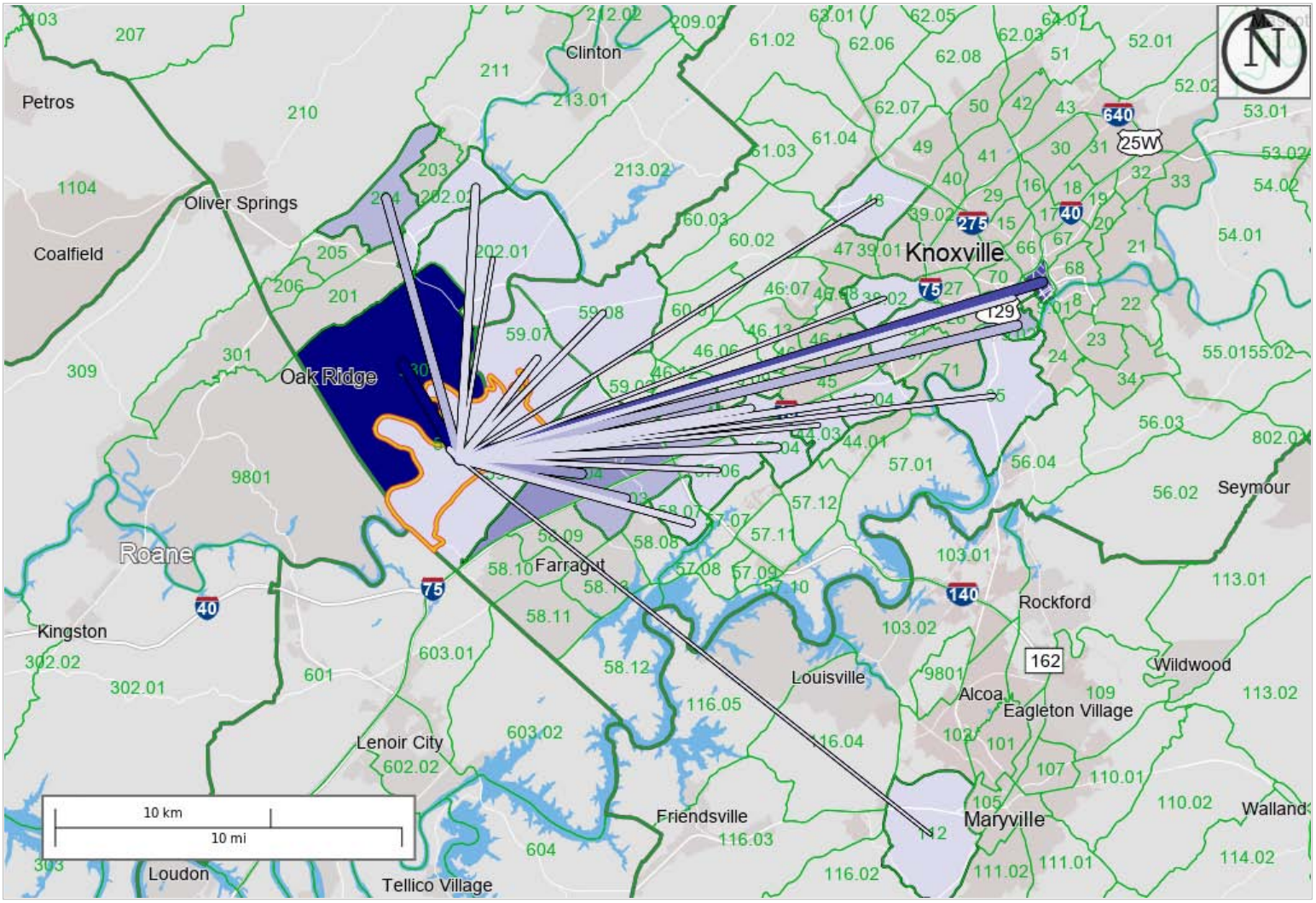
Work Destination Report - Home Selection Area to Work Census Tracts

All Jobs for All Workers in 2019

Created by the U.S. Census Bureau's OnTheMap `https://onthemap.ces.census.gov` on 11/17/2021

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

All Workers



Map Legend

Job Count
- 118 - 136
- 100 - 117
- 82 - 99
- 64 - 81
- 46 - 63
- 28 - 45
- 9 - 27

