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Transportation Impact Study
Hoppe Property Subdivision
Knox County, Tennessee

Revised August 2021

Prepared for:
Homestead Land Holdings, LLC
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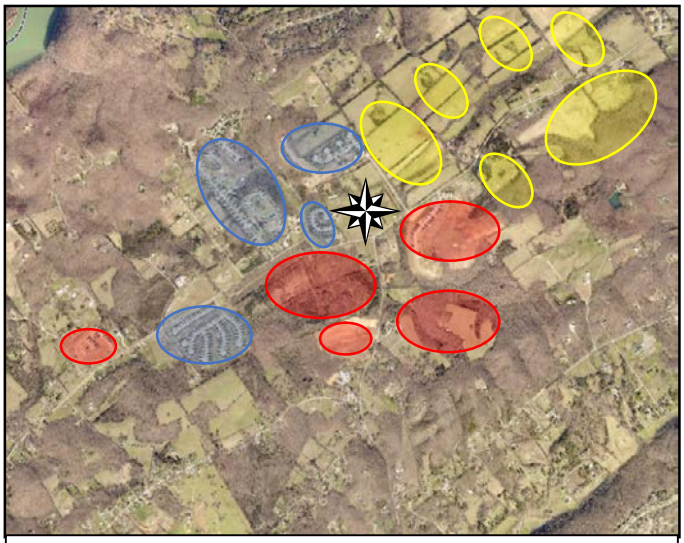
EXECUTIVE SUMMARY

Preface:

Homestead Land Holdings, LLC is proposing a residential development on the north side of Hardin Valley Road in West Knox County, TN. This proposed development is referred to in this report as "Hoppe Property Subdivision," and it will consist of 47 single-family detached houses and 33 multi-family attached townhouses on 36.77± acres. This development is anticipated to be fully built out and occupied by 2025 and proposes three road entrances. 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 required by Knox County, TN. Recommendations and mitigation measures will be offered if transportation operations were projected to be below recognized engineering standards and guidelines.

Overview:



Surrounding Subdivisions in Hardin Valley Area:

Red = Under Construction or Nearing Construction
Blue = Nearly or Fully Constructed
Yellow = Vacant, Large Properties for Future Residential Development

This development will be located near a current epicenter of surging residential development in the Hardin Valley area of West Knox County. It will be surrounded by relatively new subdivisions that have reached capacity, subdivisions currently under construction with some houses already occupied, and other subdivisions in different states of construction with some yet to break ground. Most, if not all, of these surrounding subdivisions, have been developed over the last ten years. Also, several nearby undeveloped large tracts will experience pressure for development. Transportation Impact Studies (TIA) have been completed for some adjacent subdivisions. Yet, none have combined all the projected trips generated by the currently known imminent subdivisions and determined the potential impact to the road system adjacent to this proposed development. In particular, the impact on the Hardin Valley

Road at Marietta Church Road intersection has not been comprehensively examined in the projected conditions with the cumulation of all the generated trips from the large adjacent subdivisions currently under construction or near to breaking ground.

Additionally, a few prior studies (previous Traffic Impact Letter for the Hoppe Property Subdivision and TIA for Briggs Station Subdivision) have indicated that the adjacent section of Hardin Valley Road will need to be modified soon to increase road capacity to meet demand. These prior studies demonstrated that Hardin Valley Road, in the study area, will be near capacity within the next few years and needs to be reconstructed with additional lanes to accommodate the area's rapid growth. It is foreseeable that even more large farms and undeveloped properties in this area of Hardin Valley will be transitioned into residential developments. This is due to the ever-increasing forecasted need for houses in the Knoxville area and, in particular, West Knox County.

Due to these pressures and predictions, Knox County will need to determine a course of action for the Hardin Valley Road corridor. A comprehensive decision needs to be made on what the overall Hardin Valley Road corridor should resemble. This will include decisions on road width, including the potential number of lanes, preferred type of traffic control at major intersections (i.e., traffic signals, roundabouts, etc.), and whether other road details such as sidewalks, bike lanes, or greenways should be provided along the roadway. Concerning the preferred type of intersection traffic control in the corridor, the existing t-intersection at Hardin Valley Road/East Gallaher Ferry Road/Hickory Creek Road just to the west of the proposed development is planned to be transformed into a roundabout as part of an adjacent sizeable residential subdivision currently under construction. If more passive forms of traffic control, such as roundabouts, are the preferred intersection traffic control on this section of Hardin Valley Road, consideration should be given to the very long-term future conditions once even more developments are completed. While single-lane roundabouts may be appropriate in the near future, known long-term growth and larger traffic volumes will necessitate multiple lanes on this section of Hardin Valley Road, requiring upgrading a single-lane roundabout or implementing a more traditional form of traffic control, such as a traffic signal.

This study was completed with a very conservative approach. The available traffic data in the study area was projected into the future conditions using an aggressive growth rate of 10% and also increased by the calculated trips generated by the adjacent and imminent residential subdivisions. This conservative approach of including both an aggressive growth rate and the

calculated trips generated by the other developments may overestimate and double-count vehicles. Furthermore, the turning movements at two of the surrounding intersections included in the study were estimated by trip generation calculations for adjacent subdivisions. This may again result in the overestimation of projected volumes in the future, but no other techniques have been identified as more appropriate.

Overall, the trips generated by the Hoppe Property Subdivision will input minimal volumes into the traffic stream along Hardin Valley Road. Most of the calculations and future adverse conditions concluded in this study result from large thru volumes projected to occur on Hardin Valley Road. The turning movements generated at the studied intersections associated with the proposed Hoppe Property Subdivision are comparatively small but will face conflicts with the large thru volumes on Hardin Valley Road. Ultimately, Knox County will need to provide the resources to prepare Hardin Valley Road to manage the imminent residential subdivisions and its related future traffic growth in the area.

Study Results:

The findings of this study include the following:

- The Hoppe Property Subdivision with 47 single-family detached houses and 33 multi-family attached townhouses is calculated to generate 871 trips on an average weekday at full build-out and occupancy. Of these trips, 57 will occur during the AM peak hour and 81 in the PM peak hour.
- The projected 2025 traffic conditions will require modifications to the adjacent road system. As shown in the report, the developer has proposed to construct three entrances for the subdivision. The Main Entrance is proposed at the intersection of Hardin Valley Road at Marietta Church Road and one to the west via an existing adjacent subdivision stub-out at Deer Crossing Drive. A third entrance will provide access to the townhouses on Mission Hill Lane. The calculations estimate that the vehicle delays on Mission Hill Lane and Marietta Church Road will experience substantial vehicle delays in 2025, even without the Hoppe Property Subdivision being developed.

Recommendations:

The following recommendations are offered based on the study analyses. The recommendations are offered to minimize the transportation impacts of the proposed development on the adjacent road system while attempting to achieve an acceptable traffic flow and safety level. The recommendations marked with an asterisk indicate an existing or projected transportation need but are not associated with the proposed development's projected impacts.

Major Recommendations Summary:

The major recommendations in this study are the following:

* o By 2025, add a 50-foot westbound right-turn lane with a 100-foot taper on Hardin Valley Road at Mission Hill Lane
* o By 2025, reconstruct the intersection of Hardin Valley Road at Marietta Church Road with
    a) a single-lane roundabout OR
    b) a traffic signal with exclusive left-turn lanes at all approaches except for the southbound approach (Main Entrance of Hoppe Property Subdivision)

Recommendations Detail Summary:

Hardin Valley Road at Marietta Church Road

- * It is recommended that the intersection of Hardin Valley Road at Marietta Church Road be modified to address the large projected future traffic volumes. It is estimated that a single-lane roundabout would be adequate up to the year 2025. Projected vehicle growth indicates the need for a multi-lane solution on this section of Hardin Valley Road. A single-lane roundabout could be modified to accommodate additional lanes on Hardin Valley Road; however, a traffic signal may be more appropriate as it would be more adaptable to expand to multiple lanes on the corridor.
- The Main Entrance for the Hoppe Property Subdivision is proposed to be the 4th and northern leg of the intersection of Hardin Valley Road at Marietta Church Road. This entrance will need to be incorporated into the future plans the County will have for the intersection: either as a roundabout or with a traffic signal with multiple left-turn lanes. With the Main Entrance for the Hoppe Property Subdivision comprising the northern leg, the projected traffic conditions indicate that a single-lane roundabout would be sufficient until 2025.

Hardin Valley Road at Marietta Church Road

If the intersection is modified with a traffic signal, it is recommended that separate left-turn lanes be constructed on all the approaches except for the southbound approach (the Main Entrance for the Hoppe Property Subdivision).

- It is recommended that the proposed entrance shown in the site plan via Deer Crossing Drive in the adjacent existing subdivision to the west remain as shown. This entrance will provide a secondary emergency entrance. With a Main Entrance at Hardin Valley Road and Marietta Church Road, it is not expected to experience much traffic flow, if at all.
- The Main Entrance for the Hoppe Property Subdivision should not be impacted by new signage or landscaping and should provide the required sight distance.

Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

- * It is recommended that the vegetation on the southbound approach of Muddy Creek Lane at Hardin Valley Road be trimmed and/or removed. This vegetation currently obscures the Stop Sign (R1-1).
- A westbound right-turn lane will be warranted on Hardin Valley Road at the intersection with Mission Hill Lane in the year 2025, whether the Hoppe Property Subdivision is developed or not. It is not recommended that an eastbound left-turn lane specifically be built at this intersection as part of this development. Rather, this need would be fulfilled when Hardin Valley Road is eventually modified to a multi-lane facility. The few projected left-turn volumes would not justify constructing an exclusive left-turn lane.

Hardin Valley Road at Mission Hill Lane

- The southern approach of Mission Hill Lane at Hardin Valley Road will experience LOS F in the projected 2025 conditions with or without the Hoppe Property Subdivision. Separate southbound left and right-turn lanes would not appreciably reduce vehicle delays since most turns are projected to be left-turns towards the east with minimal right-turning volumes to the west. However, even with the projected high vehicle delays for the southbound approach, the vehicle queues are calculated to only be several vehicle lengths at their maximum. When Hardin Valley Road is expanded as projected, it will likely include a center turn lane in the future, which would allow southbound vehicle delays to be significantly reduced. A center turn lane on Hardin Valley Road would allow exiting motorists to complete the left-turn in two stages and not rely on finding a traffic gap in both directions simultaneously and subsequently reduce vehicle delays.
- It is recommended that 25-mph Speed Limit Signs (R2-1) be posted near the beginning of the Main Entrance for the single-family houses and at the

townhouse entrance. A speed limit sign is not needed at the other entrance to Deer Crossing Drive due to the proximity of the existing speed limit signage on Muddy Creek Lane off Hardin Valley Road.

- Stop Signs (R1-1) and 24" white stop bars should be installed on the new internal streets, as shown in the report.
- Sight distance at the new internal intersections in the development must not be impacted by new signage or future landscaping. With a proposed internal speed limit of 25-mph, the intersection sight distance requirement is 280 feet. The stopping sight distance required is 155 feet for a level road grade. The site designer should ensure that these internal sight distance lengths are met internally.
- All drainage grates and covers for the residential development need to be pedestrian and bicycle-safe.
- The United States Postal Service (USPS) has implemented changes to its 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.
- Lots in the subdivision should not directly access Hardin Valley Road.
- Knox County has recently completed a greenway study and showed Conner Creek as a preferred route for a new greenway that would connect Hardin Valley to Powell. The developer should discuss with Knox County if this potential greenway path is desirable or feasible to implement on the development property.
- All road grade and intersection elements internally and externally should be designed to AASHTO, TDOT, and the Knox County, TN specifications and guidelines to ensure proper operation.

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DESCRIPTION OF EXISTING CONDITIONS

- **STUDY AREA:**

The proposed location of this new development is shown on a map in Figure 1a. Figure 1b shows the existing development property with more detail from KGIS mapping. It also shows the location of an adjacent unrelated proposed residential development, the S&E Property Subdivision. The proposed Hoppe Property Subdivision will be located on the north side of Hardin Valley Road between Muddy Creek Lane and Mission Hill Lane in West Knox County, TN. The development has proposed three entrances, one via Deer Crossing Drive (off Muddy Creek Lane), one at the intersection of Hardin Valley Road at Marietta Church Road, and one on Mission Hill Lane. 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:

- Hardin Valley Road at Muddy Creek Lane (and Seal Property Entrance)
- Hardin Valley Road at Marietta Church Road (and Main Entrance)
- Hardin Valley Road at Mission Hill Lane
- Muddy Creek Lane at Deer Crossing Drive
- Mission Hill Lane at the Proposed Entrance for the Townhouses

View of Proposed Development Site
(Looking Northwest from Hardin Valley Road)

The proposed development property is in an area that is rapidly changing from rural to suburbanized in West Knox County, TN. There are many single-family residences, established subdivisions, unused/farm/woodland properties, and several subdivisions currently under construction near this development. The proposed development site is currently undeveloped, with most of the land used for farm production with a few single-family structures.

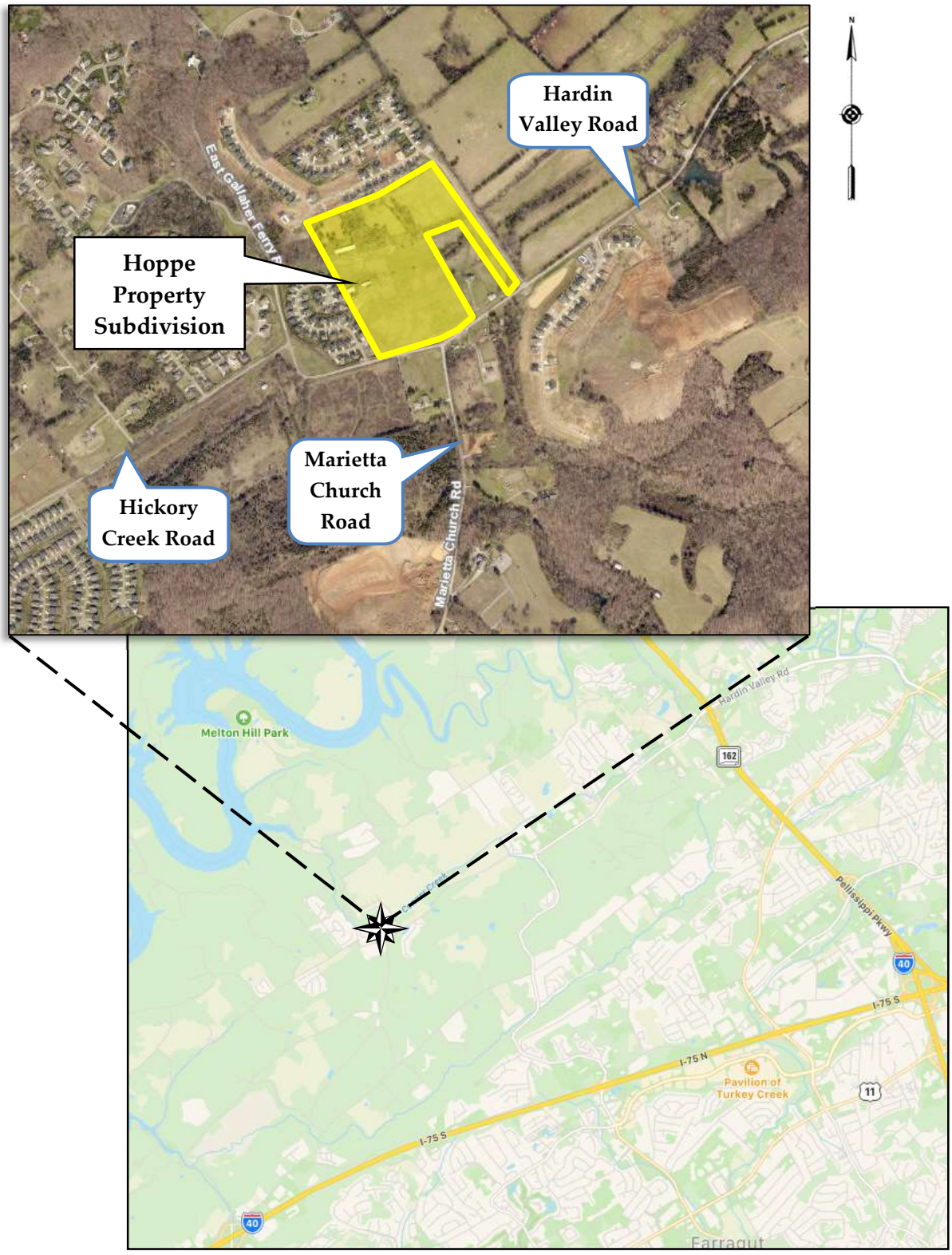


Figure 1a
Location Map

Figure 1b
Site Development Property

- **EXISTING ROADWAYS:**

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

TABLE 1
STUDY CORRIDOR CHARACTERISTICS

NAME	CLASSIFICATION [1]	SPEED LIMIT	LANES	ROAD WIDTH [2]	TRANSIT [3]	PEDESTRIAN FACILITIES	BICYCLE FACILITIES
Hardin Valley Road	Minor Arterial	40 mph	2 undivided	22 feet	None	No sidewalks along roadway	No bike lanes
Muddy Creek Lane	Local Street	25 mph	2 undivided	26 feet	None	No sidewalks along roadway	No bike lanes
Mission Hill Lane	Local Street	25 mph	2 undivided & boulevard	26 feet - 46 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

Hardin Valley Road is classified as a Minor Arterial and traverses in a generally northeast-southwest direction. Hardin Valley Road begins at a signalized intersection with Ball Camp Byington Road (SR 131) on its northeast side. On its southwest side, the road terminates at the t-intersection of Hickory Creek Road at East Gallaher Ferry Road with a total length of 6.0 miles. Hardin Valley Road provides access to several public schools, a community college, and Pellissippi Parkway (SR 162) to the east. The Pellissippi Parkway (SR 162) access is 4.1 miles to the northeast of the proposed subdivision.

Hardin Valley Road at Marietta Church Road (Looking West)

Hardin Valley Road currently consists of a 2-lane pavement section with white edge lines and a double yellow centerline near the development property. The double yellow centerline is

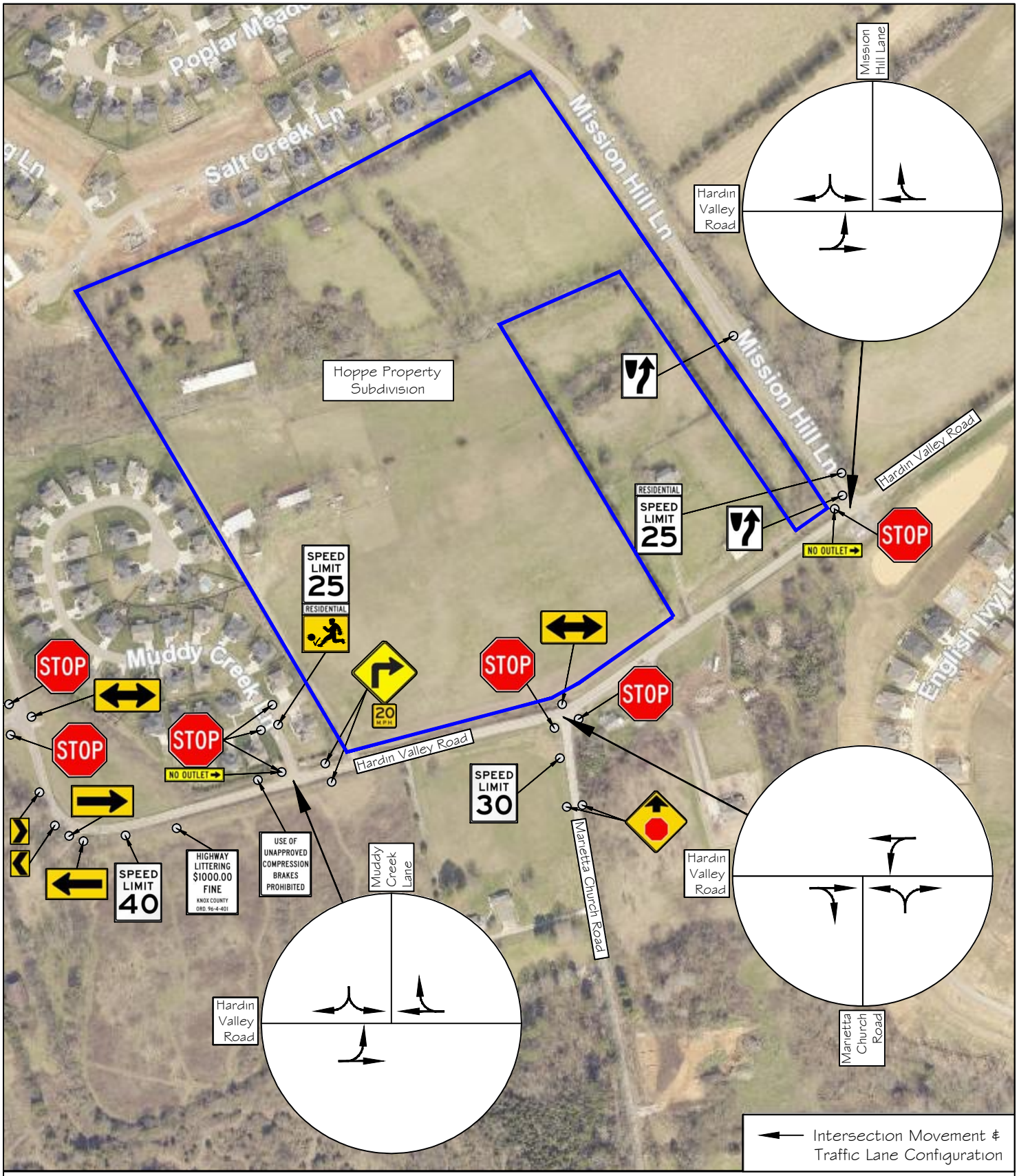
delineated with grooved pavement rumble strips. The road pavement was measured to fluctuate between 21 feet in width to just over 22 feet.

Muddy Creek Lane is a 1,440-foot long, 2-lane local street that traverses in a circuitous route that ends at a cul-de-sac within Hunters Way Subdivision. Muddy Creek Lane begins at Hardin Valley Road and serves as the only road access for 40 single-family detached homes in Hunters Way Subdivision. Muddy Creek Lane has a posted speed limit of 25-mph. Muddy Creek Lane has a single exiting lane at Hardin Valley Road and is controlled by a Stop Sign (R1-1). Deer Crossing Drive intersects Muddy Creek Lane 150 feet to the north of Hardin Valley Road at a 4-way intersection with the Deer Crossing Drive approaches controlled by Stop Signs (R1-1).

Mission Hill Lane is 2,050 feet in length and is a 2-lane local street that serves as the only road access for the adjacent Massey Creek Subdivision with 95 single-family detached homes. Mission Hill Lane begins at Hardin Valley Road with a boulevard road section for 500 feet before transitioning to an undivided 2-lane road, continues into the subdivision, and terminates at a cul-de-sac. The 500-foot boulevard road section has 18-foot lanes with an 8-foot raised center median. Mission Hill Lane has a posted speed limit of 25-mph. Mission Hill Lane has a single exiting lane at Hardin Valley Road and is controlled by a Stop Sign (R1-1).

Mission Hill Lane (Looking South)

Figure 2 shows the lane configurations of the existing roadways and intersections examined in the study and traffic signage in the near vicinity. The traffic signage shown only includes warning and regulatory signage. The pages following Figure 2 give an overview of the site study area with photographs.