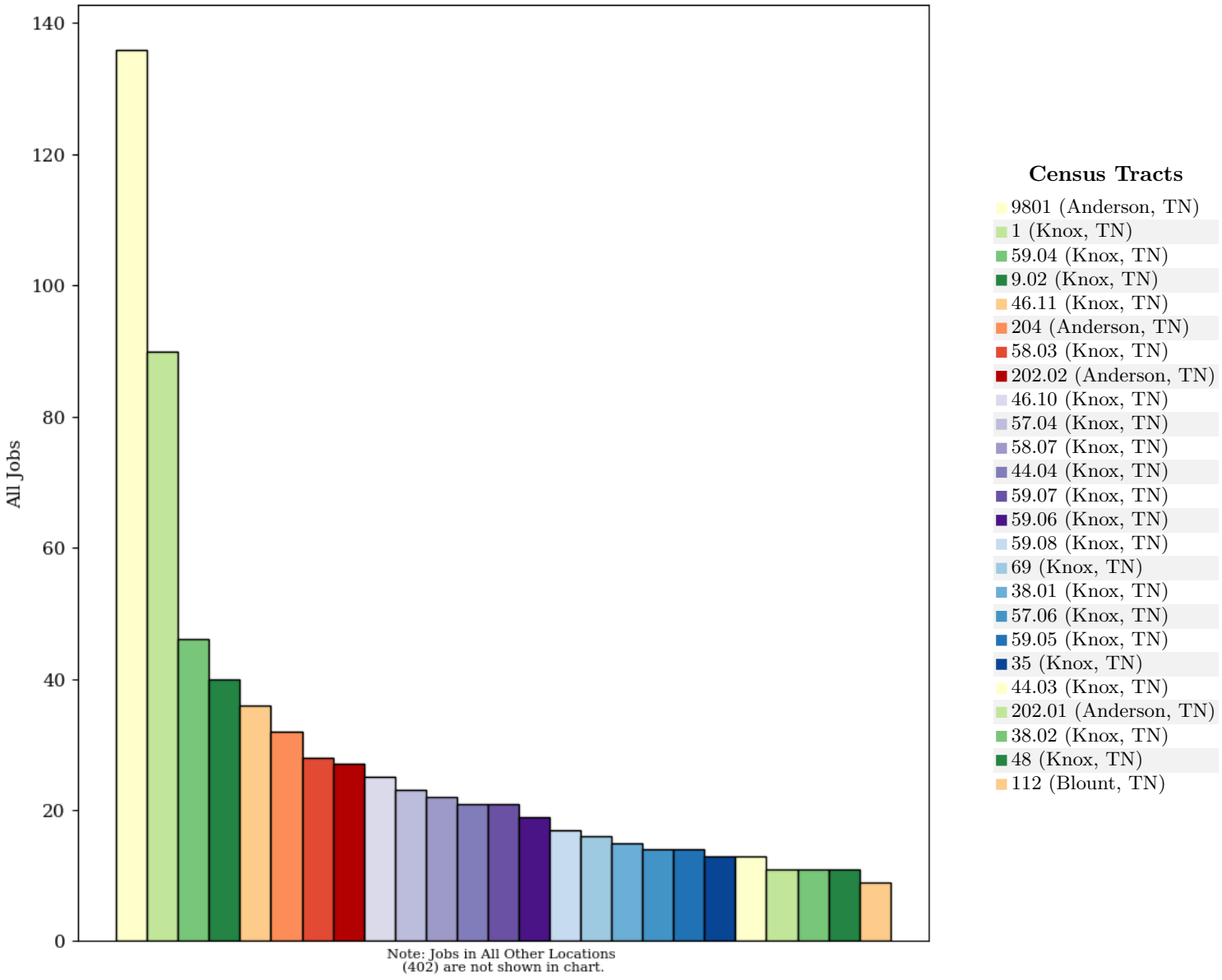
Selection Areas
- Analysis Selection

Job Count
- 118 - 136
- 100 - 117
- 82 - 99
- 64 - 81
- 46 - 63
- 28 - 45
- 9 - 27

United States Census Bureau

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

All Workers



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

All Workers

Census Tracts as Work Destination Area	2019 Count	2019 Share
All Census Tracts	1,112	100.0
9801 (Anderson, TN)	136	12.2
1 (Knox, TN)	90	8.1
59.04 (Knox, TN)	46	4.1
9.02 (Knox, TN)	40	3.6
46.11 (Knox, TN)	36	3.2
204 (Anderson, TN)	32	2.9
58.03 (Knox, TN)	28	2.5
202.02 (Anderson, TN)	27	2.4
46.10 (Knox, TN)	25	2.2
57.04 (Knox, TN)	23	2.1

Census Tracts as Work Destination Area	2019 Count	Share
58.07 (Knox, TN)	22	2.0
44.04 (Knox, TN)	21	1.9
59.07 (Knox, TN)	21	1.9
59.06 (Knox, TN)	19	1.7
59.08 (Knox, TN)	17	1.5
69 (Knox, TN)	16	1.4
38.01 (Knox, TN)	15	1.3
57.06 (Knox, TN)	14	1.3
59.05 (Knox, TN)	14	1.3
35 (Knox, TN)	13	1.2
44.03 (Knox, TN)	13	1.2
202.01 (Anderson, TN)	11	1.0
38.02 (Knox, TN)	11	1.0
48 (Knox, TN)	11	1.0
112 (Blount, TN)	9	0.8
All Other Locations	402	36.2

Additional Information

Analysis Settings

Analysis Type	Destination
Destination Type	Census Tracts
Selection area as	Home
Year(s)	2019
Job Type	All Jobs
Selection Area	59.06 (Knox, TN) from Census Tracts
Selected Census Blocks	31
Analysis Generation Date	11/17/2021 10:33 - OnTheMap 6.8.1
Code Revision	5a28dab6722a45c1d92e7074a4e03e8be2a8ecad
LODES Data Version	20211018_1647

Data Sources

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

Notes

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

APPENDIX I

KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS

TABLE 4A

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

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

63

180+1 = 181

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			95	80	65
350 - 399	135			85	70	60
400 - 449	120			75	65	55
450 - 499	105			70	60	50
500 - 549	95			65	55	50
550 - 599	85			60	50	45
600 - 649	75			55	45	40
650 - 699	70			50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Couch Mill Road at
Proposed East Entrance
(Road "A")

2028 Projected AM
WB Left Turns = 25

Turn Lane NOT
Warranted

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

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

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

180

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

Couch Mill Road at Proposed East Entrance (Road "A")

2028 Projected AM EB Right Turns = 1

Turn Lane NOT Warranted

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

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

TABLE 4A

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

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

205

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
114+4 = 118 100 - 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			95	80	65
350 - 399	135			85	70	60
400 - 449	120			75	65	55
450 - 499	105			70	60	50
500 - 549	95			65	55	50
550 - 599	85			60	50	45
600 - 649	75			55	45	40
650 - 699	70			50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Couch Mill Road at Proposed East Entrance (Road "A")

2028 Projected PM WB Left Turns = 85

Turn Lane NOT Warranted

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

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

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

114

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

Couch Mill Road at Proposed East Entrance (Road "A")

2028 Projected PM EB Right Turns = 4

Turn Lane NOT Warranted

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

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

TABLE 4A

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

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

32

77+2 = 79

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			95	80	65
350 - 399	135			85	70	60
400 - 449	120			75	65	55
450 - 499	105			70	60	50
500 - 549	95			65	55	50
550 - 599	85			60	50	45
600 - 649	75			55	45	40
650 - 699	70			50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Couch Mill Road at
Proposed West Entrance
(Road "G")

2028 Projected AM
WB Left Turns = 34

Turn Lane NOT
Warranted

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

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

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

77

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

Couch Mill Road at Proposed West Entrance (Road "G")

2028 Projected AM EB Right Turns = 2

Turn Lane NOT Warranted

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

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

TABLE 4A

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

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

92

44+7 = 51

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			95	80	65
350 - 399	135			85	70	60
400 - 449	120			75	65	55
450 - 499	105			70	60	50
500 - 549	95			65	55	50
550 - 599	85			60	50	45
600 - 649	75			55	45	40
650 - 699	70			50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Couch Mill Road at Proposed West Entrance (Road "G")

2028 Projected PM WB Left Turns = 116

Turn Lane NOT Warranted

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

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

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

44

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

Couch Mill Road at Proposed West Entrance (Road "G")

2028 Projected PM EB Right Turns = 7

Turn Lane NOT Warranted

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

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

TABLE 4A

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

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

39+82 = 121

0+47+0 = 47

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			95	80	65
350 - 399	135			85	70	60
400 - 449	120			75	65	55
450 - 499	105			70	60	50
500 - 549	95			65	55	50
550 - 599	85			60	50	45
600 - 649	75			55	45	40
650 - 699	70			50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Sam Lee Road at Swafford Road/Steele Road

2021 Projected AM NB Left Turns = 29

Left Turn Lane NOT Warranted

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

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

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

29+39 = 68

82

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

Sam Lee Road at Swafford Road/Steele Road

2021 Projected AM NB Right Turns = 82

Right Turn Lane NOT Warranted

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

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

TABLE 4A

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

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

43+119 = 162

6+23+1 = 30

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			95	80	65
350 - 399	135			85	70	60
400 - 449	120			75	65	55
450 - 499	105			70	60	50
500 - 549	95			65	55	50
550 - 599	85			60	50	45
600 - 649	75			55	45	40
650 - 699	70			50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Sam Lee Road at Swafford Road/Steele Road

2021 Projected PM NB Left Turns = 77

Left Turn Lane NOT Warranted

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

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

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

77+43 = 120

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						
119 → 100 - 149 150 - 199						
200 - 249 250 - 299						Yes
300 - 349 350 - 399					Yes Yes	Yes Yes
400 - 449 450 - 499					Yes Yes	Yes Yes
500 - 549 550 - 599		Yes Yes			Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

Sam Lee Road at Swafford Road/Steele Road

2021 Projected PM NB Right Turns = 119

Right Turn Lane NOT Warranted

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

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

TABLE 4A

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

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

44+93 = 137

0+54+6 = 60

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			95	80	65
350 - 399	135			85	70	60
400 - 449	120			75	65	55
450 - 499	105			70	60	50
500 - 549	95			65	55	50
550 - 599	85			60	50	45
600 - 649	75			55	45	40
650 - 699	70			50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Sam Lee Road at Swafford Road/Steele Road

2028 Projected AM NB Left Turns = 77

Left Turn Lane NOT Warranted

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

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

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

77+44 = 121

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						
93 → 50 - 99						
100 - 149						
150 - 199						
200 - 249						
250 - 299						Yes
300 - 349					Yes	Yes
350 - 399				Yes	Yes	Yes
400 - 449			es	Yes	Yes	Yes
450 - 499			es	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

Sam Lee Road at Swafford Road/Steele Road

2028 Projected AM NB Right Turns = 93

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.

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)

49+136 = 185

1+26+28 = 55

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			95	80	65
350 - 399	135			85	70	60
400 - 449	120			75	65	55
450 - 499	105			70	60	50
500 - 549	95			65	55	50
550 - 599	85			60	50	45
600 - 649	75			55	45	40
650 - 699	70			50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Sam Lee Road at Swafford Road/Steele Road

2028 Projected PM NB Left Turns = 236

Left Turn Lane NOT Warranted

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

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

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

236+49 = 285

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						
136 → 100 - 149 150 - 199						
200 - 249 250 - 299						Yes
300 - 349 350 - 399				Yes	Yes Yes	Yes Yes
400 - 449 450 - 499			Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