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NOT TO SCALE

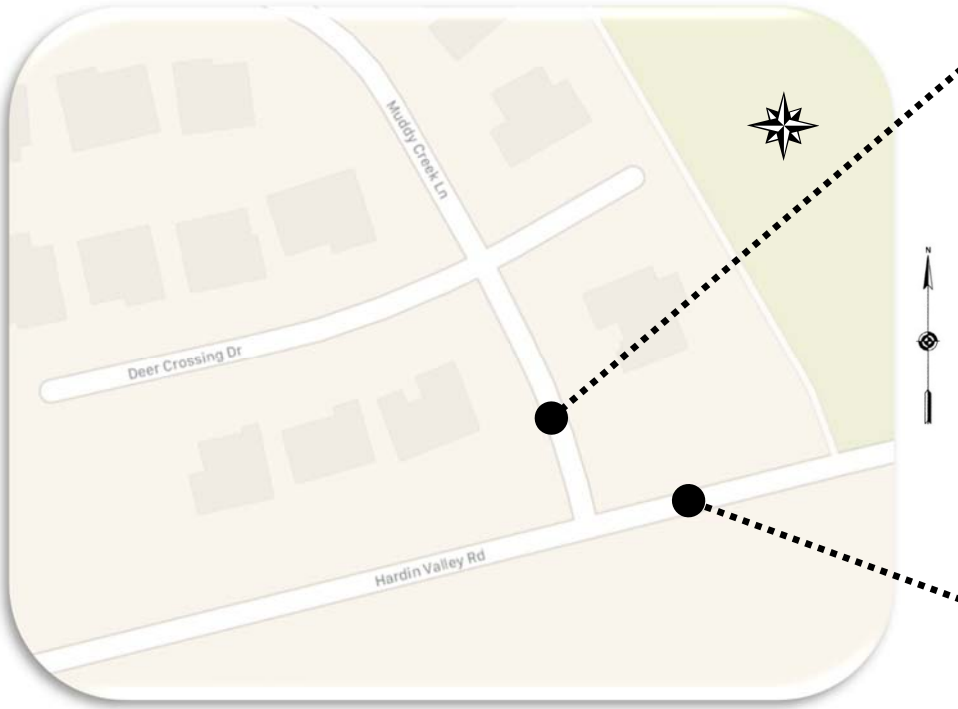
NORTH

FIGURE 2

Hoppe Property Subdivision

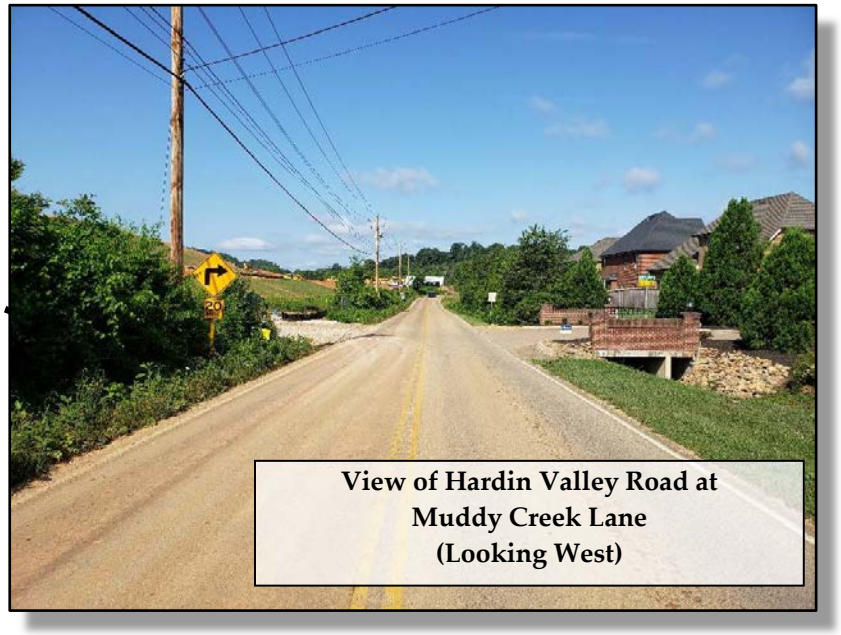
Traffic Signage & Existing Lane Configurations

PHOTO EXHIBITS

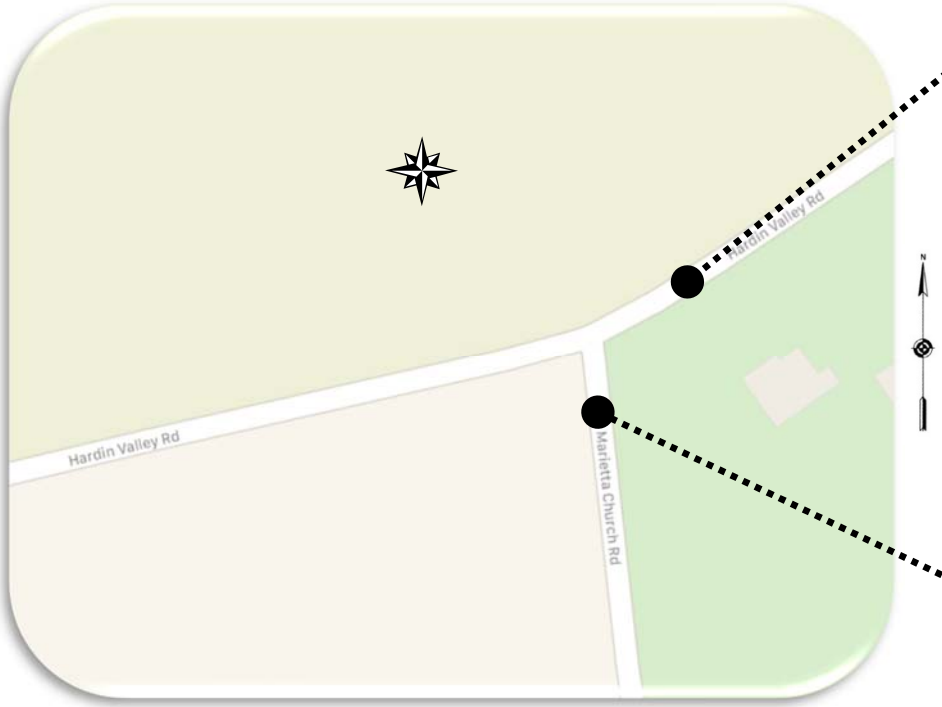


Hardin Valley Road at Muddy Creek Lane

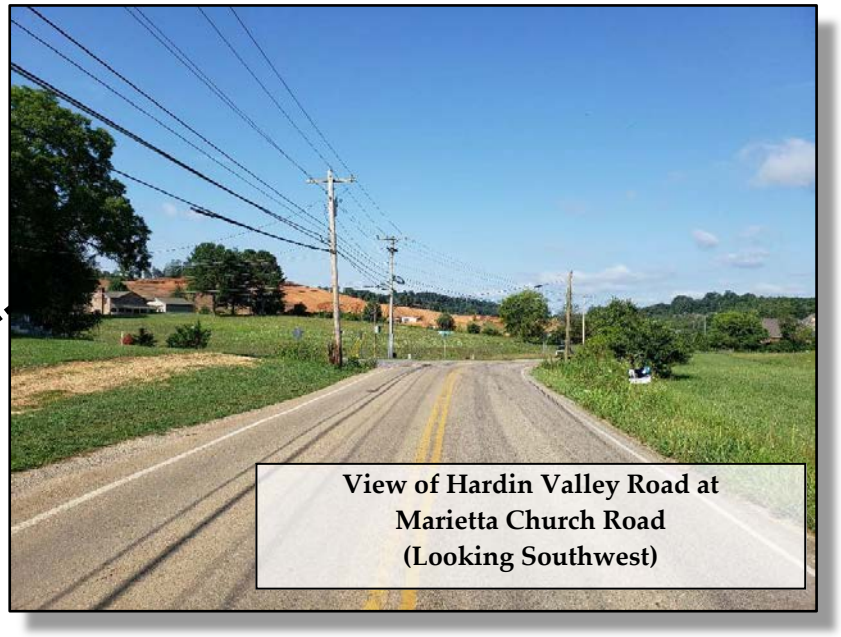
View of Muddy Creek Lane at Hardin Valley Road (Looking South)



View of Hardin Valley Road at Muddy Creek Lane (Looking West)

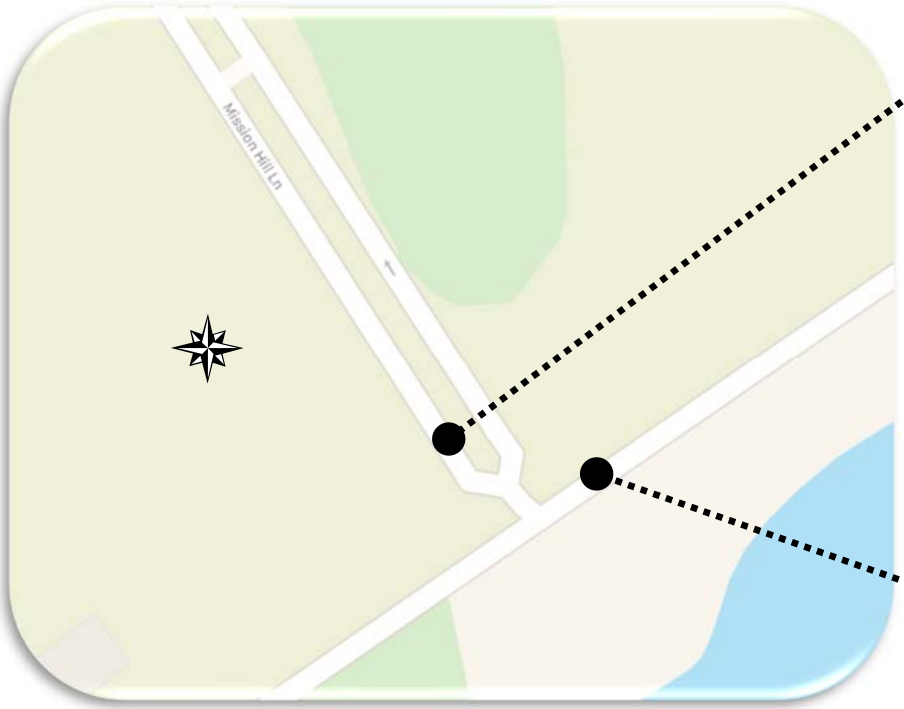


Hardin Valley Road at Marietta Church Road



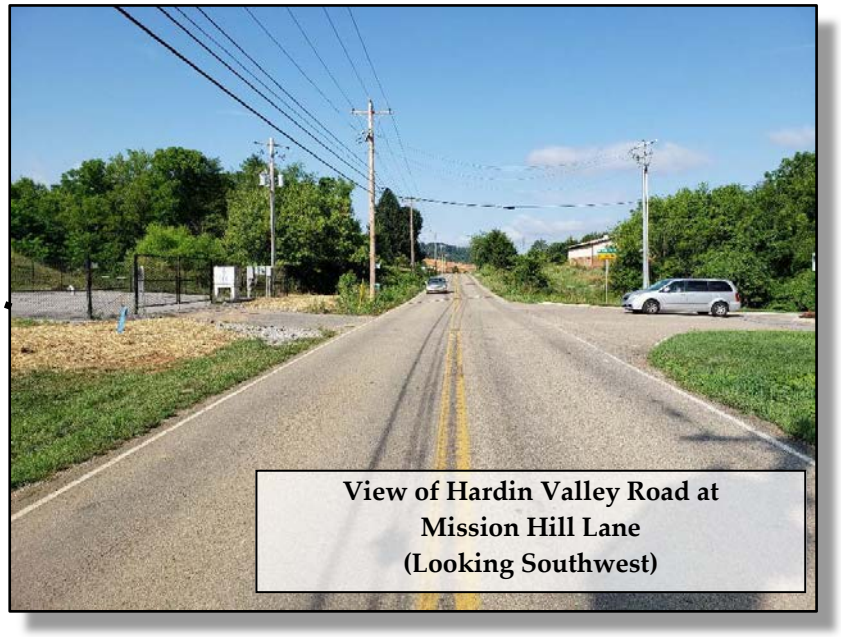
View of Hardin Valley Road at Marietta Church Road (Looking Southwest)

View of Marietta Church Road at Hardin Valley Road (Looking North)

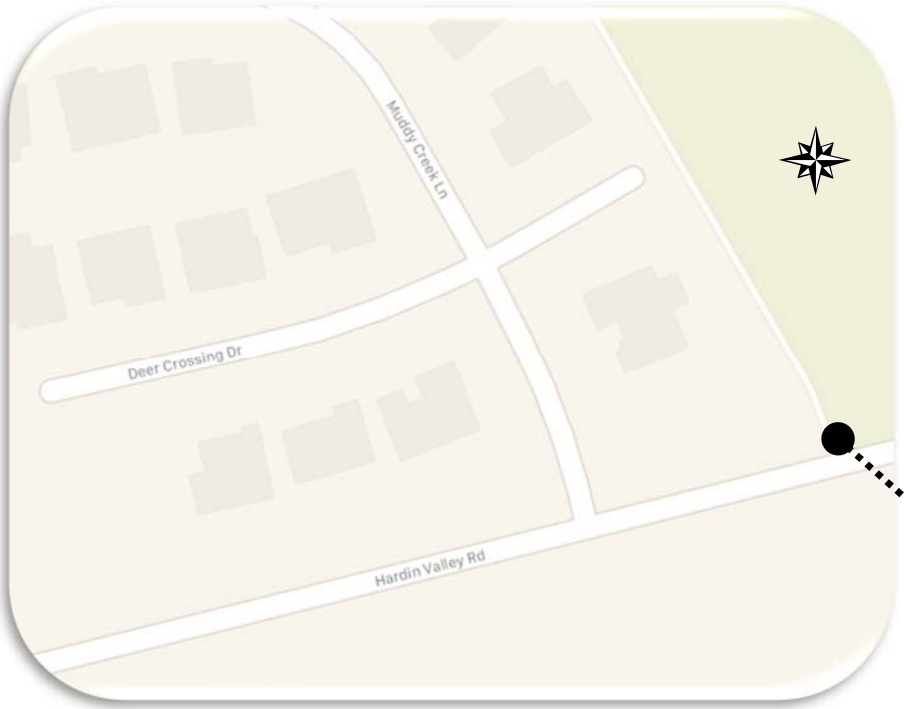


Hardin Valley Road at Mission Hill Lane

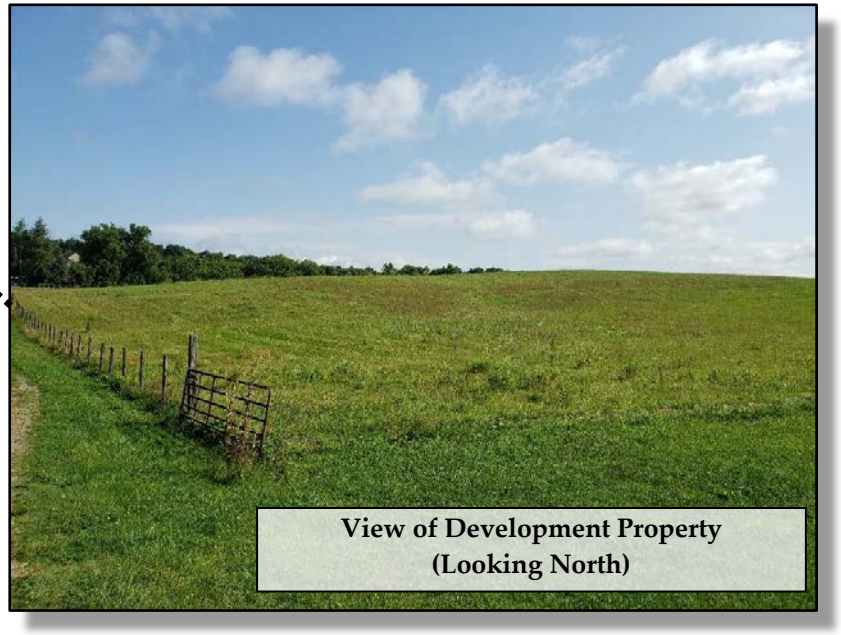
View of Mission Hill Lane at
Hardin Valley Road
(Looking Southeast)



View of Hardin Valley Road at
Mission Hill Lane
(Looking Southwest)



Hardin Valley Road at Muddy Creek Lane



View of Development Property (Looking North)

- **EXISTING TRANSPORTATION VOLUMES PER MODE:**

There are two annual vehicular traffic count locations near the development site. These count locations are conducted by the Knoxville Transportation Planning Organization (TPO). 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 Hardin Valley Road, east of Marietta Church Road and the project site, at 6,920 vehicles per day in 2019. This count location has had sporadic counts conducted every year. From 2010 – 2019, this count station has indicated an 8.2% average annual growth rate.
  - The Knoxville TPO reported an Average Daily Traffic (ADT) on Marietta Church Road, south of Hardin Valley Road and the project site, at 2,050 vehicles per day in 2019. This count location has had sporadic counts conducted every year. From 2009 – 2019, this count station has indicated a 6.3% average annual growth rate.
- Existing bicycle and pedestrian volumes:

  The average daily pedestrian and bicycle traffic along and around the study area is not known. An online website, Strava, provides "heat" maps detailing exercise routes taken by pedestrians, joggers, and bicyclists. This data is gathered from individuals allowing their smart devices to track and compile their routes (over 700 million activities). Based on the heat maps, more pedestrians/joggers use the existing internal subdivision roads. More bicyclists use the external non-subdivision roads in the study area with light traffic for both modes on Marietta Church Road.

Strava Data for Bicyclists

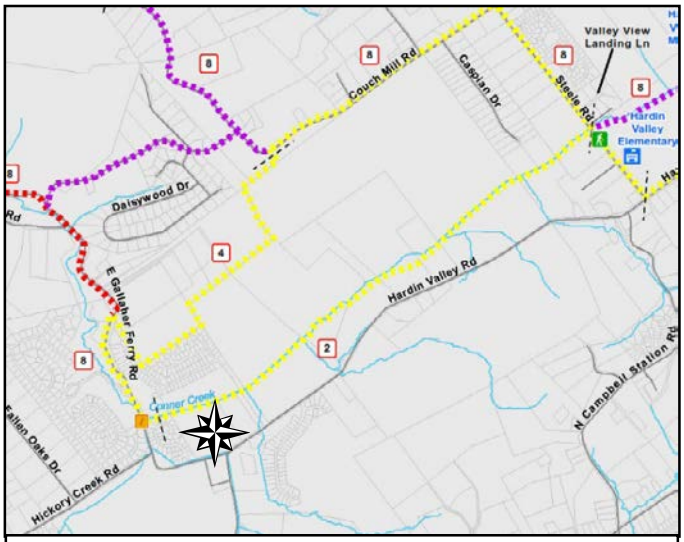
Strava Data for Pedestrians/Joggers

- **ON-STREET PARKING:**

On-street parking was not observed on any studied roadways adjacent to the project site during the field review. On-street parking is not allowed on Hardin Valley Road, but it is assumed that some residents occasionally park on Muddy Creek Lane and the other internal adjacent subdivision roads.

- **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 on the west side. The greenway is paved and is approximately one mile in length.

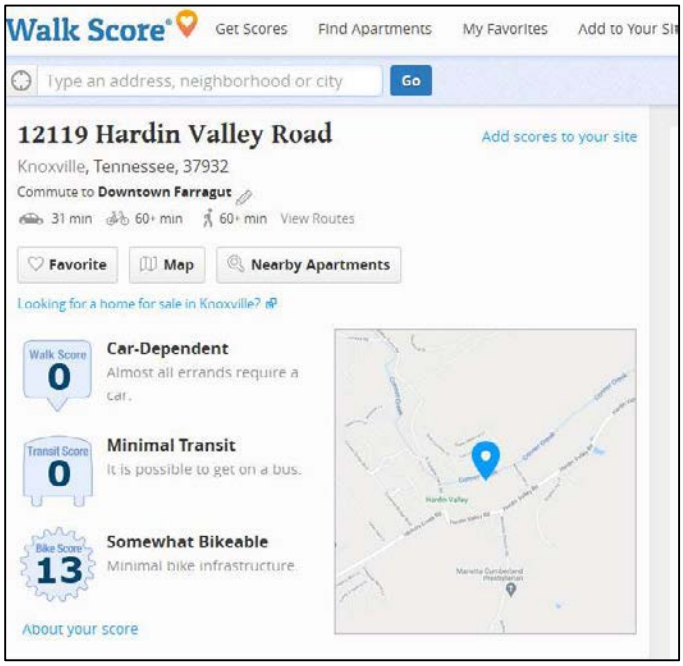


Knox County Greenway Corridor Study (2020)
Beaver Creek West

Knox County recently completed a Greenway Corridor Study in 2020. This study evaluated potential alignments for 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 corridor is shown bisecting the Hoppe Property Subdivision along Conner Creek.

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."

- **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. According to the website, the numerical values assigned for the Walk Score and the Bike Score are based on the distance to the closest amenity in various relevant categories (businesses, schools, parks, etc.) and are graded from 0 to 100. The Transit Score measures how well a location is served by public transit based on distance and type of nearby transit. The Transit Score is also graded from 0 to 100.

Appendix B shows maps and other information for the Walk Score, Bike Score, and Transit Score at the approximate property site address (12119 Hardin Valley Road). The project location is graded with a Walk Score of 0. This low score is due to the lack of sidewalks continuing to outside destinations and the lack of close-by amenities. This Walk Score indicates that the site is entirely dependent on vehicles for errands and travel. The site is graded with a Bike Score of 13, which means there is minimal bike infrastructure but is somewhat bikeable. The site is not given a transit score.

- **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. The overall KAT bus system map is in Appendix C. The closest public transit bus stop is 8.4 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 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 given by Rackley Engineering is shown in Figure 3. The plan layout shows the development proposed on the north side of Hardin Valley Road with 33 multi-family attached townhouses and 47 single-family detached houses.

As shown in Figure 3, five new streets are proposed for the development. The total length of the new streets in the development is 3,227 feet (0.61 miles). Road "B" will continue an existing public street, Deer Crossing Drive, from Hunters Way Subdivision. All but one of the proposed internal roads in the site plan are shown terminating at cul-de-sacs.

View of Northern Portion of Site – Future Townhouses Location (Looking West)

Connor Creek bisects the development property, and the 33 attached townhouses will be constructed on the north side of the property and creek. The 47 single-family detached homes will be constructed on the south side of the property and the creek. The subdivision proposes three entrances with one occurring at Mission Hill Lane for the townhouse residents. The single-family houses will have two entrances, the Main Entrance at the existing t-intersection of Hardin Valley Road at Marietta Church Road, and the other will tie to the west at an existing road stub-out on the east end of Deer Crossing Drive.

The single-family residential detached lots will average between 8,500 - 10,900 square feet (~ 0.2 acre - 0.25 acre) in size, with a few lots near half an acre. Each home will have a garage and driveway. The townhouses will also have individual driveways. Sidewalks are not proposed for this development.

The Hoppe Property Subdivision will border another proposed residential development, the

S&E Property Subdivision. This residential development at one time was proposed to coordinate with the Hoppe project, but an agreement was not achieved. The last submitted S&E Property site plan showed 18 single-family house lots with a proposed entrance road tying to Hardin Valley Road between Marietta Church Road and Mission Hill Lane. This property is in between the Hoppe Property and Mission Hill Lane and is 6.98 acres in size.

The schedule for completion of the Hoppe Property 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 four years (2025).

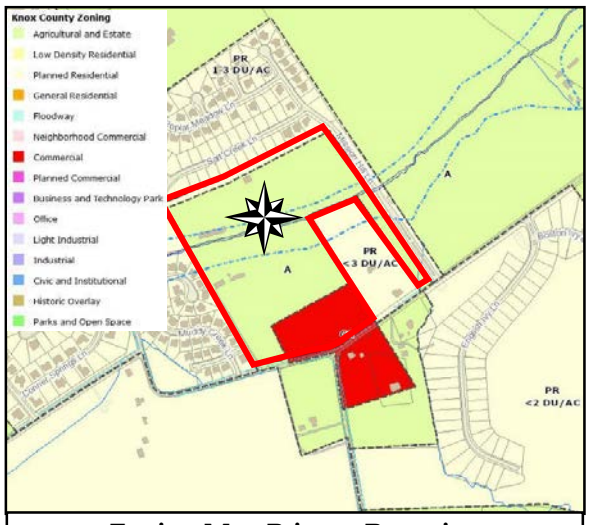
Figure 3
Proposed Plan Layout
Hoppe Property Subdivision

Not to Scale

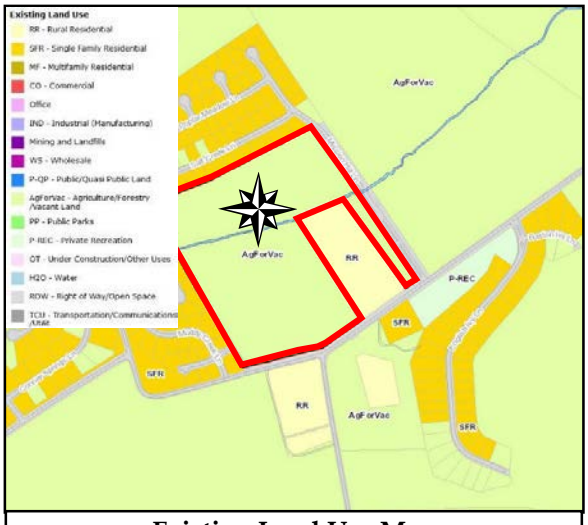
- **PROPOSED USES AND ZONING REQUIREMENTS:**

The Hoppe Property is currently zoned Agricultural (A) and General Business (CA). It is currently being requested to be changed to Planned Residential (PR) zoning with up to 3 density 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 north and west are in the Planned Residential (PR) zone and consist of single-family detached homes in the Massey Creek and Hunters Way Subdivisions. As part of the Massey Creek Subdivision development, the strip of land consisting of Mission Hill Lane is also zoned within the PR zone.
- A single large parcel is zoned as Agricultural (A) to the east and across Mission Hill Lane. This large parcel is undeveloped and is currently being used for farm activities. The Hoppe Property surrounds the S&E Property, which was recently rezoned to Planned Residential (PR).
- A portion of the properties to the south is zoned as Agricultural (A) and General Business (CA). These properties consist of standalone single-family residences. To the southwest, one large parcel is zoned as Planned Residential (PR) and is currently being transformed into a 265-lot single-family detached subdivision.



Zoning Map Prior to Rezoning



Existing Land Use Map

- **DEVELOPMENT DENSITY:**

The development's proposed density is based on a maximum of 80 units (47 houses + 33 townhouses) on 36.77 acres. The density computes to 2.18 dwelling units per acre, less than the maximum allowed for the property's requested Planned Residential (PR) zoning.

- **ON-SITE CIRCULATION:**

The total length of the six new streets within the development as shown in the site plan is 3,227 feet (0.61 miles) in length and will be designed and constructed to Knox County, TN specifications. The new streets shown in Figure 3 are labeled Road "A" thru Road "E". All of the development internal roadways will be asphalt paved and include 8" extruded concrete curbs. The lane widths internally will be 13 feet each for a total 26-foot pavement width. The street right-of-way within the development will be 50 feet. Concrete sidewalks are not proposed for this development. Knox County will maintain the streets in the subdivision after construction, and these will be dedicated public roads.