Sam Lee Road at Swafford Road/Steele Road

2028 Projected PM NB Right Turns = 136

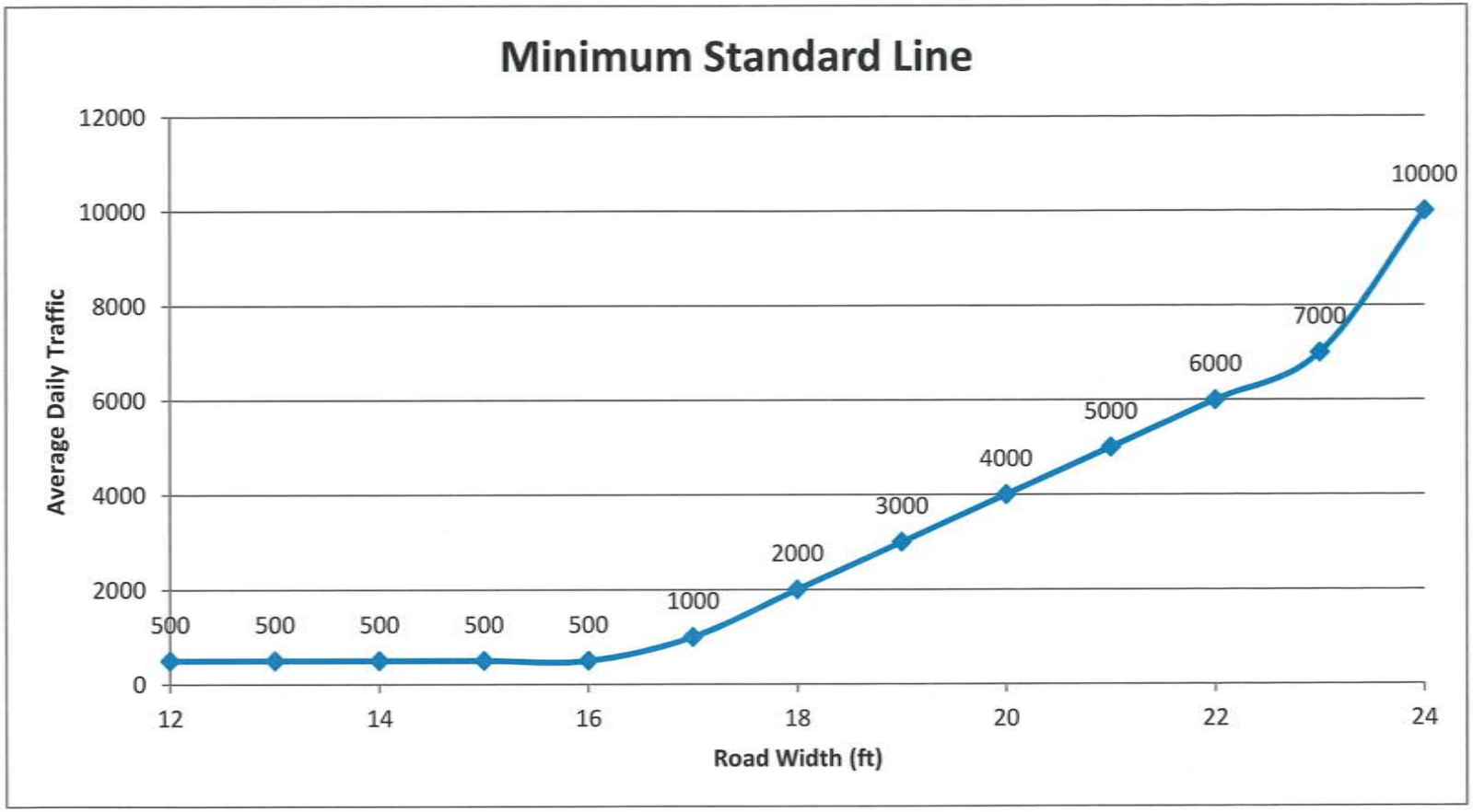
Right Turn Lane NOT Warranted

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

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

APPENDIX J

ROAD WIDTH AND ROAD CAPACITY DATA



SOURCE: Knox County Engineering

HIGHPLAN 2012 Conceptual Planning Analysis

Project Information

Analyst	RWJ	**Highway Name**	Couch Mill Road	**Study Period**	**Standard K**
Date Prepared	11/26/2021 4:29:34 PM	**From**	Project Site	**Analysis Type**	Two-Lane Segment
Agency	Ajax Engineering	**To**	Intersection of Sam Lee Road at Steele Road	**Program**	HIGHPLAN 2012
Area Type	Transitioning/Urban	**Peak Direction**	Eastbound	**Version Date**	12/12/2012
File Name	C:\Land Projects 2009\2117 - Couch Mill Road TIS\Report\couch mill road.xhp				
User Notes					

Highway Data

Roadway Variables				Traffic Variables			
Segment Length	0.600	**Median**	No	**AADT**	4458	**PHF**	0.900
# Thru Lanes	2	**Left Turn Impact**	Yes	**K**	0.090	**% Heavy Vehicles**	2.0
Terrain	Rolling	**Pass Lane Length**	N/A	**D**	0.950	**Base Capacity**	1700
Posted Speed	35	**% NPZ**	0	**Peak Dir. Hrly. Vol.**	381	**Local Adj. Factor**	0.90
Free Flow Speed	40	**Class**	3	**Off Peak Dir. Hrly. Vol.**	20	**Adjusted Capacity**	0

LOS Results

v/c Ratio	0.36	**Density**	N/A	**PTSF**	48.4	**ATS**	34.7	**% FFS**	86.9
FFS Delay	8.2	**LOS Thresh. Delay**	19.0	**Service Measure**	PctFFS	**LOS**	B		

Service Volumes

Note: The maximum normally acceptable directional service volume for LOS E in Florida for this facility type and area type is 1650 veh/h/ln.

	A	B	C	D	E
Lanes	**Hourly Volume In Peak Direction**				
1	200	490	760	1000	1090
2					
3					
4					
Lanes	**Hourly Volume In Both Directions**				
2	220	520	800	1060	1150
4					
6					
8					
Lanes	**Annual Average Daily Traffic**				
2	2500	5800	8900	11800	12800

4
6
8

*** Cannot be achieved based on input data provided.**
 # Performance measure results are no longer applicable with the presence of passing lanes. Refer to the service volume tables to obtain the LOS.

APPENDIX K

ALL-WAY STOP CONTROL ANALYSIS

Traffic Signal Warrant Analysis

Project Name	**Couch Mill Road Subdivision**
Project/File #	**#2117**
Scenario	**2028 Projected Volumes**

Intersection Information	
Major Street Name	teele Road/Swafford Roa
North/South or East/West	N/S
Speed Limit	35 mph or less
# of Approach Lanes	1
% of Right Turn Traffic to Include	100%
Minor Street Name	Sam Lee Road
# of Approach Lanes	1
% of Right Turn Traffic to Include	100%
Isolated Community < 10,000 pop	No

What Additional Warrants to Consider?	
Warrant 3, Peak Hour (A - Vol. and Delay)	No
Warrant 4, Pedestrian Volume	No
Warrant 5, School Crossing	No
Warrant 6, Coordinated Signal System	No
Warrant 7, Crash Experience	No
Warrant 8, Roadway Network	No
Warrant 9, Intersection Near a Grade Crossing	No
All-Way Stop Warrant	Yes

Traffic Signal Warrant Analysis

Steele Road/Swafford Road (Major Street) Volume

Northbound Volume by Hour				
Time	Left Turns	Through	Right Turns	Peds/Bikes
12 - 1 AM				
1 - 2 AM				
2 - 3 AM				
3 - 4 AM				
4 - 5 AM				
5 - 6 AM				
6 - 7 AM				
7 - 8 AM	67	40	75	
8 - 9 AM	81	27	65	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	106	16	14	
12 - 1 PM	124	23	18	
1 - 2 PM				
2 - 3 PM	141	21	31	
3 - 4 PM	189	33	119	
4 - 5 PM	203	33	52	
5 - 6 PM	251	25	33	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			**1,787**	**0**

Southbound Volume by Hour				
Time	Left Turns	Through	Right Turns	Peds/Bikes
12 - 1 AM				
1 - 2 AM				
2 - 3 AM				
3 - 4 AM				
4 - 5 AM				
5 - 6 AM				
6 - 7 AM				
7 - 8 AM	0	58	7	
8 - 9 AM	0	21	9	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	0	9	13	
12 - 1 PM	0	11	15	
1 - 2 PM				
2 - 3 PM	1	19	15	
3 - 4 PM	2	23	20	
4 - 5 PM	0	21	28	
5 - 6 PM	0	18	27	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			**317**	**0**

Sam Lee Road (Minor Street) Volume

Eastbound Volume by Hour				
Time	Left Turns	Through	Right Turns	Peds/Bikes
12 - 1 AM				
1 - 2 AM				
2 - 3 AM				
3 - 4 AM				
4 - 5 AM				
5 - 6 AM				
6 - 7 AM				
7 - 8 AM	19	35	238	
8 - 9 AM	20	29	195	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	13	17	108	
12 - 1 PM	12	22	116	
1 - 2 PM				
2 - 3 PM	9	20	108	
3 - 4 PM	9	26	108	
4 - 5 PM	12	35	130	
5 - 6 PM	13	32	174	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			**1,500**	**0**

Westbound Volume by Hour				
Time	Left Turns	Through	Right Turns	Peds/Bikes
12 - 1 AM				
1 - 2 AM				
2 - 3 AM				
3 - 4 AM				
4 - 5 AM				
5 - 6 AM				
6 - 7 AM				
7 - 8 AM	76	15	0	
8 - 9 AM	42	15	0	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	16	16	0	
12 - 1 PM	10	25	2	
1 - 2 PM				
2 - 3 PM	43	32	1	
3 - 4 PM	46	46	0	
4 - 5 PM	31	38	0	
5 - 6 PM	25	41	0	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			**520**	**0**

Traffic Signal Warrant Analysis

Multi-Way Stop Warrants

Project Name	Couch Mill Road Subdivision
Project/File #	#2117
Scenario	2028 Projected Volumes

Intersection Information			
Major Street (N/S Road)	Steele Road/Swafford Road	Minor Street (E/W Road)	Sam Lee Road
Analyzed with	1 approach lane	Analyzed with	1 Approach Lane
Total Approach Volume	2104 vehicles	Total Approach Volume	2020 vehicles
Total Ped/Bike Volume	0 crossings	Total Ped/Bike Volume	0 crossings
Right turn reduction of	0 percent applied	Right turn reduction of	0 percent applied

No high speed or isolated community reduction applied to the Multi-Way Stop Warrant thresholds.

Condition A - Traffic Signal Warrant	
Condition Satisfied?	**Not Satisfied**
Criteria*	Traffic Signal Warranted & Justified

* Multi-way stop control may be used as an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.