- **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:

When this study commenced, local schools were out for summer break, and prior traffic count data was used. This prior count data was collected at the intersection of Hardin Valley Road at Marietta Church Road on November 1st, 2016, and was conducted by Ajax Engineering, LLC. This intersection traffic data is the most recent available. Based on this prior count, it was determined that the AM Peak Hour was 7:15 – 8:15 AM and the PM Peak Hour was 5:00 – 6:00 PM. The data from this previous traffic count is shown in Appendix E.

In this study, the intersection volumes collected in 2016 were increased by a 10% annual growth rate to account for general growth in the area and to adjust the traffic volumes to the current existing year 2021. This high growth rate was assumed due to the rapid growth of residential development in the surrounding area and as requested by Knox County.

Figure 4a shows the traffic volumes from the existing traffic count during the AM and PM peak hours observed in 2016. The volumes shown at the intersection of Hardin Valley Road at Muddy Creek Lane were calculated from the volumes at the intersection of Hardin Valley Road and Marietta Church Road and the trips generated by 25 houses in Hunters Way Subdivision. Historical aerial photography indicated that 25 houses were built in 2016 in Hunters Way Subdivision. Mission Hill Lane had not yet been constructed in 2016.

Figure 4b shows the 2021 traffic volumes at the studied intersections. These volumes were obtained by increasing the 2016 traffic volumes counted at the intersection of Hardin Valley Road at Marietta Church Road with a 10% annual growth rate and calculating trips generated from the Hunters Way and Massey Creek Subdivisions. Currently, Hunters Way Subdivision is entirely built out with 40 single-family detached houses. Massey Creek Subdivision is nearly built out with a total of 95 single-family detached houses. Figure 4b also includes a few generated trips from the Vining Mill Subdivision located to the east of Mission Hill Lane. Vining Mill Subdivision currently has a single entrance on Hardin Valley Road with 46 completed and occupied single-family detached houses out of a proposed total of 190. The calculated generated trips and the assumed trip distribution at these intersections contributed by these adjacent subdivisions are discussed later in the report.

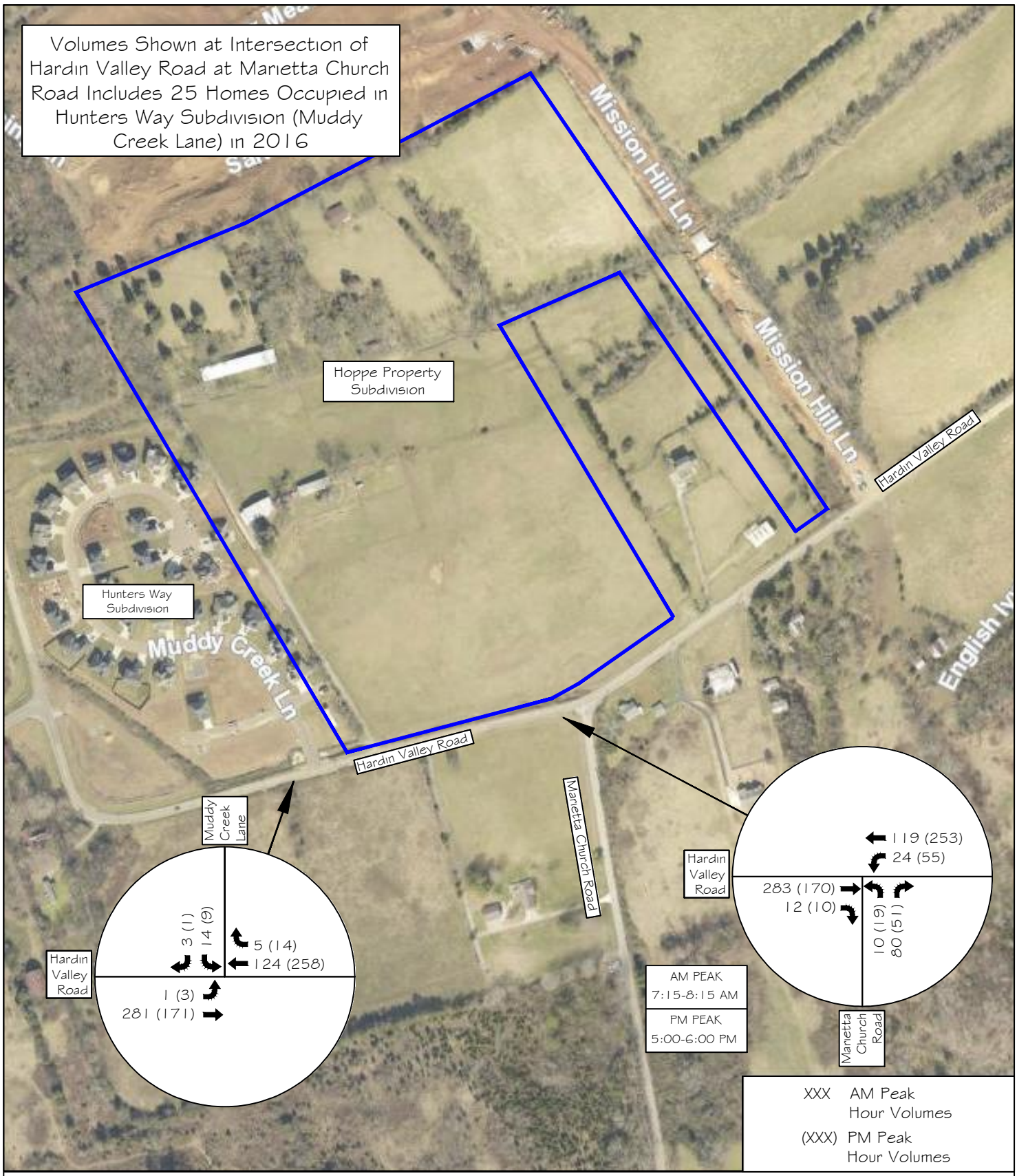


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FIGURE 4a

Hoppe Property Subdivision

2016 Peak Hour Traffic Volumes

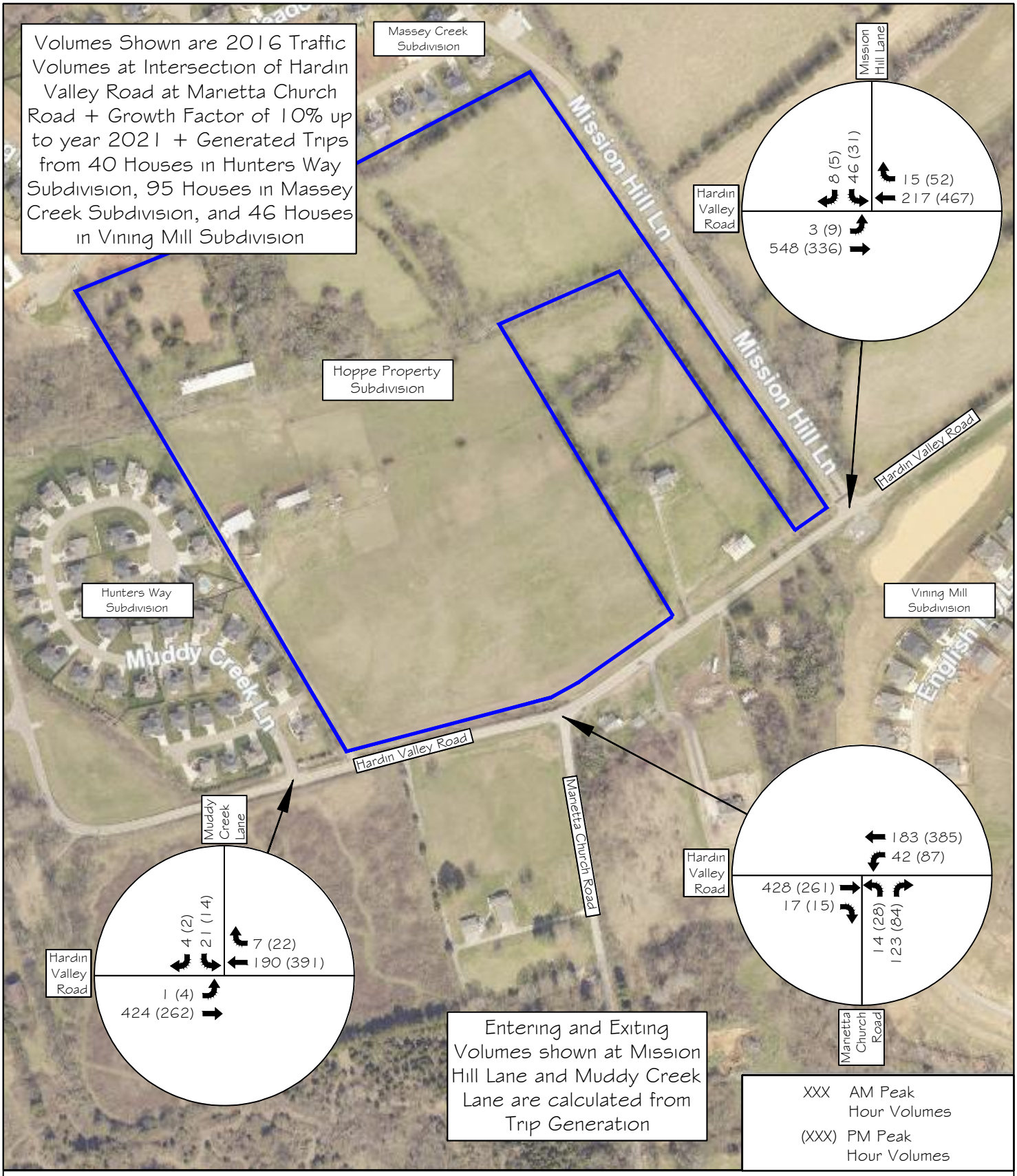

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FIGURE 4b

Hoppe Property Subdivision

2021 Peak Hour Traffic Volumes - EXISTING TRAFFIC CONDITIONS

Capacity analyses were undertaken to determine the Level of Service (LOS) for the studied intersections for the existing year 2021 traffic volumes shown in Figure 4b. 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 peak hour vehicular traffic capacity analyses.

As seen in Table 3, all the traffic movements at the intersections are calculated to operate with good to average LOS and vehicle delays currently.

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

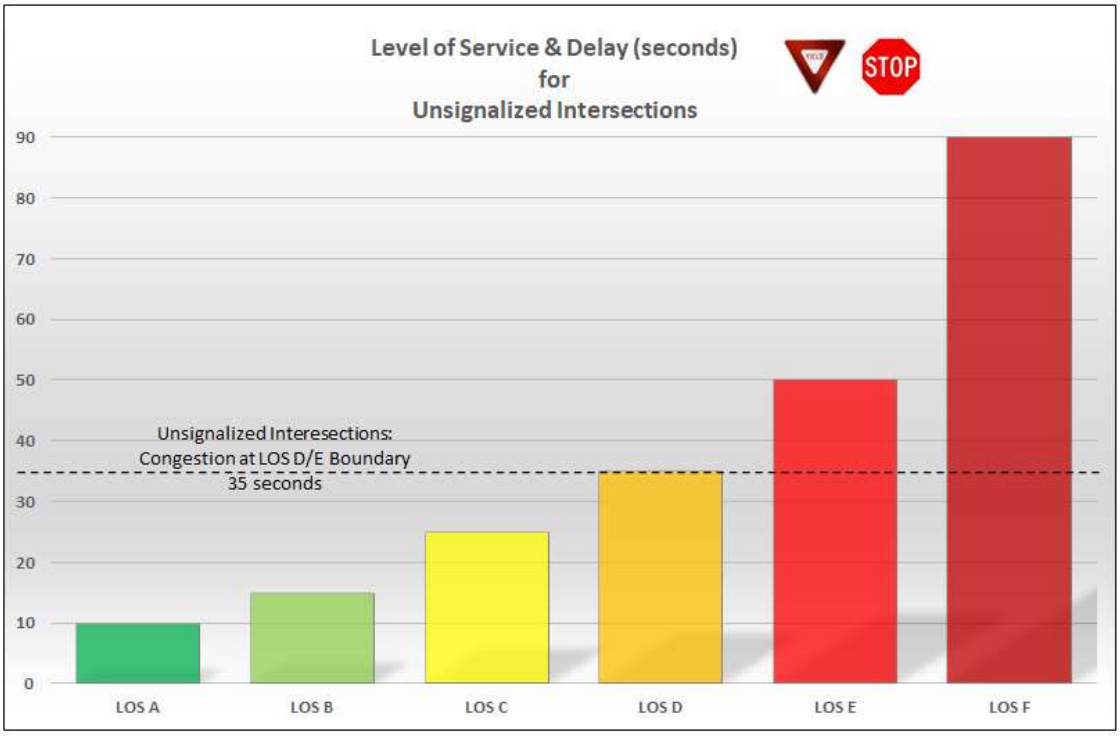


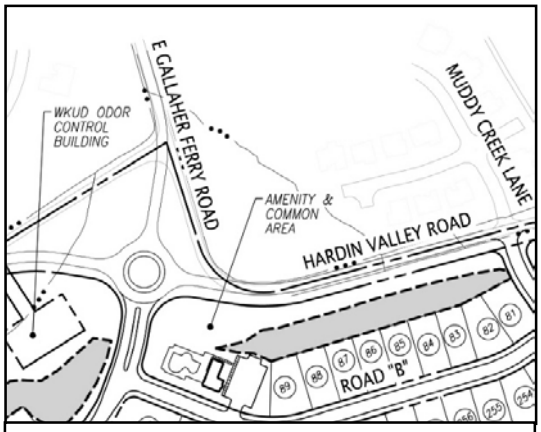
TABLE 3
2021 INTERSECTION CAPACITY ANALYSIS RESULTS -
EXISTING TRAFFIC CONDITIONS

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Hardin Valley Road at Muddy Creek Lane	Unsignalized	Eastbound Left/Thru	A	7.7	0.001	A	8.3	0.004
		Southbound Left/Right	B	14.2	0.066	B	14.5	0.045
Hardin Valley Road at Marietta Church Road	Unsignalized	Northbound Left/Right	C	15.4	0.337	B	14.5	0.306
		Westbound Left/Thru	A	8.7	0.061	A	8.1	0.080
Hardin Valley Road at Mission Hill Lane	Unsignalized	Eastbound Left/Thru	A	7.8	0.003	A	8.6	0.010
		Southbound Left/Right	C	20.4	0.204	C	20.0	0.143

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2010 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

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

Projected horizon year traffic conditions represent the future 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 2025. Due to other significant adjacent residential developments occurring in the study area, the horizon year of 2023 was also examined. These other significant developments include the previously mentioned Vining Mill Subdivision and a subdivision of the Seal Property located across Hardin Valley Road.

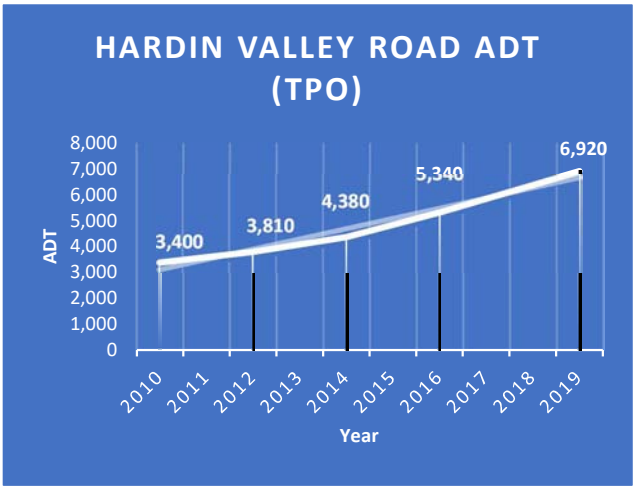


Proposed Roundabout at Hardin Valley Road / East Gallaher Ferry Road / Hickory Creek Road (by FGM)

The Seal Property Subdivision is currently undergoing mass grading and is located to the southwest of the Hoppe Property Subdivision across Hardin Valley Road. The Seal Property Subdivision is estimated to be fully built out and occupied in 2023 and will include 265 single-family detached homes on 117 acres. This subdivision will have two entrances, with one being a new southern leg at the existing intersection of Hardin Valley Road at Muddy Creek Lane. The other entrance will tie into a new roundabout constructed as part of the overall development. This roundabout will improve the existing road alignment of Hardin Valley Road and will move the existing t-intersection of Hardin Valley Road, Hickory Creek Road, and East Gallaher Ferry Road to the southwest. A conceptual plan of this adjacent subdivision, including the proposed roundabout and entrance locations, was included in a Transportation Impact Analysis (TIA) prepared by Fulghum MacIndoe Associates (FGM), and is shown in Appendix G.

Also, it is estimated that by 2023, Vining Mill Subdivision will also be fully built out and occupied. This subdivision will have a total of 190 single-family detached residential lots and will have two entrances, with one on Marietta Church Road that has not been constructed yet. The main entrance is on Hardin Valley Road and is open for the residents in the 46 homes currently in the subdivision. The main entrance road, English Ivy Lane, is east of the proposed Hoppe Property Subdivision. Most traffic generated by the Vining Mill Subdivision is not expected to impact the intersections of Hardin Valley Road at Mission Hill Lane, Marietta

Church Road, and Muddy Creek Lane. This expectation is due to the preponderance of trips generated by the Vining Mill Subdivision is assumed and expected to travel to and from the east on Hardin Valley Road. A minor amount was included in the 2023 traffic volumes at the studied intersections as projected in another TIA. The TIA completed for Vining Mill Subdivision in 2016 (by Ajax Engineering, LLC) assumed 5% of trips would travel to and from the west via Hardin Valley Road (and Hickory Creek Road), and 5% would travel south via Marietta Church Road. The trips generated by the Vining Mill Subdivision were calculated by this previous study and are shown in Appendix G.



According to the TPO, vehicular traffic on Hardin Valley Road has shown considerable growth (8.2%) over the past few years, as shown in Appendix A. Marietta Church Road has also shown significant growth (6.3%). As discussed previously and as recommended by Knox County, a 10% average annual growth rate was used for calculating past traffic volumes to future volumes. The 10% rate was used to take into account the aggressive growth in the area. This high rate would optimistically include the traffic growth from the infill of other recent subdivisions in the area (Hickory Crest and Hickory Creek Farms), a subdivision currently under construction further south on Marietta Church Road (Broady Glen), and other developments that could occur in the next few years.

The 10% growth rate was applied to the 2021 traffic volumes from Figure 4b and included the trips generated from the subdivisions of Hunters Way, Massey Creek, Vining Mill, and the Seal Property to determine the projected 2023 traffic volumes. The results are shown in Figure 5a. This figure shows the projected horizon year traffic volumes at the studied intersections in 2023 during the AM and PM peak hours without the Hoppe Property Subdivision but with the volumes from these other subdivisions.

Intersection capacity analyses were conducted for the projected 2023 traffic volumes without the Hoppe Property Subdivision being developed. The results from the 2023 projected horizon year traffic conditions without the project can be seen in Table 4a for the intersections, and the worksheets are in Appendix F.

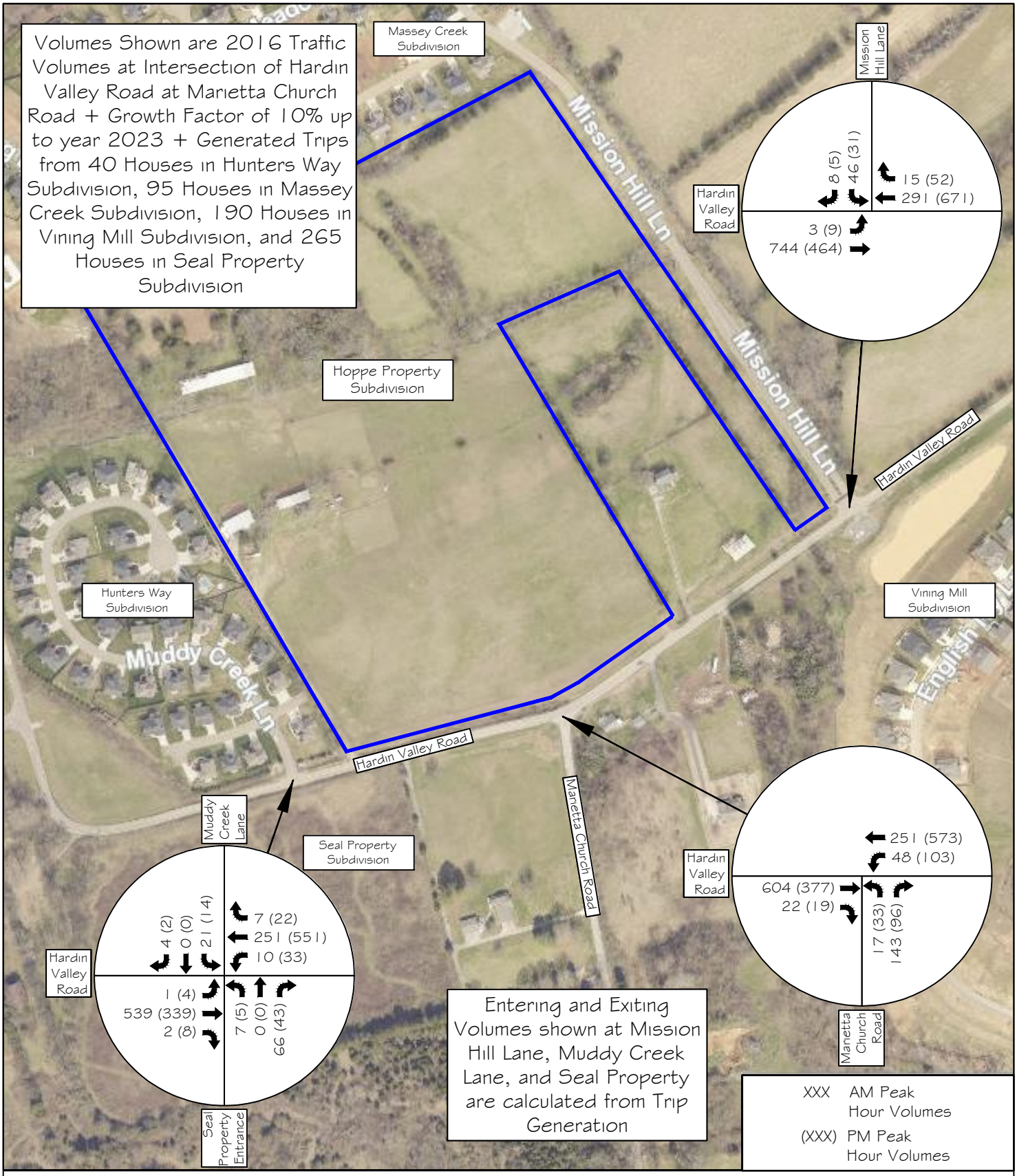


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FIGURE 5a

Hoppe Property Subdivision

2023 Peak Hour Traffic Volumes - PROJECTED HORIZON YEAR TRAFFIC (WITHOUT THE PROJECT)

As expected, the 2023 projected conditions without the project resulted in larger vehicle delays at the studied intersections than the existing 2021 conditions. In particular, the southbound approaches of Muddy Creek Lane and Mission Hill Lane at Hardin Valley Road both were calculated slipping to LOS D.

TABLE 4a
2023 INTERSECTION CAPACITY ANALYSIS RESULTS - PROJECTED HORIZON YEAR (WITHOUT THE PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance	STOP Unsignalized	Northbound Left/Thru/Right	C	15.4	0.190	B	12.6	0.101
		Eastbound Left/Thru/Right	A	7.9	0.001	A	8.8	0.005
		Westbound Left/Thru/Right	A	8.9	0.012	A	8.1	0.031
		Southbound Left/Thru/Right	D	25.1	0.134	D	27.0	0.098
Hardin Valley Road at Marietta Church Road	STOP Unsignalized	Northbound Left/Right	C	24.9	0.539	C	24.2	0.512
		Westbound Left/Thru	A	9.6	0.083	A	8.6	0.107
Hardin Valley Road at Mission Hill Lane	STOP Unsignalized	Eastbound Left/Thru	A	8.0	0.003	A	9.5	0.012
		Southbound Left/Right	D	33.5	0.324	D	34.1	0.245

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2010 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

Furthermore, to determine the 2025 projected horizon year traffic conditions without the Hoppe Property Subdivision, the same steps undertaken for 2023 were also completed. By 2025, the Briggs Station Subdivision is also expected to be completed. The Briggs Station Subdivision will include up to a maximum of 188 single-family detached homes on 94 acres. This subdivision will be located to the south of the Hoppe Property Subdivision, 1,500 feet to the south of the intersection of Hardin Valley Road at Marietta Church Road.

A TIA was completed for this subdivision in June 2021 (CDM Smith). Similar to other studies, this TIA estimated that most trips generated by this subdivision would travel to and from the east via Hardin Valley Road. An aerial map showing the location of this proposed adjacent subdivision is shown in Appendix G.

At this time, it is understood that the S&E Property Development is proposing 18 single-family detached houses, will be completed by 2025 and have a single entrance on Hardin Valley Road in between Marietta Church Road and Mission Hill Lane. It is assumed that the traffic volumes

generated by this development will be minimal and will be accounted for in the analysis in the assumed 10% traffic growth utilized in the study.