Condition B - Crash Experience	
Condition Satisfied?	**Not satisfied**
Required values reached for	less than 4 correctable crashes
Criteria - Crash Experience	5 or more correctable crashes in 12-month period

Condition C - Intersection Volume & Delay	
Condition Satisfied?	**Not Satisfied**
Required values reached for	3 hours & 131.4 sec. average delay/veh
Criteria - Major Street (veh/hr)	300 for any 8 hours of an average day
Criteria - Minor Street (total vol-veh, ped, & bikes/hr)	200 for the same 8 hours of an average day
Criteria - Delay (average sec/veh)	30 during the highest hour

Condition D - Combination Volume, Crash Experience, & Delay	
Condition Satisfied?	**Not Satisfied**
Required values reached for	4 hours, less than 4 crashes, & 131.4 sec. average delay/veh
Criteria - Major Street (veh/hr)	240 for any 8 hours of an average day
Criteria - Minor Street (total vol-veh, ped, & bikes/hr)	160 for the same 8 hours of an average day
Criteria - Crash Experience	4 or more correctable crashes in 12-month period
Criteria - Delay (average sec/veh)	24 during the highest hour

PROJECTED FUTURE VOLUMES IN YEAR 2028 WITH TRAFFIC GROWTH AND GENERATED TRAFFIC

Sam Lee Road at Steele Road and Swafford Road

	Swafford Road			Sam Lee Road			Steele Road			Sam Lee Road			
TIME	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND			
BEGIN	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT	
7:00 AM	0	12	0	9	2	0	1	3	6	0	1	23	Existing Volumes
7:15 AM	0	10	0	26	1	0	5	6	6	0	2	26	Existing Volumes
7:30 AM	0	23	0	17	0	0	4	12	28	0	1	26	Existing Volumes
7:45 AM	0	6	0	15	2	0	9	14	26	0	2	20	Existing Volumes
Sum	0	51	0	67	5	0	19	35	66	0	6	95	Sum
	0	51	0	67	5	0	19	35	66	0	6	95	
General Growth	0	7.14	0	9.38	0.7	0	2.66	4.9	9.24	0	0.84	13.3	Growth Rate of 2.0% for 7 years
Trips Generated 7-8 am	0	0	7	0	10	0	46	0	0	19	28	130	Trips Generated
2028	0	58	7	76	15	0	67	40	75	19	35	238	Total Sum
8:00 AM	0	8	0	19	1	0	11	7	22	0	1	26	
8:15 AM	0	3	2	13	4	0	10	8	13	0	2	18	
8:30 AM	0	5	0	1	0	0	7	4	9	2	0	11	
8:45 AM	0	2	1	4	0	0	6	5	13	1	0	12	
Sum	0	18	3	37	5	0	34	24	57	3	3	67	
+20% Increase	0	18	3	37	5	0	34	24	57	3	3	67	
General Growth	0	2.52	0.42	5.18	0.7	0	4.76	3.36	7.98	0.42	0.42	9.38	
Trips Generated 8-9 am	0	0	6	0	9	0	42	0	0	17	26	119	
2028	0	21	9	42	15	0	81	27	65	20	29	195	
11:00 AM	0	0	1	1	0	0	9	2	2	0	1	9	
11:15 AM	0	2	0	5	1	0	10	5	2	3	0	9	
11:30 AM	0	3	2	2	0	0	8	1	5	0	0	10	
11:45 AM	0	3	0	6	0	0	7	6	3	0	1	8	
Sum	0	8	3	14	1	0	34	14	12	3	2	36	
	0	8	3	14	1	0	34	14	12	3	2	36	
General Growth	0	1.12	0.42	1.96	0.14	0	4.76	1.96	1.68	0.42	0.28	5.04	
Trips Generated 11am-12 pm	0	0	10	0	14	0	67	0	0	10	14	67	
2028	0	9	13	16	16	0	106	16	14	13	17	108	
12:00 PM	0	3	1	4	3	0	11	4	5	1	2	14	
12:15 PM	0	1	0	2	2	1	11	5	5	0	0	7	
12:30 PM	0	3	1	0	1	1	12	3	2	0	2	4	
12:45 PM	0	3	2	3	2	0	9	8	4	0	1	11	
Sum	0	10	4	9	8	2	43	20	16	1	5	36	
	0	10	4	9	8	2	43	20	16	1	5	36	
General Growth	0	1.4	0.56	1.26	1.12	0.28	6.02	2.8	2.24	0.14	0.7	5.04	
Trips Generated 12-1 pm	0	0	11	0	16	0	74	0	0	11	16	74	
2028	0	11	15	10	25	2	124	23	18	12	22	116	
2:00 PM	0	2	0	4	0	1	10	2	6	1	1	13	
2:15 PM	0	6	0	15	4	0	10	3	3	0	1	15	
2:30 PM	1	3	1	9	2	0	11	7	9	0	3	11	
2:45 PM	0	6	0	10	4	0	7	6	9	0	2	5	
Sum	1	17	1	38	10	1	38	18	27	1	7	44	
	1	17	1	38	10	1	38	18	27	1	7	44	
General Growth	0.14	2.38	0.14	5.32	1.4	0.14	5.32	2.52	3.78	0.14	0.98	6.16	
Trips Generated 2-3 pm	0	0	14	0	21	0	98	0	0	8	12	58	
2028	1	19	15	43	32	1	141	21	31	9	20	108	
3:00 PM	1	6	0	4	2	0	19	2	12	0	3	10	
3:15 PM	0	3	1	13	5	0	9	1	3	0	1	10	
3:30 PM	1	7	2	17	5	0	16	8	39	0	2	9	
3:45 PM	0	4	0	6	7	0	23	18	50	0	4	8	
Sum	2	20	3	40	19	0	67	29	104	0	10	37	
	2	20	3	40	19	0	67	29	104	0	10	37	
General Growth	0.28	2.8	0.42	5.6	2.66	0	9.38	4.06	14.56	0	1.4	5.18	
Trips Generated 3-4 pm	0	0	16	0	24	0	113	0	0	9	14	66	
2028	2	23	20	46	46	0	189	33	119	9	26	108	
4:00 PM	0	3	3	6	2	0	19	7	17	0	6	12	
4:15 PM	0	9	1	5	2	0	19	10	13	0	7	11	
4:30 PM	0	2	2	8	2	0	12	10	12	0	2	12	
4:45 PM	0	4	2	8	3	0	14	2	4	1	1	12	
Sum	0	18	8	27	9	0	64	29	46	1	16	47	
	0	18	8	27	9	0	64	29	46	1	16	47	
General Growth	0	2.52	1.12	3.78	1.26	0	8.96	4.06	6.44	0.14	2.24	6.58	
Trips Generated 4-5 pm	0	0	19	0	28	0	130	0	0	11	16	77	
2028	0	21	28	31	38	0	203	33	52	12	35	130	
5:00 PM	0	4	2	9	2	0	21	6	4	0	4	24	
5:15 PM	0	5	0	7	1	0	23	9	10	0	2	18	
5:30 PM	0	2	0	1	1	0	19	3	10	1	5	16	
5:45 PM	0	5	3	5	4	0	28	4	5	0	1	19	
Sum	0	16	5	22	8	0	91	22	29	1	12	77	
	0	16	5	22	8	0	91	22	29	1	12	77	
General Growth	0	2.24	0.7	3.08	1.12	0	12.74	3.08	4.06	0.14	1.68	10.78	
Trips Generated 5-6 pm	0	0	21	0	32	0	147	0	0	12	19	86	
2028	0	18	27	25	41	0	251	25	33	13	32	174	

Assumed Average Growth Rate (%)= 2.0% 0% Increase due to Covid

Number of years = 7

Horizon Year = 2028 # of Horizon Years = 7

Note 1: The entering and exiting traffic volumes are estimated based on trip generation of the entire development, based on assumed amounts of entering and exiting traffic, assumed percentages of directional traffic, and the assumed percentage of trips based on time of day (from TDOT Table 4.2 in Traffic Design Manual)

Note 2: It is assumed that the construction of homes is linear growth

Trips Generated by Entire Development: 3,484

95% of trips

Daily Trips Generated from Subdivision/Year 498 = 3,484 / 7

3484 trips by 2028

Traffic Movement Assumed Distribution:	AM	PM
	10% to/from Swafford Road, 15% to/from Sam Lee Road, and 70% to/from Steele Road	10% to/from Swafford Road, 15% to/from Sam Lee Road, and 70% to/from Steele Road

Assume all Single-Family Houses

Entering and Exiting %'s (from ITE):		Directional Distribution Assumptions:
26% Enter	AM Hours	10% to/from Swafford
74% Exit		15% to/from Sam Lee
		70% to/from Steele
50% Enter	Mid-Day Hours	10% to/from Swafford
50% Exit		15% to/from Sam Lee
		70% to/from Steele
63% Enter	PM Hours	10% to/from Swafford
37% Exit		15% to/from Sam Lee
		70% to/from Steele

TDOT Traffic Engineering Office - Table 4.2 - TDOT Traffic Design Manual

Population Tier = A (Knoxville)

TDOT Region 1 Average for Arterial Facilities (Two Lane)

Time of Day	Percentage of Trips
7-8 am	7.20%
8-9 am	6.60%
11 am-Noon	5.52%
Noon-1 pm	6.11%
2-3 pm	6.39%
3-4 pm	7.34%
4-5 pm	8.48%
5-6 pm	9.57%
	57.21%

APPENDIX L

SIMTRAFFIC VEHICLE QUEUE LENGTHS

Intersection: 3: Steele Road/Swafford Road & Sam Lee Road

Movement	EB	WB	NB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	116	75	42
Average Queue (ft)	59	36	5
95th Queue (ft)	95	61	24
Link Distance (ft)	583	412	682
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Steele Road/Swafford Road & Sam Lee Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	112	72	77	6
Average Queue (ft)	50	36	17	0
95th Queue (ft)	86	60	54	3
Link Distance (ft)	583	412	682	258
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

APPENDIX M

RESPONSE LETTER TO ADDRESS REVIEW COMMENTS

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

February 1, 2022

PROJECT NAME: Couch Mill Road Subdivision TIS

TO: Knoxville-Knox County Planning

SUBJECT: TIS Comment Response Document for Couch Mill Road Subdivision Review Comments dated December 13, 2021

Dear Knoxville-Knox County Planning Staff:

The following comment response document is submitted to address comments from a letter from Mike Conger, PE, dated December 13, 2021. This letter is added to the end of the revised report in Appendix M.

1. **Page 4 and 6 reference a pump station facility that should be referenced as being owned by West Knox Utility instead of First Utility District.**

   Response: Page 4 and 6 have been revised to reflect that West Knox Utility owns the pump station facility.

2. **Page 14 – The figure is labeled as Figure 3 but should be Figure 2.**

   Response: On Page 14, the figure has been labeled as Figure 2.

3. **Page 22 – The figure is labeled as Figure 2 but should be Figure 3.**

   Response: On Page 22, the figure has been labeled as Figure 3.

4. **Please label Steele Road in Figures 5, 6, 7 and 8 for reference purposes.**

   Response: Figures 5, 6, 7, and 8 have been updated to include the Steele Road label.