Intersection capacity analyses were conducted for the projected 2025 traffic volumes without the Hoppe Property Subdivision being developed. The results of the 2025 projected traffic conditions without the project can be seen in Table 4b for the intersections. The 2025 intersection capacity analysis worksheets are in Appendix F. The 2025 projected volumes are shown in Figure 5b.

With the addition of the Briggs Station Subdivision in the study area in 2025, it is projected that there will be extreme delays for the southbound approach of Mission Hill Lane at Hardin Valley Road. This approach is calculated to operate at LOS F in the 2025 AM and PM peak hours due to traffic growth and the influx of traffic volumes generated by the Briggs Station Subdivision and general growth. The results shown in Table 4b include a 125-foot westbound left-turn lane on Hardin Valley Road at Marietta Church Road in the analysis. This turn lane is included in the 2025 analysis since it was recommended in the TIA prepared for Briggs Station Subdivision. The northbound approach of Marietta Church Road at Hardin Valley Road is also calculated to be LOS F.

It is essential to point out that these intersection LOS projections could exist in 2023 and 2025, even without the proposed Hoppe Property Subdivision being constructed and developed.

TABLE 4b
2025 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITHOUT THE PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance	STOP Unsignalized	Northbound Left/Thru/Right	C	16.9	0.212	B	13.5	0.112
		Eastbound Left/Thru/Right	A	8.0	0.001	A	9.1	0.005
		Westbound Left/Thru/Right	A	9.1	0.012	A	8.3	0.032
		Southbound Left/Thru/Right	D	29.9	0.161	D	32.2	0.119
Hardin Valley Road at Marietta Church Road	STOP Unsignalized	Northbound Left/Right	F	97.0	1.042	F	104.4	1.046
		Westbound Left/Thru	B	10.3	0.150	A	9.4	0.227
Hardin Valley Road at Mission Hill Lane	STOP Unsignalized	Eastbound Left/Thru	A	8.2	0.003	B	10.2	0.014
		Southbound Left/Right	F	56.5	0.472	F	57.5	0.374

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2010 methodology
Note 2: Results shown for Intersection of Hardin Valley Road at Marietta Church Road include a 125' WB Left-Turn Lane
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

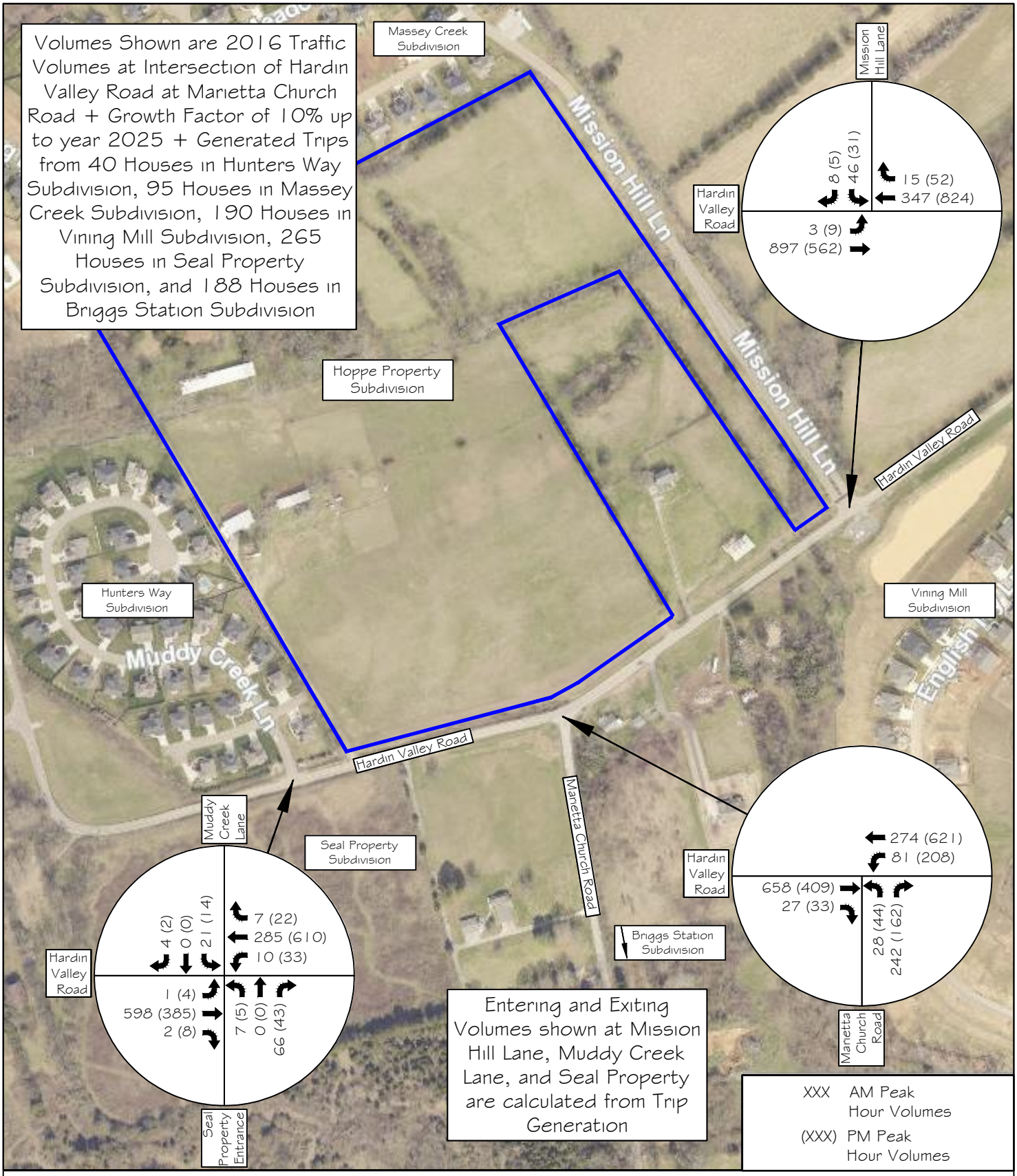

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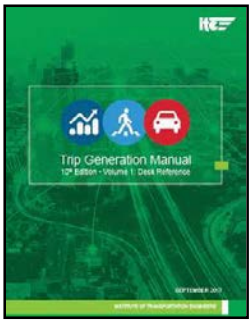
FIGURE 5b

Hoppe Property Subdivision

2025 Peak Hour Traffic Volumes - PROJECTED HORIZON YEAR TRAFFIC (WITHOUT THE PROJECT)

- **TRIP GENERATION:**



For the Hoppe Property Subdivision, the estimated amount of traffic that the 47 single-family detached houses will generate was calculated based upon rates and equations provided by the Trip Generation Manual, 10th Edition, a publication of the Institute of Transportation Engineers (ITE). The trip rate for the 33 attached townhouses was based upon equations provided by Knoxville-Knox County Planning. 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. This local rate calculates higher trip rates than the similar ITE land use. The data and calculations from ITE and the local study for the proposed land uses are shown in Appendix H. A summary of this information is presented in the following table:

TABLE 5a
TRIP GENERATION FOR HOPPE PROPERTY SUBDIVISION
47 Single-Family Detached Houses and 33 Townhouses

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	47 Houses	519	25%	75%		63%	37%	
				9	29	38	31	18	49
Local Trip Rate	Townhouses	33 Townhouses	352	22%	78%		55%	45%	
				4	15	19	18	14	32
Total New Volume Site Trips			**871**	**13**	**44**	**57**	**49**	**32**	**81**

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

For the proposed residential subdivision, with 47 single-family detached houses and 33 townhouses, it is estimated that 13 vehicles will enter and 44 will exit, for a total of 57 generated trips during the AM peak hour in the year 2025. Similarly, it is estimated that 49 vehicles will enter, and 32 will exit, for a total of 81 generated trips during the PM peak hour in the year 2025. The calculated trips generated for an average weekday are 871 vehicles for the proposed development in 2025. No trip reductions were included in the analysis.

As discussed earlier, trips generated by the adjacent subdivisions were calculated to estimate the entering and exiting turning movements at the intersections of Hardin Valley Road at Muddy Creek Lane and Mission Hill Lane due to the lack of available turning movement counts. These trips were calculated for the adjacent subdivisions based on the number of houses constructed and occupied at different times. These calculations are provided in Appendix H, and a summary is presented in the following table:

TABLE 5b
TRIP GENERATION FOR ADJACENT SUBDIVISIONS

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Hunters Way (2016)	25 Houses	290	25%	75%		63%	37%	
				6	17	23	17	10	27
#210	Hunters Way (2021)	40 Houses	448	25%	75%		63%	37%	
				8	25	33	26	16	42
#210	Massey Creek (2021)	95 Houses	992	25%	75%		63%	37%	
				18	54	72	61	36	97
#210	Vining Mill (2021)	46 Houses	509	25%	75%		63%	37%	
				9	28	37	30	18	48
#210	Vining Mill (2023)	190 Houses	1,877	25%	75%		63%	37%	
				35	105	140	118	70	188

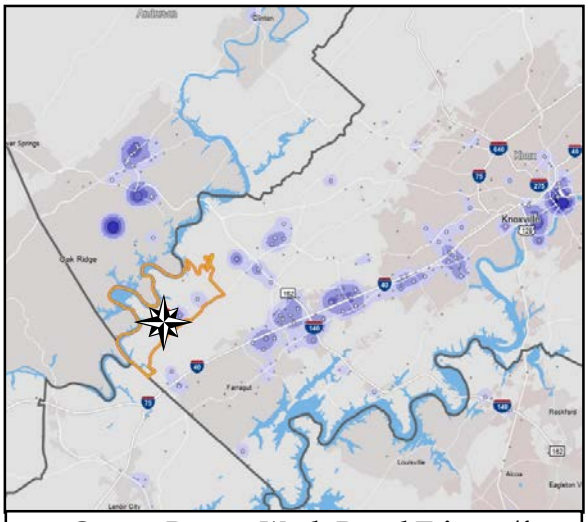
ITE Trip Generation Manual, 10th Edition
Trips calculated by using Fitted Curve Equation

The trips generation and distribution of the Seal Property Subdivision and the Briggs Station Subdivision were obtained from the TIA's completed by others and shown in Appendix H. The trip distribution used for Hunters Way, Massey Creek, and Vining Mill subdivisions was based on a distribution of 85% to/from the east on Hardin Valley Road, 10% to/from the south on Marietta Church Road, and 5% to/from the west on Hardin Valley Road (Hickory Creek Road).

- **TRIP DISTRIBUTION AND ASSIGNMENT:**

Figure 6 shows the projected distribution for traffic entering and exiting the proposed development based on the site plan. The percentages in Figure 6 only pertain to the new proposed residential dwellings' trips in the development calculated from the ITE and local trip rates and shown in Table 5a.

All the generated trips for the single-family homes are assumed to enter and exit at the Main Entrance. The second entrance via Deer Crossing Drive is not expected to experience any vehicle trips except for occasional interconnected travel such as mail and delivery vehicles. All townhouse trips were distributed to Mission Hill Lane.



2018 Census Bureau Work-Based Trips to/from Census Tract 59.06

The percentages assumed and shown in Figure 6 are based on several factors. The first is based on work-related trips in the area. Work-based trips will be a significant driver of generated trips by the development. These trips are more likely to travel to and from the east. This assertion is based on data from the United States Census Bureau website for Census Tract 59.06, which includes the development property on Hardin Valley Road. Based on 2018 (latest available) census data and shown in Appendix I, most work-based trips in the area will correspond to businesses and companies (public and private) around Pellissippi Parkway, Oak Ridge, and areas along Interstate 40 to the east, and downtown Knoxville.

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

The percentages assumed and shown in Figure 6 are also based on the 2016 traffic count

conducted at the intersection of Hardin Valley Road at Marietta Church Road. Overall, 85% of the generated traffic is assumed for the analysis to/from the east, 10% to/from the south, and 5% to/from the west.

Since the development will have several entrances with several directions of traffic flow, spreadsheets were developed for this study to calculate trip distribution and volumes at all the studied intersections for the different horizon years. These spreadsheets are presented in Appendix J.

Figures 7a and 7b show the Traffic Assignment of the computed trips generated by the development (from Table 5a) based on the assumed distribution of trips shown in Figure 6.

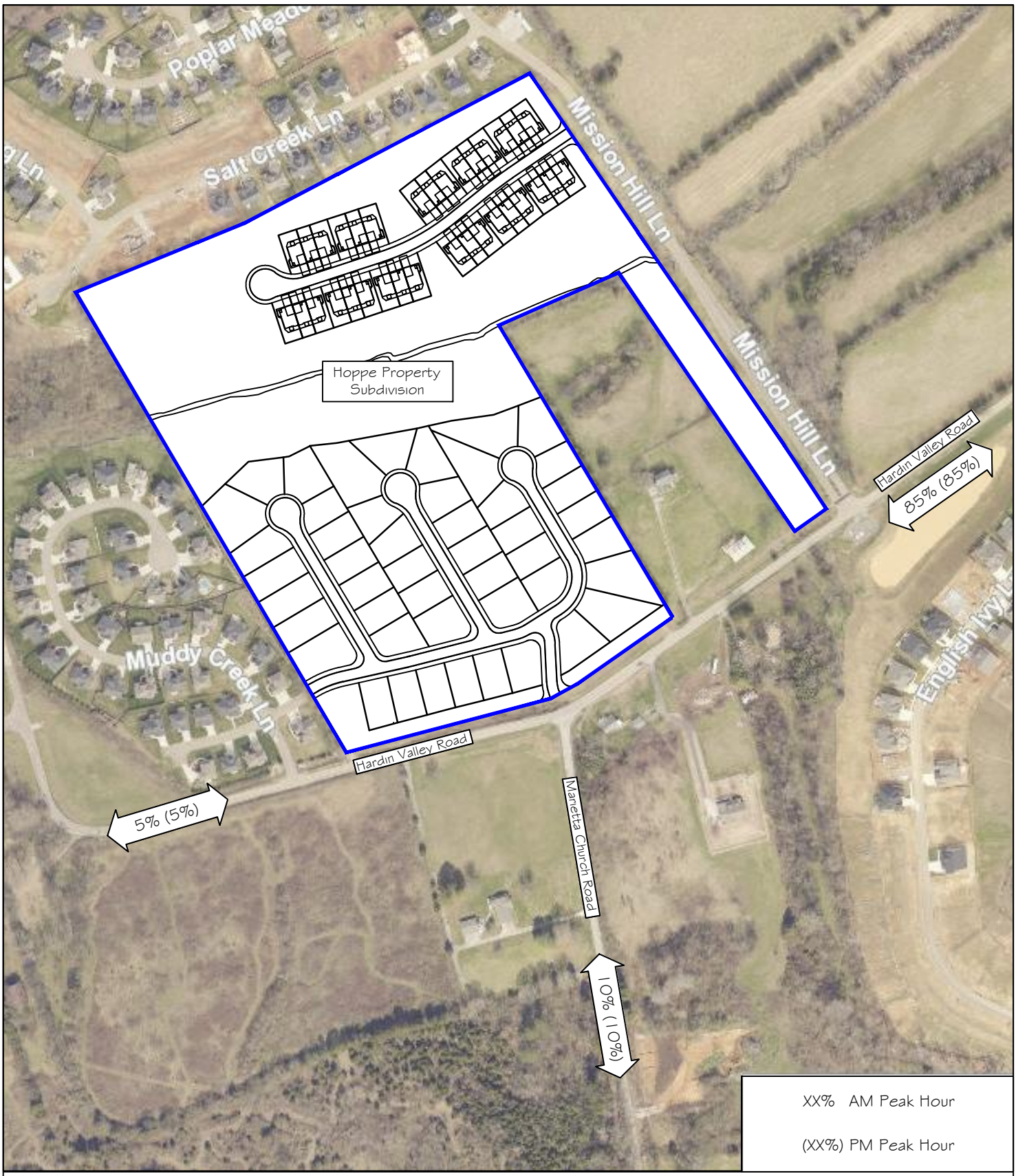


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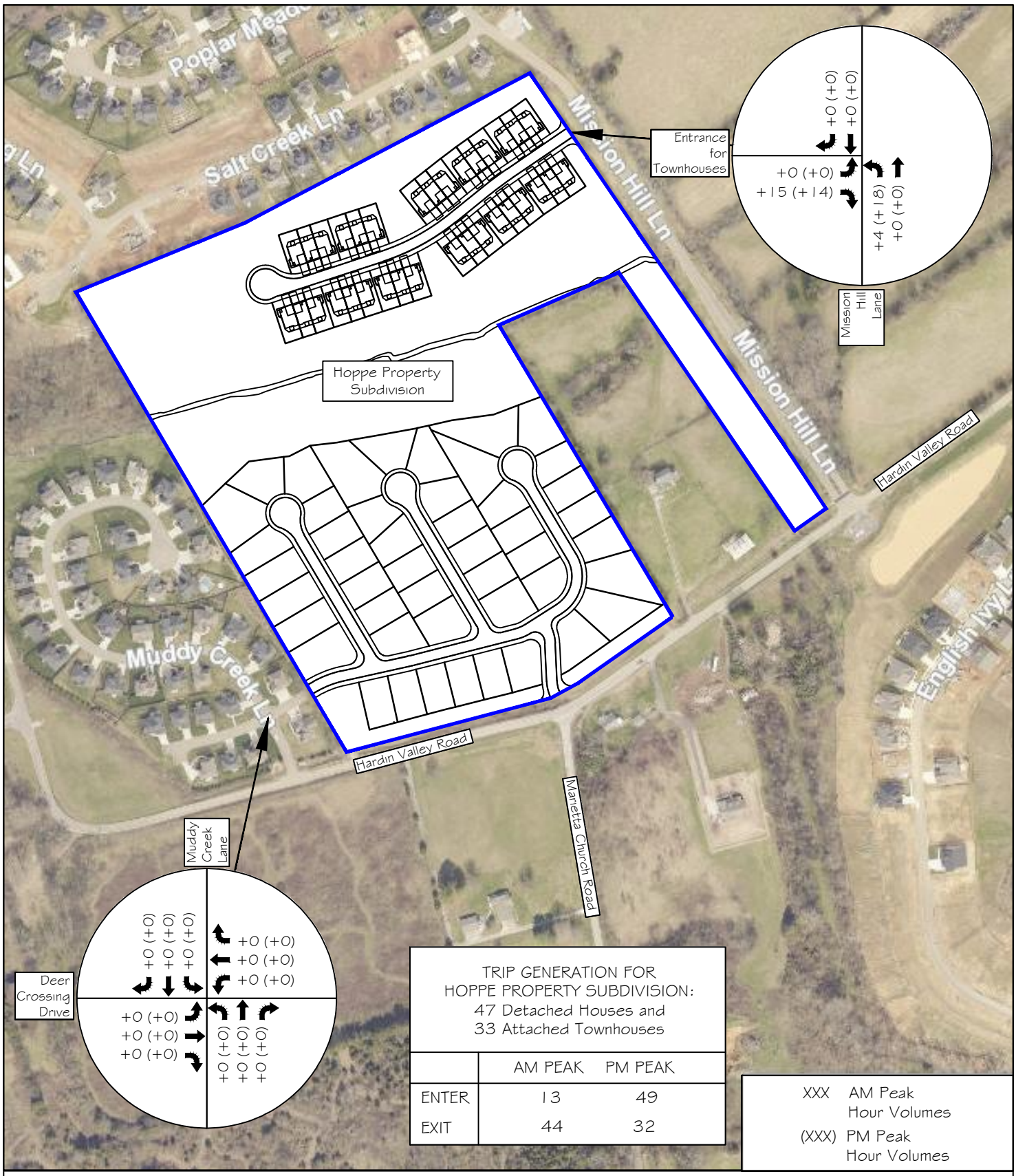
FIGURE 6

Hoppe Property Subdivision

Directional Distribution of Generated Traffic during AM and PM Peak Hour



TRIP GENERATION FOR
HOPPE PROPERTY SUBDIVISION:
47 Detached Houses and
33 Attached Townhouses

	AM PEAK	PM PEAK
ENTER	13	49
EXIT	44	32

XXX AM Peak Hour Volumes

(XXX) PM Peak Hour Volumes

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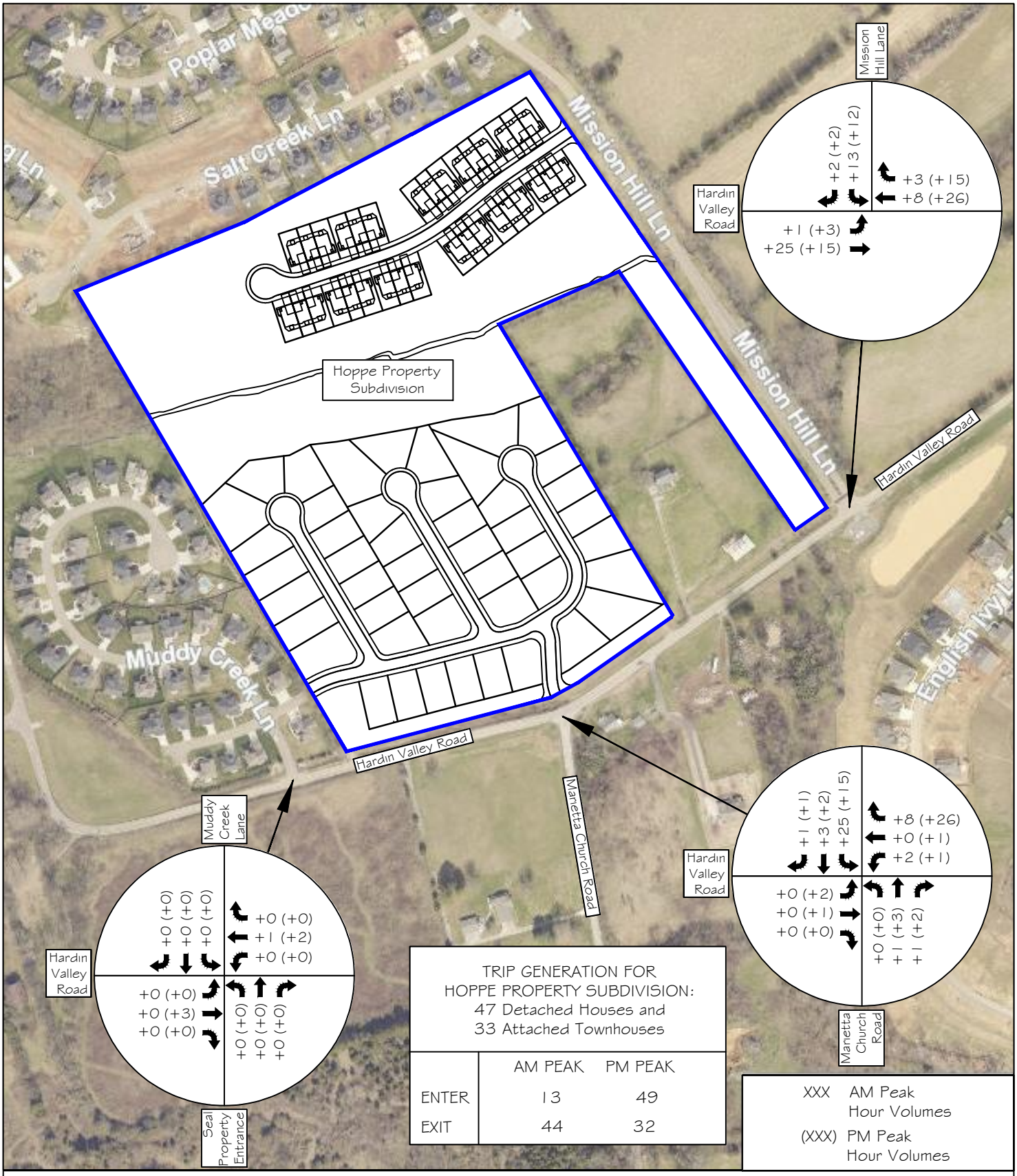
FIGURE 7a

Hoppe Property Subdivision

Traffic Assignment of Generated Traffic during AM and PM Peak Hour



TRIP GENERATION FOR
HOPPE PROPERTY SUBDIVISION:
47 Detached Houses and
33 Attached Townhouses

	AM PEAK	PM PEAK
ENTER	13	49
EXIT	44	32

XXX AM Peak Hour Volumes

(XXX) PM Peak Hour Volumes

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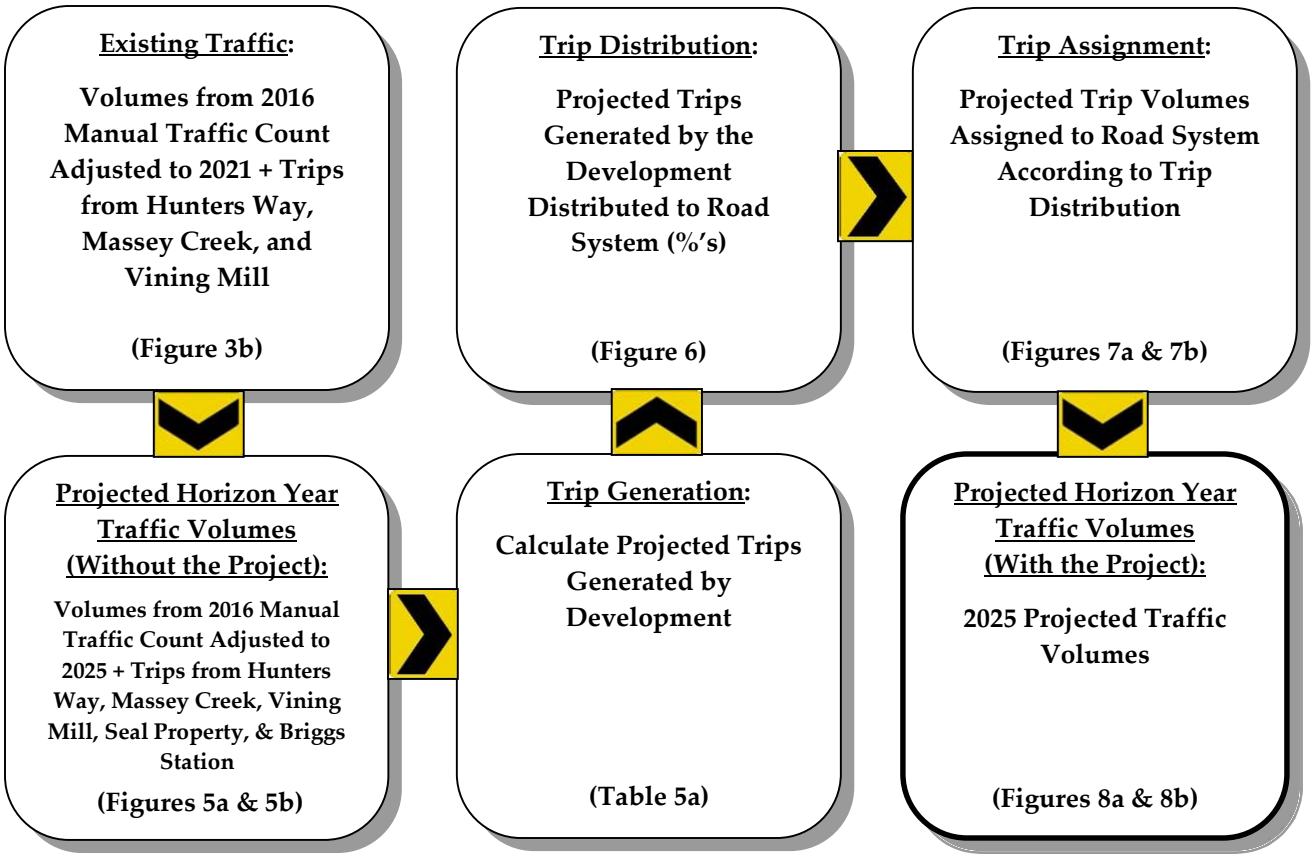
FIGURE 7b

Hoppe Property Subdivision

Traffic Assignment of Generated Traffic during AM and PM Peak Hour with Improvements

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

Overall, several additive steps were taken to estimate the projected total horizon year traffic volumes at the studied intersections when the Hoppe Property Subdivision is entirely constructed and occupied by 2025. The steps are illustrated below for clarity:



To calculate the total future projected traffic volumes at the studied intersections, the calculated peak hour traffic volumes generated by the Hoppe Property Subdivision were added to the 2025 projected horizon year traffic volumes (Figure 5b) by following the predicted directional distributions and assignments (Figures 6, 7a, and 7b). This procedure was completed to obtain the total projected traffic volumes when the development is fully built out and occupied in 2025. Figures 8a and 8b show the projected AM and PM peak hour volumes at the studied intersections for 2025 with the Hoppe Property Subdivision traffic.

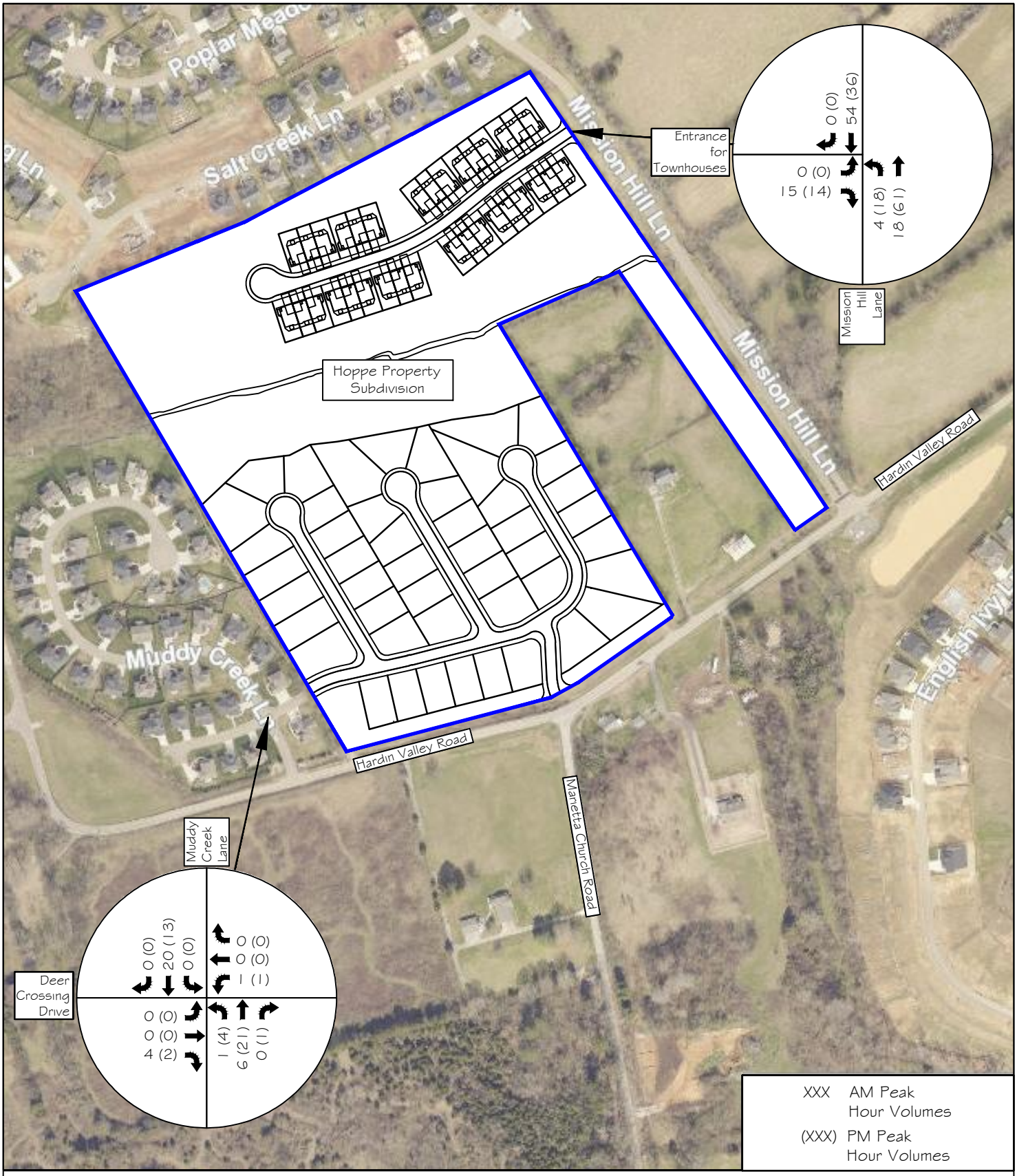


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FIGURE 8a

Hoppe Property Subdivision

2025 Peak Hour Traffic Volumes - PROJECTED HORIZON YEAR TRAFFIC (WITH THE PROJECT)

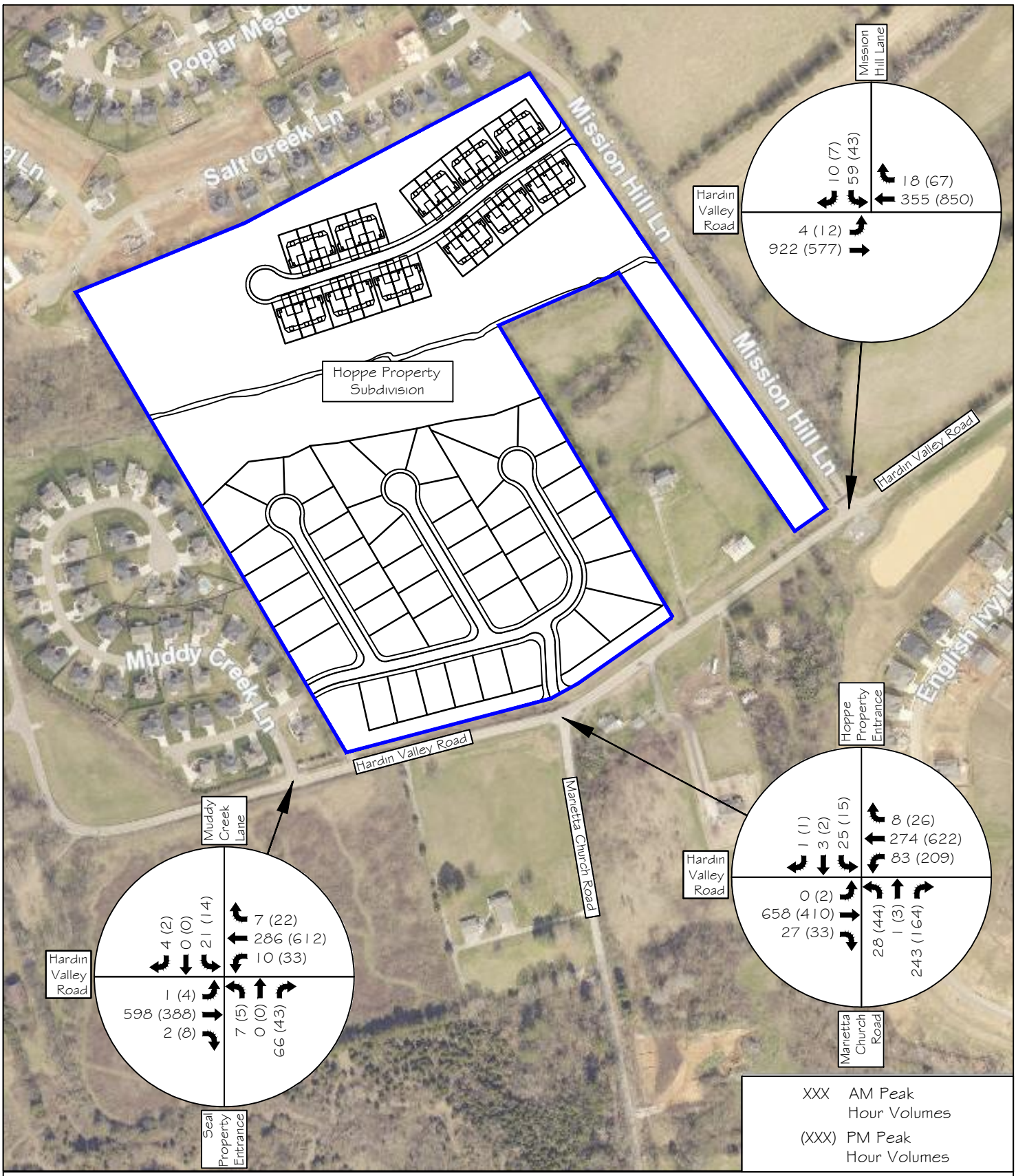

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FIGURE 8b

Hoppe Property Subdivision

2025 Peak Hour Traffic Volumes - PROJECTED HORIZON YEAR TRAFFIC (WITH THE PROJECT)

Intersection capacity analyses were conducted to determine the projected Level of Service for vehicles with the development traffic in the year 2025. Appendix F includes the worksheets for these 2025 capacity analyses. From the analyses, as expected, the additional traffic generated from the proposed Hoppe Property Subdivision development increased the calculated vehicle delays at the intersections as compared to the 2025 projected conditions without the project, as shown in Table 4b. As shown, several of the minor northbound and southbound approaches at the studied intersections will experience LOS F. The intersection of Hardin Valley Road at Marietta Church Road with the addition of the Main Entrance as the 4th leg was modeled under two-way stop control.

Existing End of Deer Crossing Drive (Looking East)

The projected 2025 peak hour vehicular capacity results at the studied intersections can be seen in Table 6 for the AM and PM peak hours. These results are reported with the proposed townhouse entrance on Mission Hill Lane, the Main Entrance at the existing intersection of Hardin Valley Road at Marietta Church Road, and the secondary entrance on Deer Crossing Drive. The traffic movements at the proposed entrance on Mission Hill Lane are calculated to operate at LOS A. The existing intersection of Muddy Creek Lane at Deer Crossing Drive in Hunters Way Subdivision is also calculated to operate at LOS A. This intersection is included in the analysis since the current stub-out on the eastern end of Deer Crossing Drive is proposed to be tied into the Hoppe Property Subdivision, as shown in the site plan.

A summary of the Hardin Valley Road intersections with Muddy Creek Lane, Marietta Church Road, and Mission Hill Lane capacity analysis results are presented in Tables 7a – 7c. Graphs follow the tables highlighting the LOS results. The tables provide a side-by-side summary and comparison of the intersections for the 2021 existing conditions, projected horizon year 2023 conditions without the project, projected horizon year 2025 conditions without the project, and projected horizon year 2025 conditions with the project. The proposed entrance intersections are not included since they only exist in the future conditions. The intersection of Hardin Valley Road at Marietta Church Road in Table 7b only shows the current approaches. It does

not include the addition of the Main Entrance approach at the intersection in 2025.

TABLE 6
2025 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITH THE PROJECT)

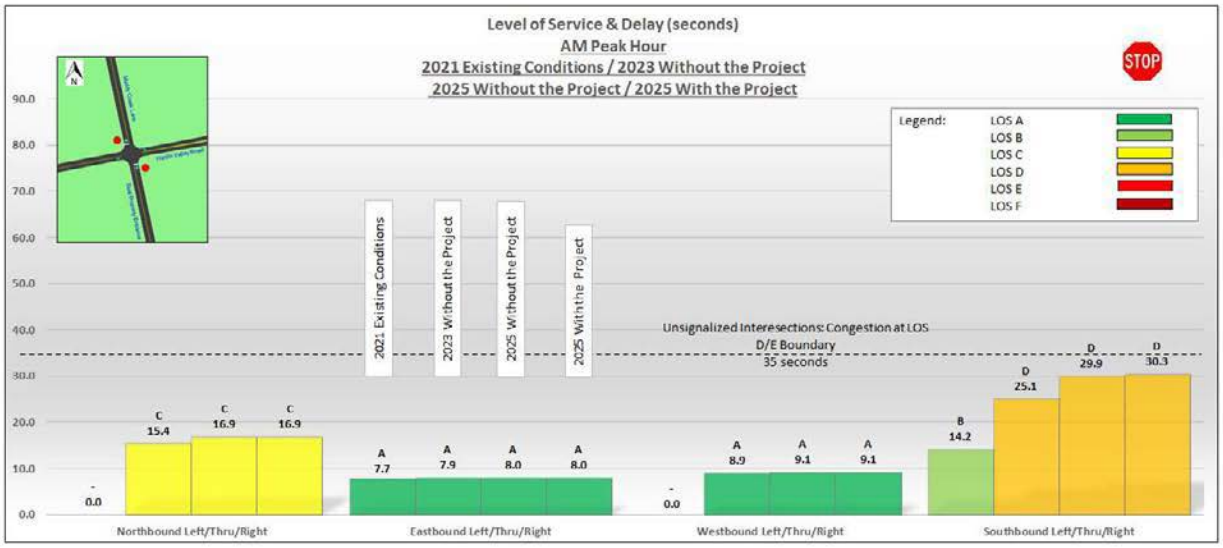
INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance	STOP Unsignalized	Northbound Left/Thru/Right	C	16.9	0.212	B	13.5	0.112
		Eastbound Left/Thru/Right	A	8.0	0.001	A	9.1	0.005
		Westbound Left/Thru/Right	A	9.1	0.012	A	8.3	0.032
		Southbound Left/Thru/Right	D	30.3	0.163	D	32.6	0.120
Hardin Valley Road at Marietta Church Road	STOP Unsignalized	Northbound Left/Thru/Right	F	132.6	1.141	F	221.0	1.342
		Eastbound Left/Thru	A	-	-	A	9.1	0.00
		Westbound Left/Thru	B	10.3	0.154	A	9.4	0.228
		Southbound Left/Thru/Right	F	605.1	1.433	F	216.1	0.593
Hardin Valley Road at Mission Hill Lane	STOP Unsignalized	Eastbound Left/Thru	A	8.2	0.004	B	10.4	0.020
		Southbound Left/Right	F	79.7	0.650	F	83.1	0.573
Muddy Creek Lane at Deer Crossing Drive	STOP Unsignalized	Northbound Left/Thru/Right	A	7.2	0.001	A	7.2	0.003
		Eastbound Left/Thru/Right	A	8.4	0.004	A	8.4	0.002
		Westbound Left/Thru/Right	A	8.7	0.001	A	8.8	0.001
		Southbound Left/Thru/Right	A	-	-	A	-	-
Mission Hill Lane at Entrance for Townhouses	STOP Unsignalized	Northbound Left/Thru	A	7.3	0.003	A	7.3	0.013
		Eastbound Left/Right	A	8.6	0.016	A	8.5	0.015

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2010 methodology
Note 2: Results shown for Intersection of Hardin Valley Road at Marietta Church Road include a 125' WB Left-Turn Lane
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

TABLE 7a
INTERSECTION CAPACITY ANALYSIS SUMMARY
HARDIN VALLEY ROAD AT MUDDY CREEK LANE AND SEAL PROPERTY ENTRANCE STOP

LOCATION / PEAK HOUR MOVEMENT	2021 EXISTING CONDITIONS			2023 WITHOUT THE PROJECT			2025 WITHOUT THE PROJECT			2025 WITH THE PROJECT		
	LOS[a]	Delay[b]	v/c[c]	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	-	-	-	C	15.4	0.190	C	16.9	0.212	C	16.9	0.212
Eastbound Left/Thru/Right	A	7.7	0.001	A	7.9	0.001	A	8.0	0.001	A	8.0	0.001
Westbound Left/Thru/Right	-	-	-	A	8.9	0.012	A	9.1	0.012	A	9.1	0.012
Southbound Left/Thru/Right	B	14.2	0.066	D	25.1	0.134	D	29.9	0.161	D	30.3	0.163
PM Peak												
Northbound Left/Thru/Right	-	-	-	B	12.6	0.101	B	13.5	0.112	B	13.5	0.112
Eastbound Left/Thru/Right	A	8.3	0.004	A	8.8	0.005	A	9.1	0.005	A	9.1	0.005
Westbound Left/Thru/Right	-	-	-	A	8.1	0.031	A	8.3	0.032	A	8.3	0.032
Southbound Left/Thru/Right	B	14.5	0.045	D	27.0	0.098	D	32.2	0.119	D	32.6	0.120

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2010 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio



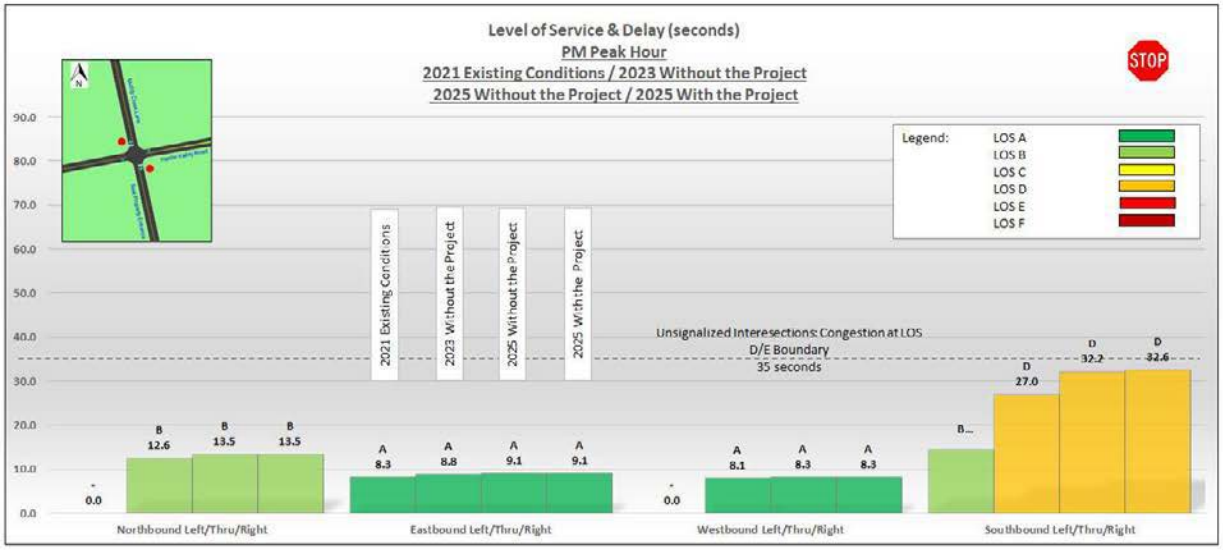
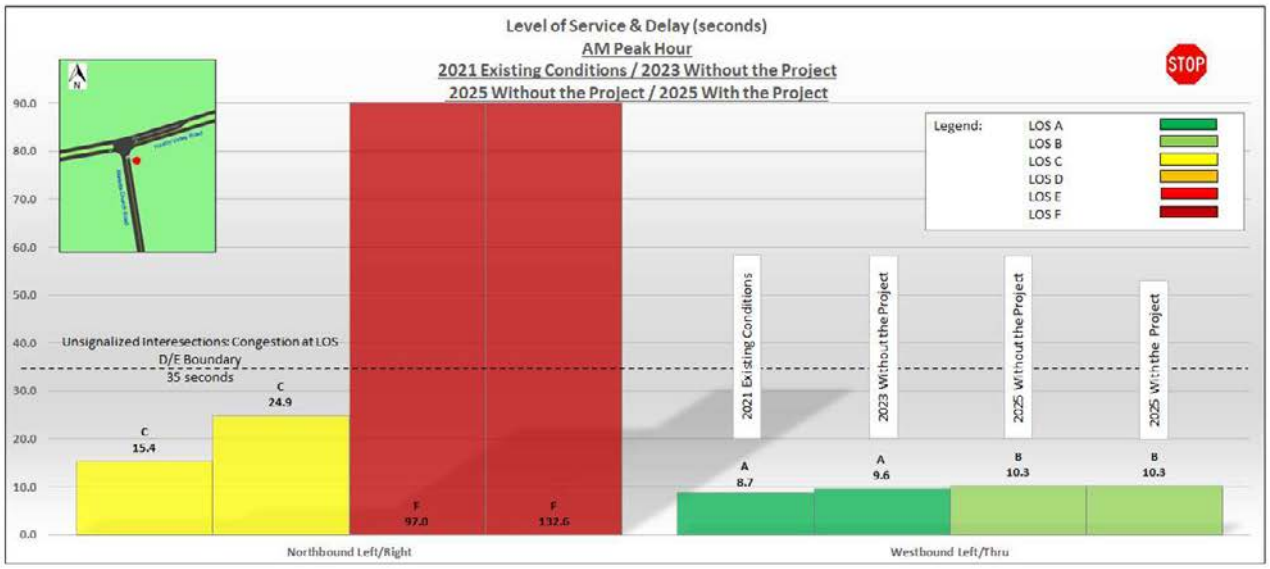


TABLE 7b
INTERSECTION CAPACITY ANALYSIS SUMMARY
HARDIN VALLEY ROAD AT MARIETTA CHURCH ROAD

LOCATION / PEAK HOUR MOVEMENT	2021 EXISTING CONDITIONS			2023 WITHOUT THE PROJECT			2025 WITHOUT THE PROJECT			2025 WITH THE PROJECT		
	LOS[a]	Delay[b]	v/c[c]	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/Right	C	15.4	0.337	C	24.9	0.539	F	97.0	1.042	F	132.6	1.141
Westbound Left/Thru	A	8.7	0.061	A	9.6	0.083	B	10.3	0.150	B	10.3	0.154
PM Peak												
Northbound Left/Right	B	14.5	0.306	C	24.2	0.512	F	104.4	1.046	F	221.0	1.342
Westbound Left/Thru	A	8.1	0.080	A	8.6	0.107	A	9.4	0.227	A	9.4	0.228

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2010 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio



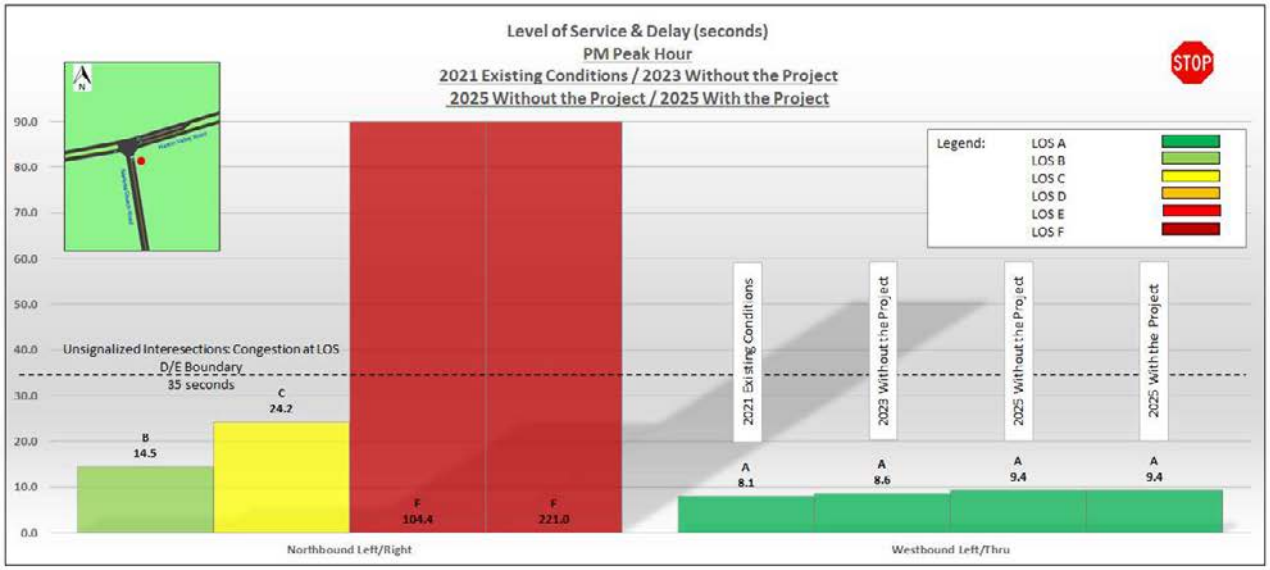
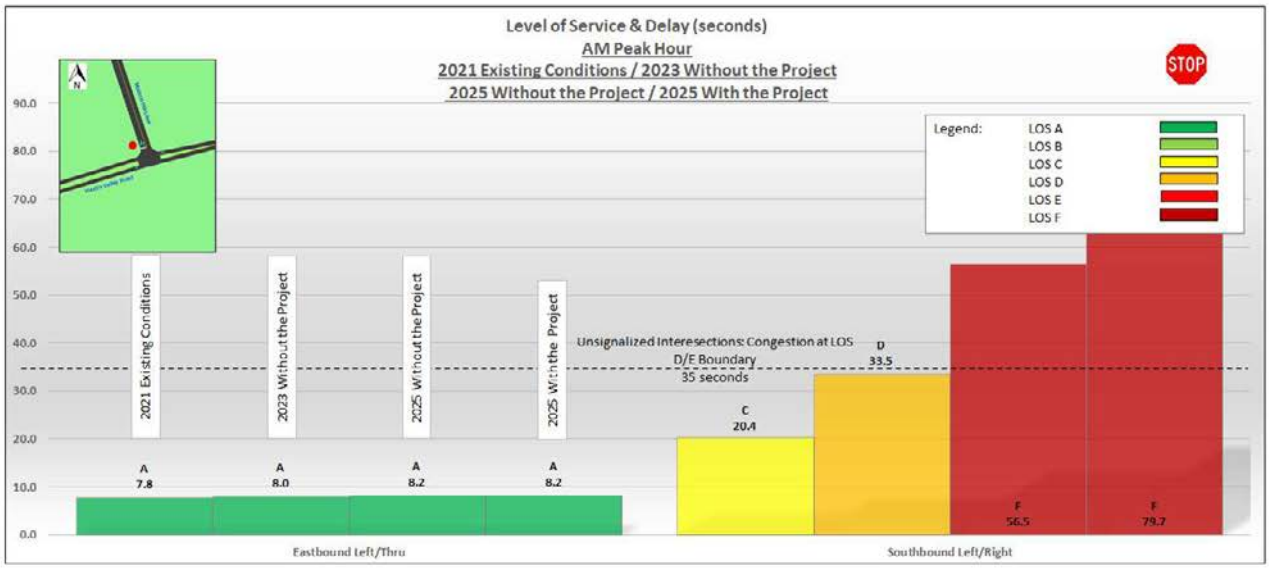
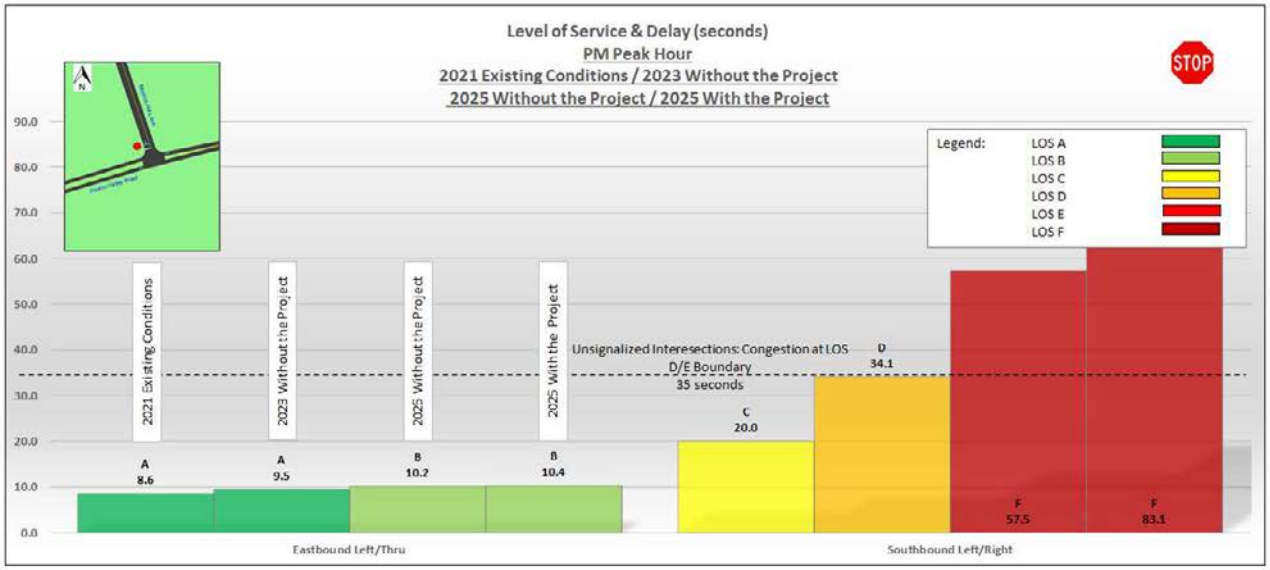


TABLE 7c
INTERSECTION CAPACITY ANALYSIS SUMMARY
HARDIN VALLEY ROAD AT MISSION HILL LANE

LOCATION / PEAK HOUR MOVEMENT	2021 EXISTING CONDITIONS			2023 WITHOUT THE PROJECT			2025 WITHOUT THE PROJECT			2025 WITH THE PROJECT		
	LOS[a]	Delay[b]	v/c[c]	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	7.8	0.003	A	8.0	0.003	A	8.2	0.003	A	8.2	0.004
Southbound Left/Right	C	20.4	0.204	D	33.5	0.324	F	56.5	0.472	F	79.7	0.650
PM Peak												
Eastbound Left/Thru	A	8.6	0.010	A	9.5	0.012	B	10.2	0.014	B	10.4	0.020
Southbound Left/Right	C	20.0	0.143	D	34.1	0.245	F	57.5	0.374	F	83.1	0.573

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2010 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio





▪ POTENTIAL TRANSPORTATION SAFETY ISSUES:

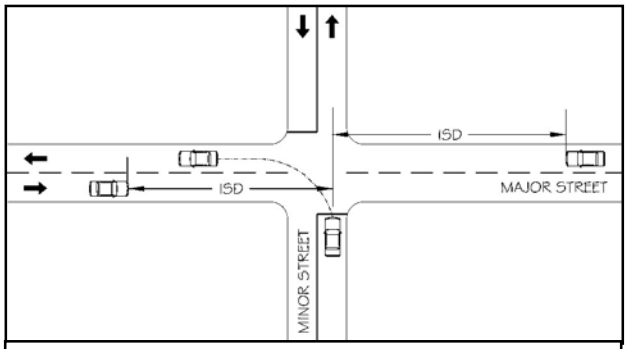
The study area was investigated for potential existing and future safety issues. A couple of features of the adjacent transportation system are discussed in the following pages.

☛ 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: left-turn, right-turn, or a crossing maneuver across the major road. For turns from the minor street, ISD is needed to allow a stopped motorist on a minor street to turn onto a major street without being overtaken by an approaching vehicle. The most critical 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. SSD is considered the desirable visibility distance standard for evaluating the safety of an intersection. In general, SSD is generally more critical than ISD; however, the ISD must be at least the same distance or greater than SSD for safe operations at an intersection.

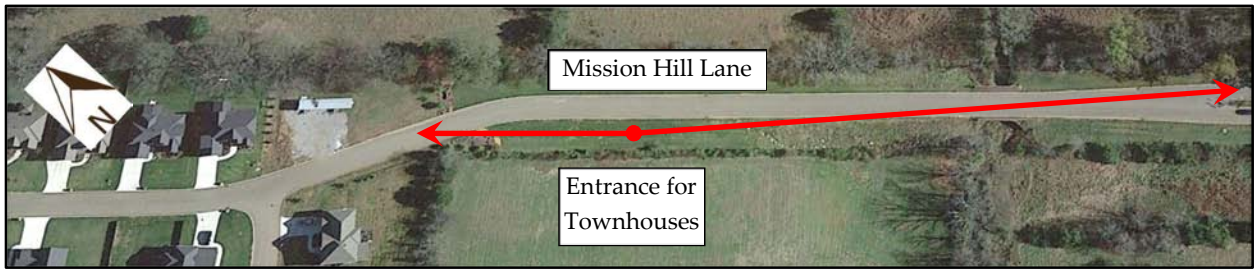
The development is proposing three new entrances (intersections), with one on Mission Hill Lane. With a posted speed limit of 25-mph on Mission Hill Lane, the ISD would be 250 feet looking north and south from the proposed entrance based on Knox County policy requiring 10 feet of sight distance per 1-mph of speed. At the proposed entrance for the townhouses on Mission Hill Lane, with a posted speed limit of 25-mph and an existing 15% road grade (downhill to the south), the SSD is 135 feet for northbound vehicles and 200 feet for southbound vehicles.

The proposed Main Entrance will be constructed on the north side of the intersection of Hardin Valley Road at Marietta Church Road. With a posted speed limit of 40-mph on Hardin Valley Road, the ISD would be 400 feet looking east and west from the proposed entrance. At the Main Entrance on Hardin Valley Road, with a posted speed limit of 40-mph and an existing 3% road grade (downhill to the west), the SSD is 290 feet for eastbound vehicles and 315 feet for westbound vehicles.

A cursory examination of the sight distances at the proposed entrances was undertaken. Based on visual observation, it appears that the intersection sight distances from the proposed entrances will be adequate. Using a Nikon Laser Rangefinder (limit of the rangefinder is 999 feet) at the proposed townhouse entrance, the intersection sight distance looking to the north was estimated to be 250+ feet and 999+ feet to the south. At the proposed Main Entrance, the intersection sight distance looking to the east was estimated to be 500+ feet and more than 999+ to the west.

The other studied intersections are relatively new and assumed to be constructed to current Knox County standards. During the site visit, they did not appear visually to have substandard sight distances.

Images of the existing sight distances from the proposed entrance locations on Mission Hill Lane and at the intersection of Hardin Valley Road at Marietta Church Road are presented in the following:

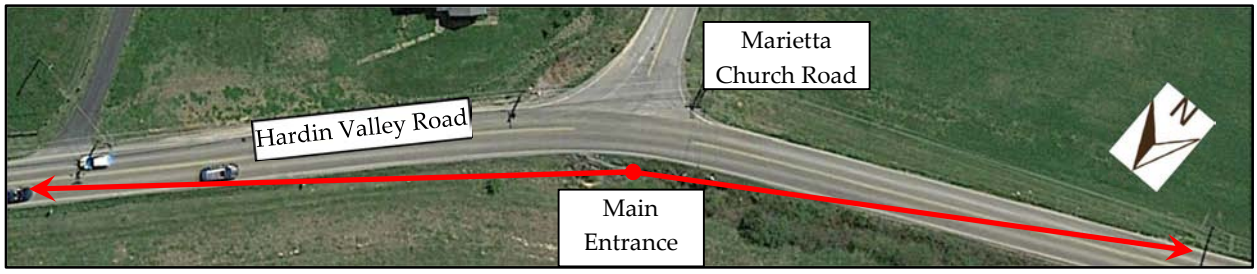


View of Sight Distance on Mission Hill Lane at Entrance for Townhouses (Looking North)

View of Sight Distance on Mission Hill Lane at Entrance for Townhouses (Looking South)

View of Sight Distance on Hardin Valley Road at Main Entrance (Looking East)

View of Sight Distance on Hardin Valley Road at Main Entrance (Looking West)



EVALUATION OF TURN LANE THRESHOLDS

An evaluation of the need for separate auxiliary turn lanes on Hardin Valley Road for entering vehicles into the proposed development was conducted at the intersections with Muddy Creek Lane, Mission Hill Lane, and Marietta Church Road. The evaluations were completed for the intersections in 2025 without the project and also with the Hoppe Property Subdivision included in 2025. The design policy used for these turn lane evaluations 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. The Knox County turn lane worksheets evaluations are in Appendix K.

The prior TIA completed for the Briggs Station Subdivision recommended constructing a 125-foot westbound left-turn lane on Hardin Valley Road at Marietta Church Road. The evaluation for this intersection in this study for the Hoppe Property Subdivision confirmed that a westbound left-turn lane would be needed, and an eastbound right-turn lane would be warranted. The results of the evaluations are summarized in Table 8.

TABLE 8
TURN LANE WARRANT SUMMARY

INTERSECTION	TURN LANE	TURN LANE WARRANTED 2025 WITHOUT PROJECT		TURN LANE WARRANTED 2025 WITH PROJECT	
		AM PEAK HOUR	PM PEAK HOUR	AM PEAK HOUR	PM PEAK HOUR
Hardin Valley Road at Mission Hill Lane	Eastbound Left	NO	NO	NO	NO
	Westbound Right	NO	YES	NO	YES
Hardin Valley Road at Muddy Creek Lane	Eastbound Left	NO	NO	NO	NO
	Westbound Right	NO	NO	NO	NO
Hardin Valley Road at Marietta Church Road	Westbound Left	YES	YES	YES	YES
	Eastbound Right	YES	NO	YES	NO

The table shows that a westbound right-turn lane on Hardin Valley Road at Mission Hill Lane and eastbound and westbound turn lanes on Hardin Valley Road at Marietta Church Road would be warranted in 2025 without the Hoppe Property Subdivision being developed.

CONCLUSIONS & RECOMMENDATIONS

The area in which the Hoppe Property Subdivision is proposed is seeing extreme residential growth. In addition to the Hoppe Property Subdivision, several other large subdivisions are currently under construction or nearly beginning construction. As shown in this study results, the addition of the Hoppe Property Subdivision will not appreciably impact the surrounding road system; however, the adjacent intersections will experience increased vehicle delays in the future due to the residential developments in the area.

The transportation impact studies recently completed for the other residential developments indicated that road improvements would be necessary in the near future in the study area. These recommendations included reconstructing the Hardin Valley Road/East Gallaher Ferry Road/ Hickory Creek Road intersection into a roundabout. In addition to this roundabout, the study for the Briggs Station Subdivision recommended a 125-foot westbound left-turn lane on Hardin Valley Road at Marietta Church Road. Other study conclusions have shown that this section of Hardin Valley Road will need to be reconstructed with multiple lanes with a 3-lane road section at a minimum.

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

1 **Hardin Valley Road at Marietta Church Road:** The northbound approach of this intersection, Marietta Church Road, was calculated to operate poorly in the projected 2025 conditions even without the project. As shown in Table 6, the proposed Main Entrance comprising the southbound approach would also operate at LOS F. It is recommended that this intersection be modified to provide adequate future road capacity to combat the projected considerable vehicle delays in the future.

1a) A roundabout was evaluated as a potential modification and remediation for the projected peak hour volumes at the intersection of Hardin Valley Road at Marietta Church Road. Modifying this intersection with a roundabout would eliminate the need for separate turn lanes. A roundabout was analyzed with single-lane approaches, and the results are shown in Table 9.

TABLE 9
2025 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITH THE PROJECT & IMPROVEMENTS)
Hardin Valley Road at Marietta Church Road and Main Entrance

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Hardin Valley Road at Marietta Church Road and Main Entrance	Roundabout	Eastbound Left/Thru/Right	B	14.5	0.725	A	9.3	0.496
		Westbound Left/Thru/Right	A	6.1	0.357	C	15.6	0.773
		Northbound Left/Thru/Right	C	17.8	0.596	A	8.5	0.369
		Southbound Left/Thru/Right	A	4.7	0.039	A	8.0	0.042

Note: Results shown for Roundabout of Hardin Valley Road at Marietta Church Road are reported with HCM 2010 Methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

With a roundabout at the intersection, the vehicle delays for the northbound approach of Marietta Church Road are significantly reduced. In the projected 2025 conditions with the project, the northbound approach operating under existing two-way stop control conditions will experience LOS F in the AM and PM peak hours. In contrast, with a roundabout, the northbound approach of Marietta Church Road would operate at LOS C and A in the AM and PM peak hours, respectively. The Main Entrance's southbound approach would also operate at LOS A with a roundabout instead of LOS F while controlled with a two-way stop.

As part of evaluating the projected 2025 conditions with the Main Entrance at Hardin Valley Road at Marietta Church Road and a roundabout, vehicle queue lengths at the intersection were calculated based on the projected 2025 traffic volumes. The previously mentioned Synchro Traffic Software includes SimTraffic. The Synchro portion of the software performs the macroscopic calculations for intersections, and SimTraffic performs micro-simulation and animation of vehicular traffic. SimTraffic (Version 8) software was utilized to estimate the queue lengths with the projected 2023 volumes.

The 95th percentile vehicle queue lengths were calculated based on the intersection operating as a roundabout. The 95th percentile vehicle queue is the recognized measurement in the traffic engineering profession as the design standard used when considering queue lengths. A 95th percentile vehicle queue length means 95% certainty that the vehicle queue will not extend beyond that point. The calculated

vehicle queue results were based on averaging the outcome obtained during ten traffic simulations. The vehicle queue results from the SimTraffic software are in Appendix L. The 95th percentile queue lengths with a roundabout at the intersection are shown in Table 10.

TABLE 10
95TH PERCENTILE VEHICLE QUEUE LENGTHS
2025 PROJECTED PEAK HOUR TRAFFIC VOLUMES
Hardin Valley Road at Marietta Church Road and Main Entrance

INTERSECTION	APPROACH/ MOVEMENT	SIMTRAFFIC 95th PERCENTILE VEHICLE QUEUE LENGTH (ft)	
		AM PEAK HOUR	PM PEAK HOUR
Hardin Valley Road at Marietta Church Road and Main Entrance	Eastbound Left/Thru/Right	167	79
	Westbound Left/Thru/Right	28	289
	Northbound Left/Thru/Right	90	62
	Southbound Left/Thru/Right	26	27

Note: 95th percentile queues were calculated in SimTraffic 8 software

These calculated queue lengths are reasonable for the northbound and southbound approaches. The projected queue lengths on Hardin Valley Road for eastbound and westbound traffic would not be unreasonable considering the number of projected volumes on these approaches.

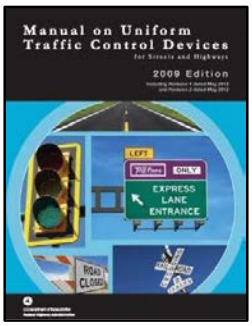
Overall, the projected results indicate that the intersection would operate poorly for northbound and southbound motorists operating under the existing stop control conditions even when adding a warranted westbound left-turn and eastbound right-turn lanes. The large vehicle delays in 2025 are estimated to occur even without the Hoppe Property Subdivision being developed. The significant growth in traffic volumes in the area combined with the proposed adjacent residential subdivisions will create intolerable delays that will not be satisfied operating under stop control.

Even further growth in the area past 2025 may support a multi-lane roundabout as part of the overall projections that Hardin Valley Road will need to be reconstructed with multiple traffic lanes. However, it is unknown if this would be an acceptable approach since a multi-lane roundabout would require increased right-of-way and reduced pedestrian and bicyclist safety. It would also require public education since a

multi-lane roundabout requires more forethought and higher-level decision-making. However, some single-lane roundabouts can be given additional service life by including right-turn bypass (slip) lanes. This is particularly true when right-turning volumes are large, as projected for the northbound traffic movements on Marietta Church Road towards the east.

1b) As an investigation into potential remediation for this intersection, this intersection was also examined concerning traffic signal warrants.

Methodology:



The Manual on Uniform Traffic Control Devices – 2009 Edition (MUTCD) presents nine different warrants that the traffic engineering profession has developed to determine whether a traffic signal is warranted. These warrants cover a broad range of minimum elements required to indicate whether a traffic signal is justified for any particular location. These elements consist of traffic volumes, pedestrian volumes, crash history, and other factors. The MUTCD explicitly states that a traffic control signal should not be installed unless one or more of the manual's signal warrants are met. However, the satisfaction of a warrant does not entirely in itself justify the need for a traffic signal. Sometimes further engineering studies and judgments also need to be applied before justifying the need for a traffic signal installation. These additional studies are a significant step in ensuring that a traffic signal's installation will not degrade safety and efficiencies.

The MUTCD defines nine different warrants, two of which are potentially applicable for this intersection at this time and are explained below:

Warrant #1, Eight-Hour Vehicular Volume:

Warrant #1 is comprised of 2 conditions – A and B. The Minimum Vehicular Volume, Condition A, is intended for application where the volume of intersecting traffic is the principal reason for consideration of signal installation. The Interruption of Continuous Traffic, Condition B, is intended for use at locations where Condition A is

not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

Warrant #2, Four-Hour Vehicular Volume:

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Even though nine warrants are offered to justify a traffic signal, according to the TDOT Traffic Signal Manual, the agency gives precedence to Warrant #1 (Eight Hour Vehicular Volume) and Warrant #7 (Crash Experience). Even though Warrant #2 is not a primary warrant used by TDOT, it is included in this study. Furthermore, TDOT does not allow installing a traffic signal on a state route based on speculative developments or unrealized traffic volumes.

The intersection was evaluated in the projected 2025 conditions to justify a traffic signal based on the MUTCD Warrants listed above. Marietta Church Road and the proposed Main Driveway were used as the minor side streets for the warrant analysis, and Hardin Valley Road was the major street. The original traffic count in 2016 at the intersection of Hardin Valley Road at Marietta Church Road only tabulated 6 hours of data. Thus, a complete 8-hour traffic signal warrant analysis was not achievable.

A spreadsheet was developed for the projected 2025 conditions to determine the traffic volumes generated by all the developments in the vicinity added to the intersection during the highest 6 hours of traffic based on the assumed traffic distribution in the projected conditions. This spreadsheet is shown in Appendix M. Based on this spreadsheet output, it is calculated that this intersection will not meet Warrant #1 or #2 in the year 2025 when right-turns are excluded from the analysis.

Even though TDOT does not typically accept justification for traffic signals except for Warrant #1 and #7, the intersection met Warrant #3 when right-turns were not included in the analysis. Warrant #3 is usually only used in rare instances such as

locations near office complexes, manufacturing plants, etc. According to the MUTCD, Warrant #3 "is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street." Appendix M shows the traffic signal warrant assessment for these evaluations.

When right-turns are included in the analysis, the intersection will likely meet Warrant #1 (it is not definitive due to the lack of a full 8 hours of traffic data) and will meet Warrants #2 and #3.

A cursory analysis of the intersection operating under a traffic signal in the projected conditions resulted in very favorable LOS conditions. However, separate left-turn lanes would be required on all approaches except for the southbound approach (the Main Entrance for the Hoppe Property Subdivision). In either instance, Knox County will need to provide resources and guidance on whether a roundabout or a traffic signal is the best course of action in the area.

Nonetheless, if desired, the justification for a traffic signal will likely be possible in 2025 if a roundabout is not chosen as potential intersection remediation. However, the strongest case could be made for a roundabout based on the traffic signal warrant evaluation that is tenuous at best.

1b) The Main Entrance for the Hoppe Property Subdivision should not be impacted by new signage or landscaping for the residential development and should provide the required sight distance.

2 **Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance:** In the projected 2025 conditions with the Hoppe Property Subdivision, this intersection is calculated to operate adequately in the projected 2025 conditions.

2a) The 2025 intersection capacity results at this intersection are shown in Table 11.

TABLE 11
2025 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITH THE PROJECT & IMPROVEMENTS)
Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance	Unsignalized	Northbound Left/Thru/Right	C	16.9	0.212	B	13.5	0.112
		Eastbound Left/Thru/Right	A	8.0	0.001	A	9.1	0.005
		Westbound Left/Thru/Right	A	9.1	0.012	A	8.3	0.032
		Southbound Left/Thru/Right	D	30.3	0.163	D	32.6	0.120

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2010 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

As part of evaluating the projected 2025 conditions, vehicle queue lengths at the intersection were calculated based on the projected 2025 traffic volumes. The vehicle queue results from the SimTraffic software are in Appendix L. The 95th percentile queue lengths at the intersection are shown in Table 12.

TABLE 12
95TH PERCENTILE VEHICLE QUEUE LENGTHS
2025 PROJECTED PEAK HOUR TRAFFIC VOLUMES
Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

INTERSECTION	APPROACH/ MOVEMENT	SIMTRAFFIC 95th PERCENTILE VEHICLE QUEUE LENGTH (ft)	
		AM PEAK HOUR	PM PEAK HOUR
Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance	Eastbound Left/Thru/Right	5	17
	Westbound Left/Thru/Right	30	39
	Northbound Left/Thru/Right	57	50
	Southbound Left/Thru/Right	42	37

Note: 95th percentile queues were calculated in SimTraffic 8 software

These calculated queue lengths are reasonable and would not impact upstream

intersections in the Hunters Way Subdivision, the Seal Property Subdivision, or Hardin Valley Road.