5. **Page 36 – In the discussion of site trip distribution please include an explanation of apportioning trips to each of the two site driveways.**

   Response: Page 36 has been updated to include the following statement: "The distribution of traffic shown in Figure 6 at the proposed Couch Mill Road Subdivision entrances is based on the proposed internal layout. It was assumed that 65% of the (253 out of the 390) houses would have quicker and shorter outside access via the Proposed West Entrance. This percentage corresponds to all the house lots along and to the south and west of Road "F". Thus, the entering and exiting traffic at the proposed entrances to and from the east is portioned to 40% at the Proposed East Entrance and 55% at the Proposed West Entrance."

6. **Page 45 – In your discussion about stopping sight distance (SSD) and intersection sight distance (ISD), you have cited SSD as the "minimum" and ISD as "desirable". Knox County's subdivision regulation is very clear in stating that ISD and not SSD is the minimum standard for these applications, so the verbiage should reflect this.**

   Response: On Page 45, the phrasing has been changed to state that Knox County's minimum standard for sight distance is ISD.

7. **Page 48 – Include turn lane warrant analyses for the existing intersection of Steele Road at Same Lee Road/Swafford Road.**

   Response: A turn lane warrant analysis was included in the report for the intersection with the existing traffic volumes and the projected traffic volumes without road modifications. The results are discussed on Page 48 and included in Appendix I.

8. **Please document the location and distance to the nearest sidewalk to the site along Steele Road.**

   Response: On Page 20, additional information has been included that documents the nearest sidewalk on Steele Road.

9. **This is not a comment specific to the actual TIS, but please note that additional revisions may required per the final decision regarding the zoning and allowable density on this property since it was only approved for 2 dwellings per acre at the December 9th Planning Commission hearing instead of the 3 dwellings per acre indicated on the current site plan. Additionally, our staff would like to have further discussions with the development team regarding the context of this parcel with potential longer-term development patterns of adjoining properties in the context of the layout of the overall road network and future connectivity of the system.**

   Response: This information has been noted and understood.

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

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

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

Sincerely,

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

AJAX ENGINEERING
CIVIL ENGINEERING / TRAFFIC ENGINEERING

11812 Black Road
Knoxville, Tennessee 37932
Phone (865) 556-0042
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February 18, 2022

PROJECT NAME: Couch Mill Road Subdivision TIS

TO: Knoxville-Knox County Planning

SUBJECT: Addendum for Couch Mill Road Subdivision TIS (1-SA-22-C)

Dear Knoxville-Knox County Planning Staff:

The following is an addendum to the revised Couch Mill Road Subdivision TIS (stamped and dated 2.1.22). This letter reflects the proposed site layout changes to the subdivision since the revised TIS was submitted. This addendum is added to the end of the revised TIS report in Appendix M.

The revised TIS report from 2.1.22 examined the site development with 278 single-family detached houses and 115 multi-family attached townhouses and resulted in the following trip generation volumes:

TRIP GENERATION FOR THE COUCH MILL ROAD SUBDIVISION
278 Single-Family Detached Homes and 115 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	278	2,585	26%	74%		63%	37%	
				49	140	189	164	96	260
Local Trip Rate	Multi-Family Attached Townhouses	115	1,082	22%	78%		55%	45%	
				13	48	61	48	39	87
Total New Volume Site Trips			**3,667**	**62**	**188**	**250**	**212**	**135**	**347**

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

Since the revised TIS was submitted, the site plan layout for the subdivision was modified as shown in plans stamped on February 9th, 2022, by Batson, Himes, Norvell, & Poe. This site revision included eliminating the proposed townhouse lots and increasing single-family detached houses to 359 units. This site revision results in the following updated trip generation volumes:

UPDATED TRIP GENERATION FOR THE COUCH MILL ROAD SUBDIVISION
359 Single-Family Detached Homes

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	359	3,270	26%	74%		63%	37%	
				62	176	238	208	122	330
Total New Volume Site Trips			**3,270**	**62**	**176**	**238**	**208**	**122**	**330**

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

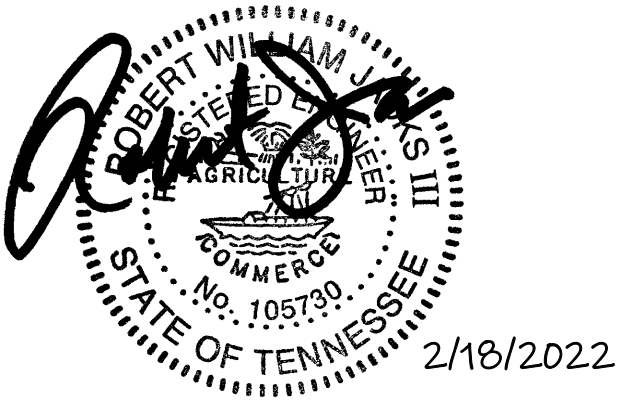
Comparing the results shown in the two tables reflect an overall reduction in expected trips generated by the development based on the revised plans. Overall, the daily generated traffic is decreased by 397 trips, the AM Peak Hour is decreased by 12 trips, and the PM Peak Hour is decreased by 17 trips.

The updated projected trips generated by the development will slightly reduce the transportation impacts (intersection vehicle delays, etc.) than initially shown in the revised TIS. However, overall, these trip reductions are minor and do not change the recommendations listed in the revised TIS. Furthermore, the revised site plan does not change the proposed internal road system or entrance locations and does not change the recommendations listed in the revised TIS regarding these aspects.

If you have any questions or further comments, please feel free to contact me at any time.

Sincerely,

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



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