2b) It is recommended that the vegetation on the southbound approach of Muddy Creek Lane at Hardin Valley Road be trimmed and/or removed. This vegetation currently obscures the Stop Sign (R1-1).

Stop Sign Obscured on Muddy Creek Lane at Hardin Valley Road (Looking South)

3 **Hardin Valley Road at Mission Hill Lane:** In the projected 2025 conditions with the Hoppe Property Subdivision, this intersection is calculated to operate adequately in the projected 2025 conditions except for the southbound approach, as shown previously in Table 6. A westbound right-turn lane is warranted at this intersection in 2025, even without the Hoppe Property Subdivision being developed.

3a) The intersection capacity results with a westbound right-turn lane are shown in Table 13.

TABLE 13
2025 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITH THE PROJECT & IMPROVEMENTS)
Hardin Valley Road at Mission Hill Lane

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Hardin Valley Road at Mission Hill Lane	STOP Unsignalized	Eastbound Left/Thru	A	8.2	0.004	B	10.1	0.018
		Southbound Left/Right	F	77.1	0.639	F	75.0	0.539

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2010 methodology
Note 2: Results shown include a 75' WB Right-Turn Lane
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

As part of evaluating the projected 2025 conditions with the Main Entrance at Hardin Valley Road at Marietta Church Road, vehicle queue lengths at the intersection were calculated based on the projected 2025 traffic volumes. The 95th percentile queue lengths at the intersection are shown in Table 14. The vehicle queue results from the SimTraffic software are in Appendix L.

TABLE 14
95TH PERCENTILE VEHICLE QUEUE LENGTHS
2025 PROJECTED PEAK HOUR TRAFFIC VOLUMES
Hardin Valley Road at Mission Hill Lane

INTERSECTION	APPROACH/ MOVEMENT	SIMTRAFFIC 95th PERCENTILE VEHICLE QUEUE LENGTH (ft)	
		AM PEAK HOUR	PM PEAK HOUR
Hardin Valley Road at Mission Hill Lane	Eastbound Left/Thru	14	66
	Westbound Right	0	2
	Southbound Left/Right	75	56

Note: 95th percentile queues were calculated in SimTraffic 8 software

Besides LOS calculations, another appropriate metric to determine whether mitigation should be pursued can be based on projected vehicle queue lengths. When considerable vehicle delays are calculated for minor side streets, as in this case for the southbound approach, it does not always necessitate mitigation. If only one vehicle experiences a significant delay in attempting to enter a high-volume major street, mitigation is not always realistic nor particularly cost-effective. Likewise, mitigation should be pursued if many vehicles on a minor side street are experiencing significant delays.

As shown in Table 14, the calculated queue lengths are reasonable for the southbound approach, with the lengths indicating only a few vehicles at their maximum.

3b) Separate southbound left and right-turn lanes would not appreciably improve the overall vehicle delays since most turns will be left-turns towards the east with minimal right-turning volumes to the west. When Hardin Valley Road is expanded to include a center turn lane in the future, it is expected that the southbound vehicle delays will be significantly reduced. A center turn lane on Hardin Valley Road would allow exiting motorists to complete the left-turn in two stages and not rely on finding a traffic gap in both directions simultaneously and reduce vehicle delays.

3c) A westbound right-turn lane will be warranted on Hardin Valley Road at the intersection with Mission Hill Lane in the year 2025, whether the Hoppe Property Subdivision is developed or not. It is recommended that a 50-foot westbound right

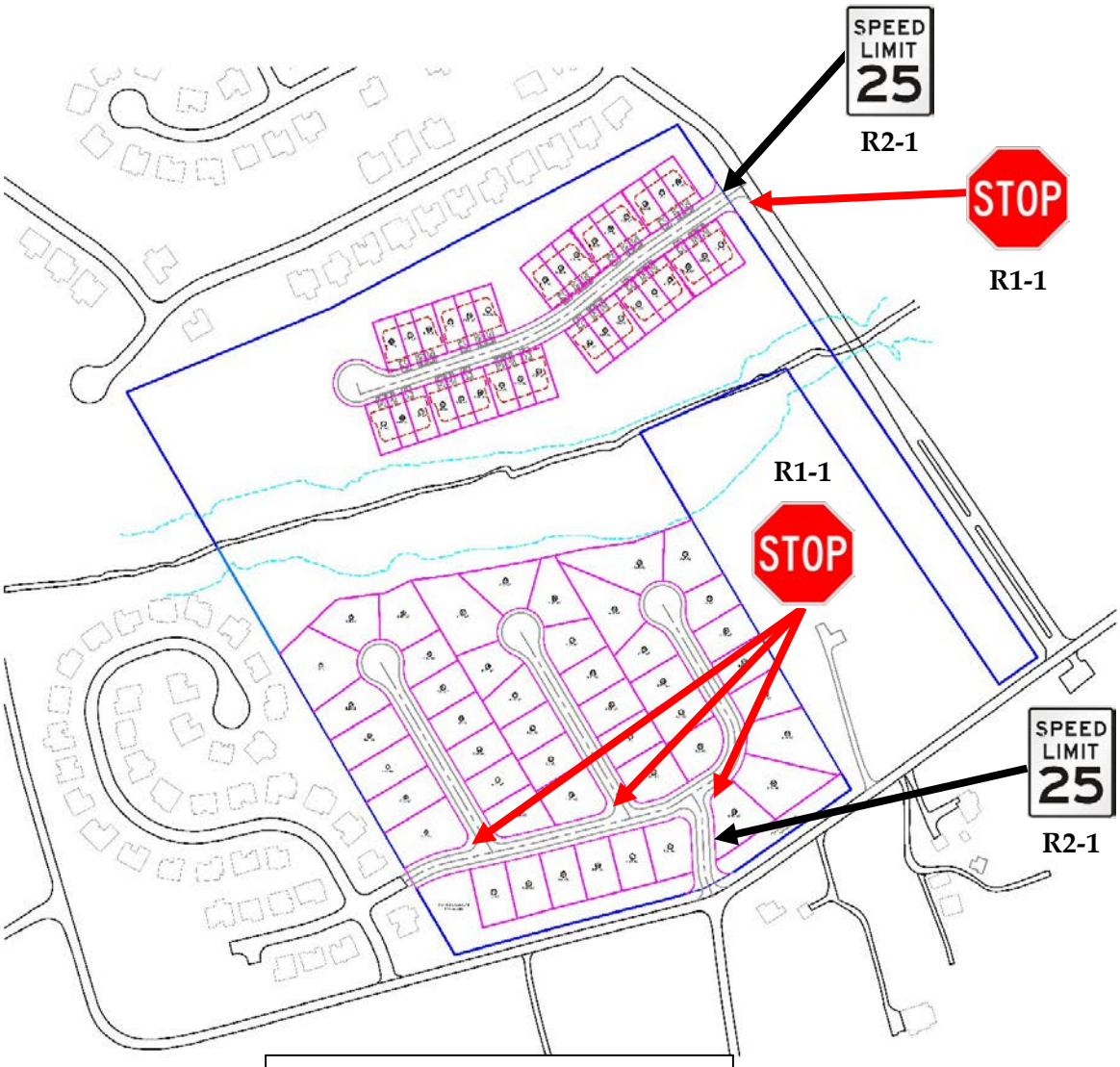
turn lane be constructed with a 100-foot taper. To accomplish this, the installation of a right-turn lane will need to be facilitated by Knox County since this length will infringe on the frontage of the adjacent property on Hardin Valley Road. Adding a westbound right-turn lane at this intersection could be beneficial to this adjacent property in the future if and when it is developed, and this benefit may provide a motivation to enable the construction.

3d) An eastbound left-turn lane will be below the threshold in the projected 2025 conditions with the project. The Hoppe Property Subdivision will add very few vehicles to this turning movement. It is not recommended that an eastbound left-turn lane specifically be built at this location for this development. Rather, this need would be fulfilled when Hardin Valley Road is eventually modified to a multi-lane facility. The few projected left-turn volumes would not justify constructing an exclusive left-turn lane.

4 **Hoppe Property Subdivision Internal Roads:** The current proposed plan layout shows five new roads constructed within the development, as shown in Figure 3.

4a) It is recommended that 25-mph Speed Limit Signs (R2-1) be posted near the beginning of each entrance within the development except for the entrance at Deer Crossing Drive due to the proximity of the existing signage on Muddy Creek Lane off Hardin Valley Road.

4b) Stop Signs (R1-1) and 24" white stop bars should be installed on the new internal streets, as shown below.



Internal Traffic Sign Locations

4c) Sight distance at the new internal intersections in the development must not be impacted by new signage or future landscaping. With a proposed internal speed limit of 25-mph, the intersection sight distance requirement is 280 feet. The stopping sight distance required is 155 feet for a level road grade. The site designer should ensure that these internal sight distance lengths are met internally.

4d) All drainage grates and covers for the residential development need to be pedestrian and bicycle-safe.

4e) The United States Postal Service (USPS) has implemented changes to its 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

4f) Lots in the subdivision should not directly access Hardin Valley Road.

4g) As mentioned previously, Knox County has recently completed a greenway study and has shown that Conner Creek is a preferred route for a new greenway that would connect Hardin Valley to Powell. The developer should discuss with Knox County if this potential greenway path is desirable or feasible to implement on the development property.

4h) All internal and external road grade and intersection elements should be designed to AASHTO, TDOT, and the Knox County, TN specifications and guidelines to ensure proper operation.

APPENDIX A

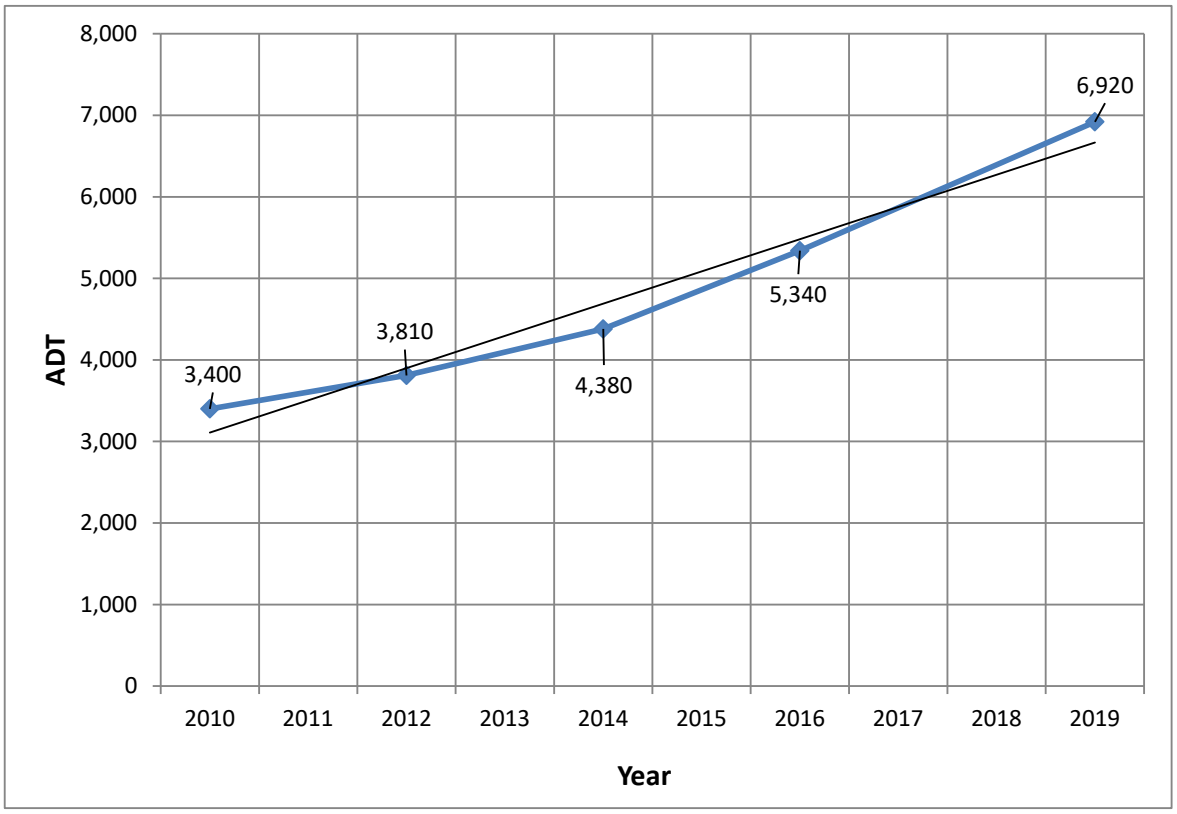
HISTORICAL TRAFFIC COUNT DATA

Historical Traffic Counts

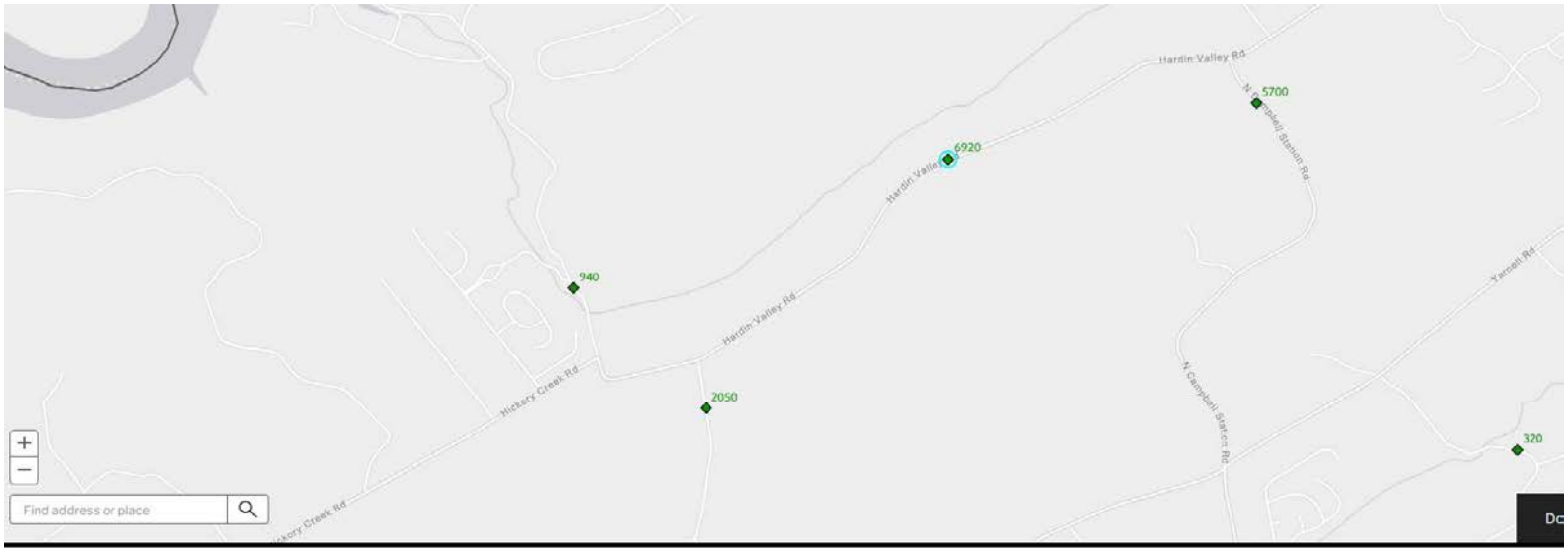
Organization: Knoxville TPO
Station ID #: 093M353
Location: Hardin Valley Road, east of Marietta Church Road

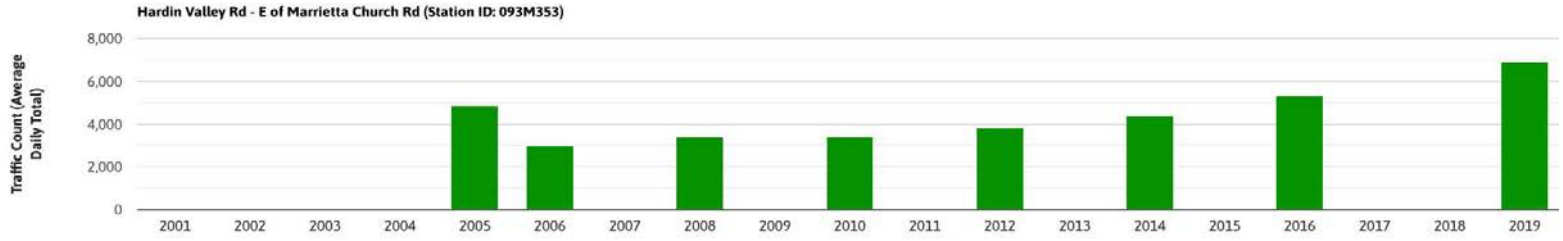
YEAR	AADT
2009	-
2010	3,400
2011	-
2012	3,810
2013	-
2014	4,380
2015	-
2016	5,340
2017	-
2018	-
2019	6,920

Trendline



2010 - 2019 Growth Rate = 103.5%
Average Annual Growth Rate = 8.2%


Hardin Valley Rd
5700
6920
940
Hardin Valley Rd
Hardin Valley Rd
2050
Hickory Creek Rd
N Campbell Station Rd
320
Find address or place

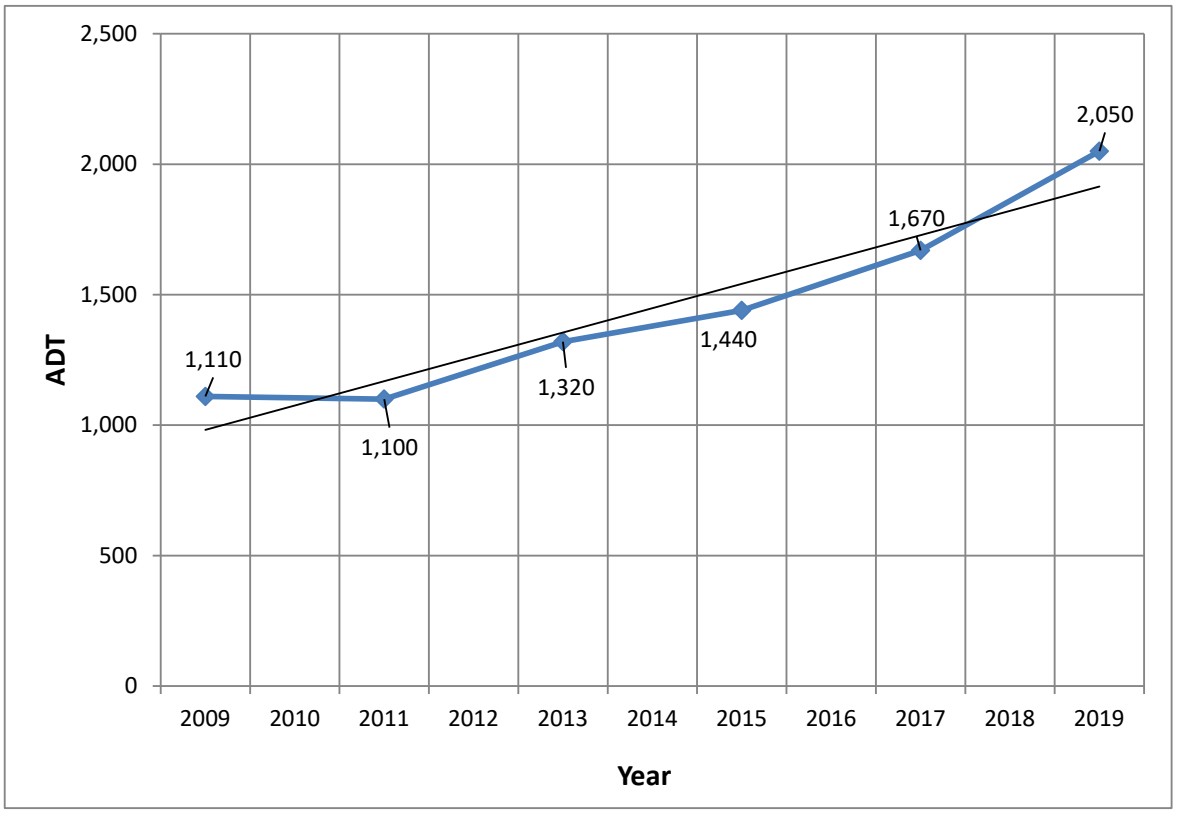

Hardin Valley Rd - E of Marrietta Church Rd (Station ID: 093M353)
Traffic Count (Average Daily Total)
8,000
6,000
4,000
2,000
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019

Historical Traffic Counts

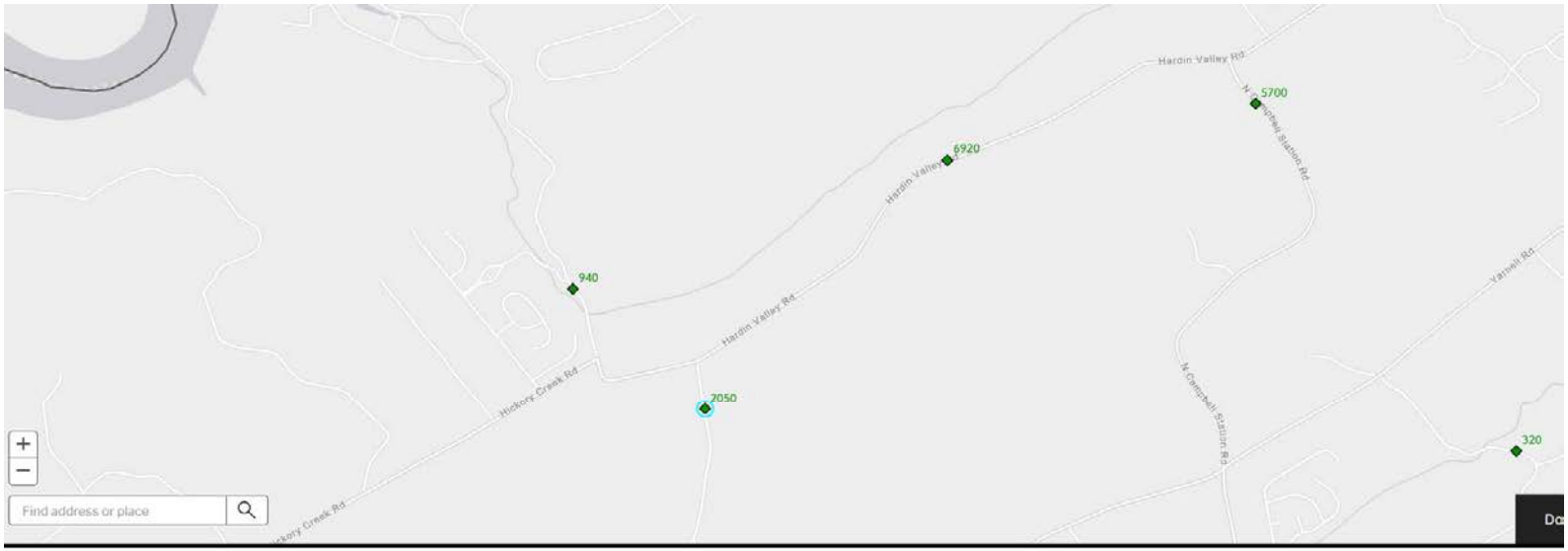
Organization: Knoxville TPO
Station ID #: 093M275
Location: Marietta Church Road, south of Hardin Valley Road

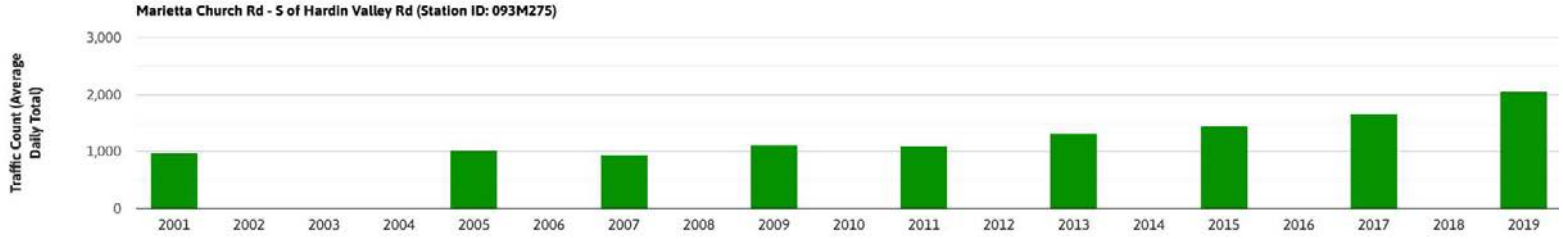
YEAR	AADT
2009	1,110
2010	
2011	1,100
2012	-
2013	1,320
2014	-
2015	1,440
2016	-
2017	1,670
2018	-
2019	2,050

Trendline



2009 - 2019 Growth Rate = 84.7%
Average Annual Growth Rate = 6.3%


Hardin Valley Rd
5700
6920
940
7050
320
Hickory Creek Rd
Find address or place

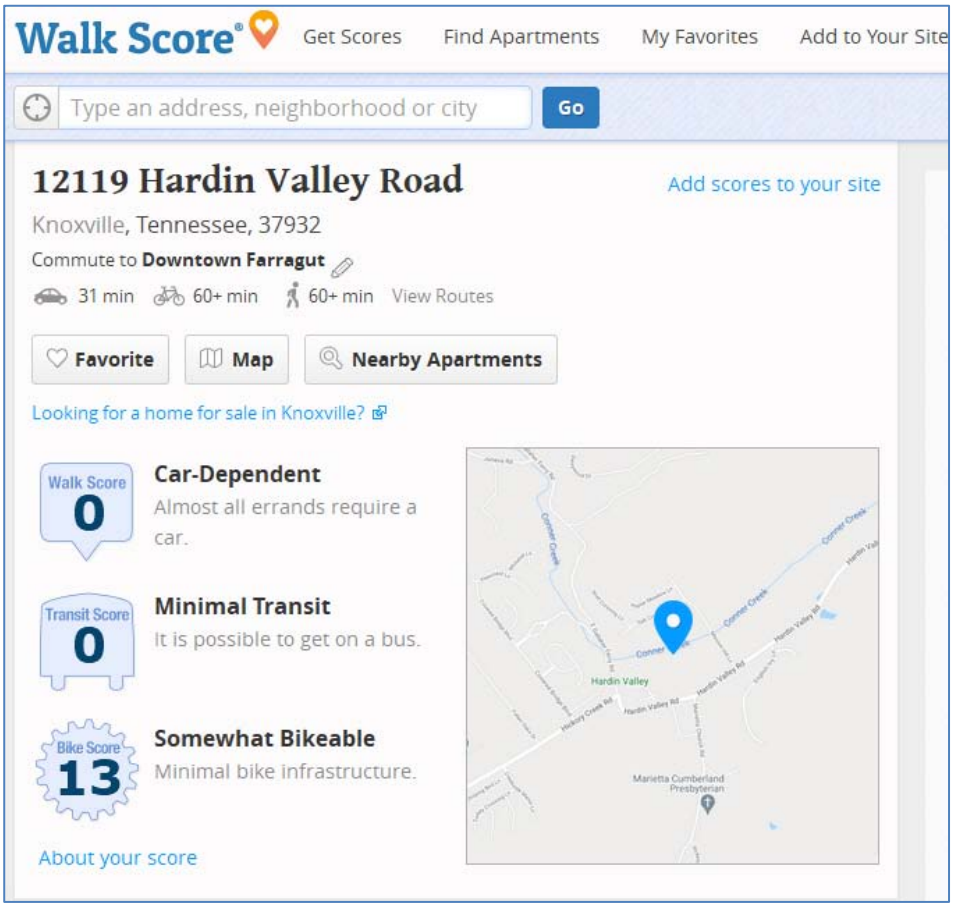

Marietta Church Rd - S of Hardin Valley Rd (Station ID: 093M275)
Traffic Count (Average Daily Total)
3,000
2,000
1,000
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019

APPENDIX B

WALK SCORE

WALKSCORE

(from walkscore.com)



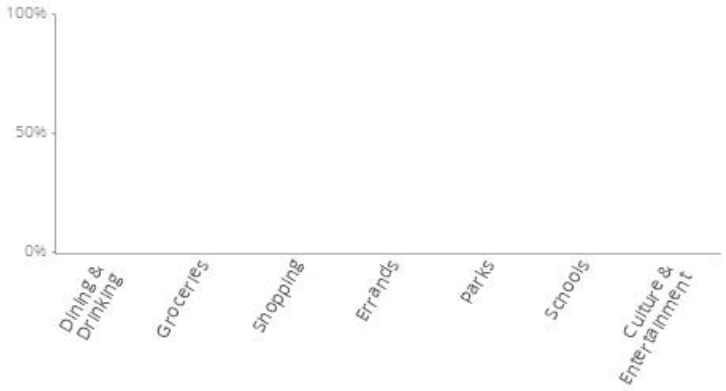
Scores for 12119 Hardin Valley Road

Bike Score
13

Walk Score | Transit Score | Bike Score

Score Details | What is Walk Score

The Walk Score for 12119 Hardin Valley Road is based on the following categories.



Scores for 12119 Hardin Valley Road

Bike Score
13

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 12119 Hardin Valley 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

What's Nearby

Restaurants:
Kasumi & Thai Cafe 2.6mi

Coffee:
Starbucks 3.7mi

Bars:
Big Kahuna Wings 3.8mi

Groceries:
Food City 1.6mi

Parks:
Melton Hill Park 2.3mi

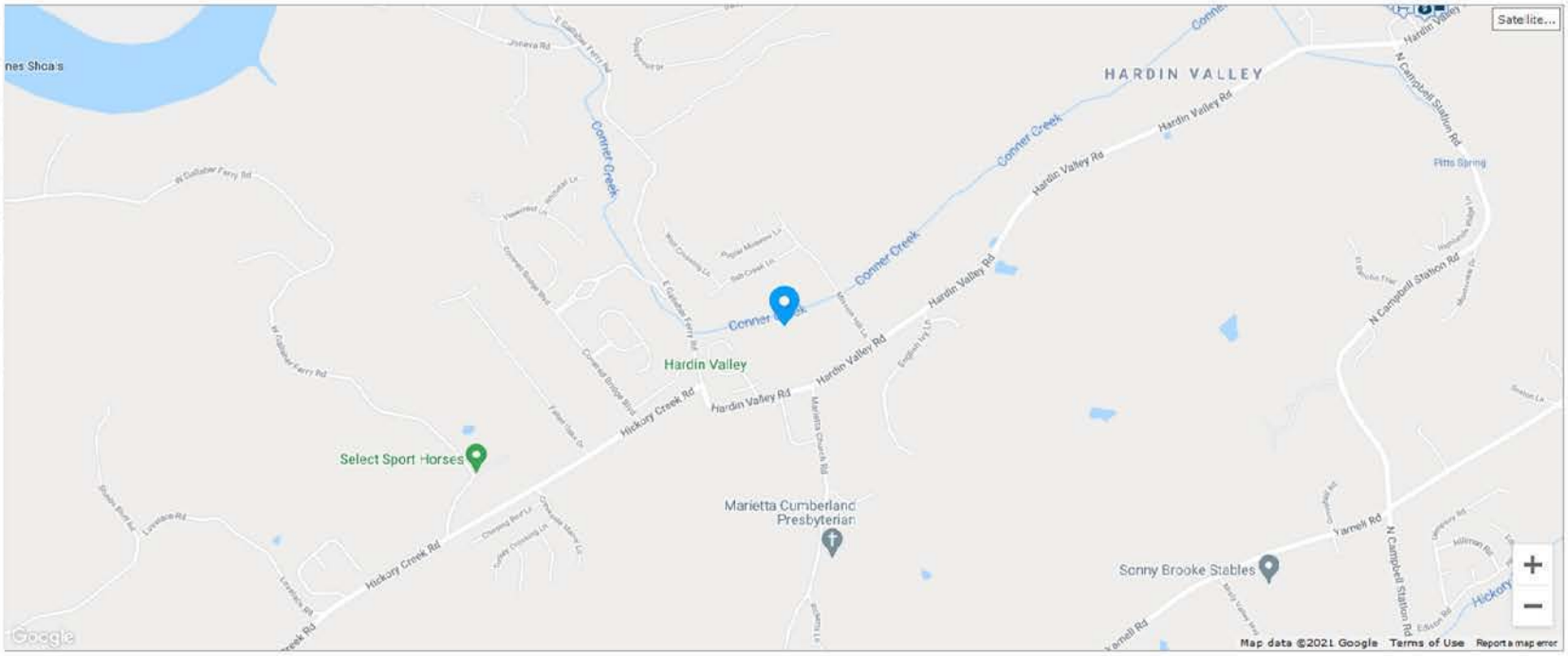
Schools:
Hardin Valley Elementary Sch... 1.8mi

Shopping:
Knoxville Landscaping Compa... 2.6mi

Entertainment:
Redbox 1.7mi

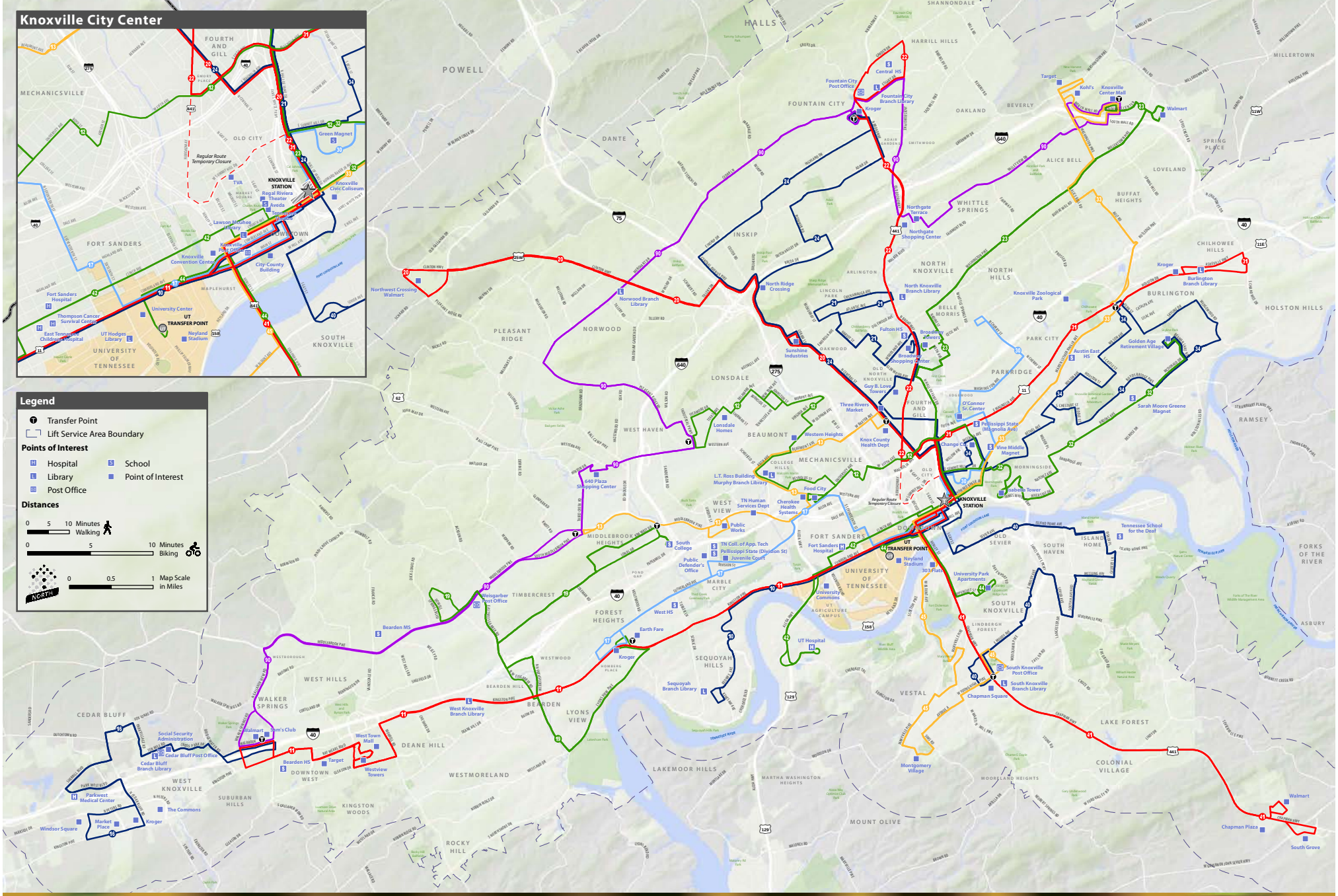
Errands:
U.S. Bank Branch 1.7mi

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

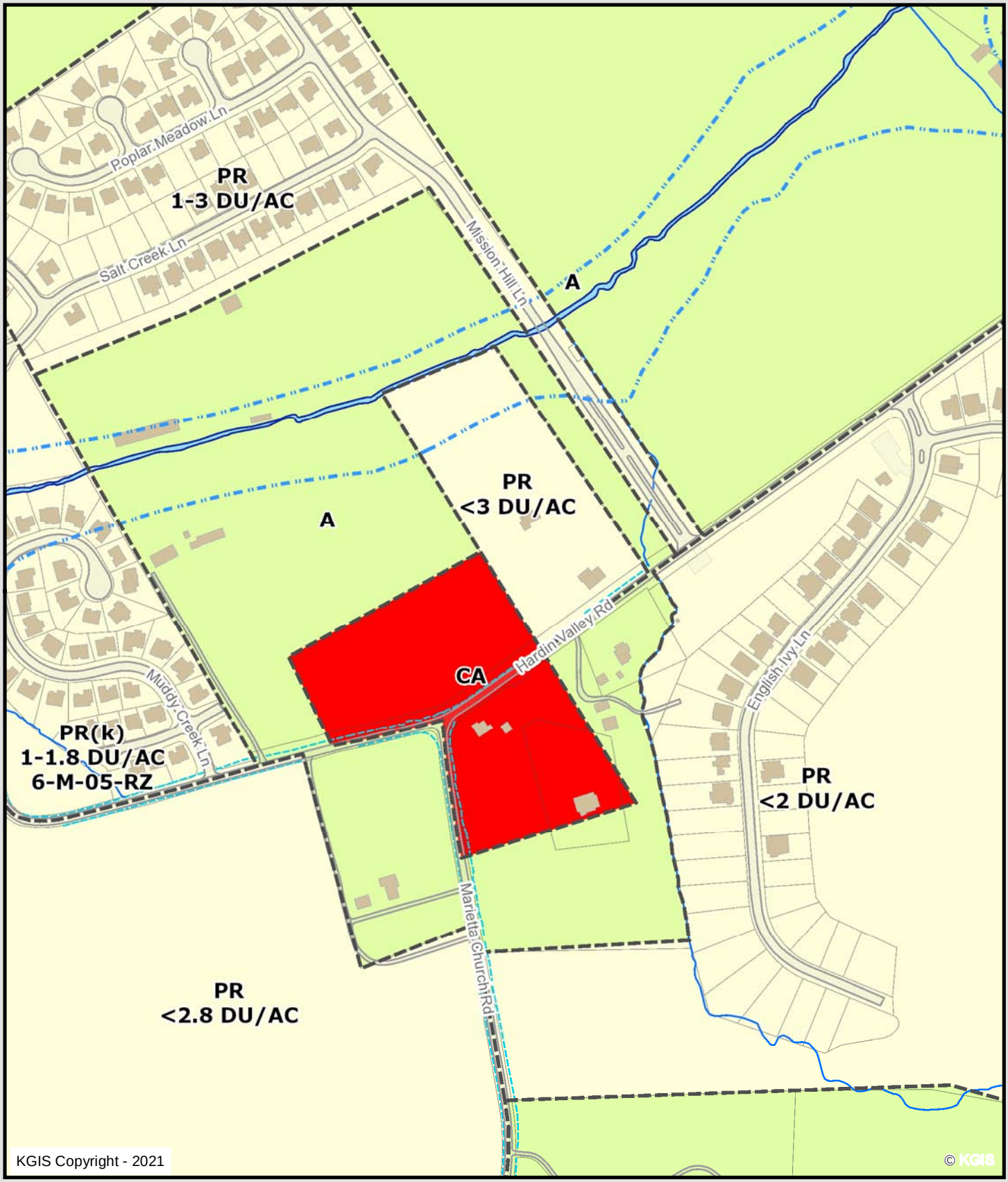
Information Updated: February 1, 2021

	Going from Wal Mart to Windsor Square				*Going from Windsor Square to Wal Mart*		
	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



Zoning Map

Knoxville - Knox County - KUB Geographic Information System

Printed: 7/5/2021 at 11:05:30 AM

0 200 400 800

ft

APPENDIX E

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: Hardin Valley Road (EB-WB)
Minor Street: Marietta Church Road (NB)
Traffic Control: Stop Control on Minor Street

11/1/2016 (Tuesday)
Warm/Sunny
Conducted by: Ajax Engineering

Primary Movement: Vehicles

TIME	WESTBOUND		NORTHBOUND		EASTBOUND		VEHICLE	PEAK
BEGIN	LT	THRU	LT	RT	THRU	RT	TOTAL	HOUR
7:00 AM	4	13	2	17	56	1	93	
7:15 AM	***3***	***26***	***3***	***15***	***85***	***2***	***134***	***7:15 AM - 8:15 AM***
7:30 AM	***9***	***31***	***4***	***17***	***78***	***5***	***144***	
7:45 AM	***7***	***26***	***3***	***23***	***54***	***3***	***116***	
8:00 AM	***5***	***36***	***0***	***25***	***66***	***2***	***134***	
8:15 AM	6	35	2	19	50	1	113	
8:30 AM	4	44	2	18	45	2	115	
8:45 AM	3	20	1	10	52	1	87	
TOTAL	41	231	17	144	486	17	936	
2:00 PM	11	41	5	5	32	1	95	
2:15 PM	4	40	2	5	25	2	78	
2:30 PM	5	27	5	5	38	2	82	
2:45 PM	13	45	3	2	45	0	108	
3:00 PM	13	40	4	10	28	3	98	
3:15 PM	6	39	2	6	40	0	93	
3:30 PM	16	38	7	8	25	2	96	
3:45 PM	24	55	4	4	31	2	120	
4:00 PM	14	42	3	3	28	6	96	
4:15 PM	9	54	2	6	31	2	104	
4:30 PM	9	48	3	6	37	7	110	
4:45 PM	7	61	6	6	35	2	117	
5:00 PM	***13***	***60***	***2***	***19***	***37***	***3***	***134***	***5:00 PM - 6:00 PM***
5:15 PM	***16***	***66***	***5***	***17***	***46***	***0***	***150***	
5:30 PM	***14***	***55***	***7***	***6***	***44***	***5***	***131***	
5:45 PM	***12***	***72***	***5***	***9***	***43***	***2***	***143***	
TOTAL	186	783	65	117	565	39	1755	

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

TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
7:15 AM	3	26	3	15	85	2
7:30 AM	9	31	4	17	78	5
7:45 AM	7	26	3	23	54	3
8:00 AM	5	36	0	25	66	2
TOTAL	24	119	10	80	283	12
PHF	0.67	0.83	0.63	0.80	0.83	0.60

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

TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
5:00 PM	13	60	2	19	37	3
5:15 PM	16	66	5	17	46	0
5:30 PM	14	55	7	6	44	5
5:45 PM	12	72	5	9	43	2
TOTAL	55	253	19	51	170	10
PHF	0.86	0.88	0.68	0.67	0.92	0.50

APPENDIX F

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 8)

EXISTING TRAFFIC CONDITIONS

Intersection	
Int Delay, s/veh	3.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	428	17	42	183	14	123
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, %	2	-	-	-2	-2	-
Peak Hour Factor	83	60	67	83	63	80
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	516	28	63	220	22	154

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	544	0	876	530
Stage 1	-	-	-	-	530	-
Stage 2	-	-	-	-	346	-
Critical Hdwy	-	-	4.1	-	6	6
Critical Hdwy Stg 1	-	-	-	-	5	-
Critical Hdwy Stg 2	-	-	-	-	5	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1035	-	355	569
Stage 1	-	-	-	-	630	-
Stage 2	-	-	-	-	749	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1035	-	331	569
Mov Cap-2 Maneuver	-	-	-	-	331	-
Stage 1	-	-	-	-	630	-
Stage 2	-	-	-	-	697	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.9	15.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	522	-	-	1035	-
HCM Lane V/C Ratio	0.337	-	-	0.061	-
HCM Control Delay (s)	15.4	-	-	8.7	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.5	-	-	0.2	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	3	548	217	15	46	8
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, %	-	2	-2	-	2	-
Peak Hour Factor	90	83	83	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	3	660	261	17	51	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	278	0	-	0	937	270
Stage 1	-	-	-	-	270	-
Stage 2	-	-	-	-	667	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1296	-	-	-	267	762
Stage 1	-	-	-	-	757	-
Stage 2	-	-	-	-	477	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1296	-	-	-	266	762
Mov Cap-2 Maneuver	-	-	-	-	266	-
Stage 1	-	-	-	-	757	-
Stage 2	-	-	-	-	475	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	20.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1296	-	-	-	294
HCM Lane V/C Ratio	0.003	-	-	-	0.204
HCM Control Delay (s)	7.8	0	-	-	20.4
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.8

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	424	190	7	21	4
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, %	-	2	-2	-	0	-
Peak Hour Factor	90	83	83	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	1	511	229	8	23	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	237	0	-	0	746	233
Stage 1	-	-	-	-	233	-
Stage 2	-	-	-	-	513	-
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	1342	-	-	-	384	811
Stage 1	-	-	-	-	810	-
Stage 2	-	-	-	-	605	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1342	-	-	-	384	811
Mov Cap-2 Maneuver	-	-	-	-	384	-
Stage 1	-	-	-	-	810	-
Stage 2	-	-	-	-	604	-

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

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1342	-	-	-	419
HCM Lane V/C Ratio	0.001	-	-	-	0.066
HCM Control Delay (s)	7.7	0	-	-	14.2
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	3.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	261	15	87	385	28	84
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, %	2	-	-	-2	-2	-
Peak Hour Factor	92	50	86	88	68	67
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	284	30	101	438	41	125

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	314	0	939	299
Stage 1	-	-	-	-	299	-
Stage 2	-	-	-	-	640	-
Critical Hdwy	-	-	4.1	-	6	6
Critical Hdwy Stg 1	-	-	-	-	5	-
Critical Hdwy Stg 2	-	-	-	-	5	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1258	-	328	758
Stage 1	-	-	-	-	782	-
Stage 2	-	-	-	-	568	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1258	-	293	758
Mov Cap-2 Maneuver	-	-	-	-	293	-
Stage 1	-	-	-	-	782	-
Stage 2	-	-	-	-	508	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.5	14.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	544	-	-	1258	-
HCM Lane V/C Ratio	0.306	-	-	0.08	-
HCM Control Delay (s)	14.5	-	-	8.1	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	1.3	-	-	0.3	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	9	336	467	52	31	5
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, %	-	2	-2	-	2	-
Peak Hour Factor	90	92	88	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	10	365	531	58	34	6

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	588	0	-	0	945	560
Stage 1	-	-	-	-	560	-
Stage 2	-	-	-	-	385	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	997	-	-	-	264	515
Stage 1	-	-	-	-	541	-
Stage 2	-	-	-	-	663	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	997	-	-	-	261	515
Mov Cap-2 Maneuver	-	-	-	-	261	-
Stage 1	-	-	-	-	541	-
Stage 2	-	-	-	-	654	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	20
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	997	-	-	-	280
HCM Lane V/C Ratio	0.01	-	-	-	0.143
HCM Control Delay (s)	8.6	0	-	-	20
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.5

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	4	262	391	22	14	2
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, %	-	2	-2	-	0	-
Peak Hour Factor	90	92	88	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	285	444	24	16	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	469	0	-	0	751	457
Stage 1	-	-	-	-	457	-
Stage 2	-	-	-	-	294	-
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	1103	-	-	-	381	608
Stage 1	-	-	-	-	642	-
Stage 2	-	-	-	-	761	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1103	-	-	-	379	608
Mov Cap-2 Maneuver	-	-	-	-	379	-
Stage 1	-	-	-	-	642	-
Stage 2	-	-	-	-	758	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	14.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1103	-	-	-	398
HCM Lane V/C Ratio	0.004	-	-	-	0.045
HCM Control Delay (s)	8.3	0	-	-	14.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

PROJECTED HORIZON YEAR TRAFFIC CONDITIONS (WITHOUT THE PROJECT)

Intersection	
Int Delay, s/veh	4.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	604	22	48	251	17	143
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, %	2	-	-	-2	-2	-
Peak Hour Factor	83	60	67	83	63	80
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	728	37	72	302	27	179

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	764	0	1192	746
Stage 1	-	-	-	-	746	-
Stage 2	-	-	-	-	446	-
Critical Hdwy	-	-	4.1	-	6	6
Critical Hdwy Stg 1	-	-	-	-	5	-
Critical Hdwy Stg 2	-	-	-	-	5	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	858	-	238	434
Stage 1	-	-	-	-	513	-
Stage 2	-	-	-	-	682	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	858	-	214	434
Mov Cap-2 Maneuver	-	-	-	-	214	-
Stage 1	-	-	-	-	513	-
Stage 2	-	-	-	-	613	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	24.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	382	-	-	858	-
HCM Lane V/C Ratio	0.539	-	-	0.083	-
HCM Control Delay (s)	24.9	-	-	9.6	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	3.1	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	3	744	291	15	46	8
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, %	-	2	-2	-	2	-
Peak Hour Factor	90	83	83	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	3	896	351	17	51	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	367	0	-	0	1262	359
Stage 1	-	-	-	-	359	-
Stage 2	-	-	-	-	903	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1203	-	-	-	165	676
Stage 1	-	-	-	-	683	-
Stage 2	-	-	-	-	361	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1203	-	-	-	164	676
Mov Cap-2 Maneuver	-	-	-	-	164	-
Stage 1	-	-	-	-	683	-
Stage 2	-	-	-	-	359	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	33.5
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1203	-	-	-	185
HCM Lane V/C Ratio	0.003	-	-	-	0.324
HCM Control Delay (s)	8	0	-	-	33.5
HCM Lane LOS	A	A	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	1.3

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	539	2	10	251	7	7	0	66	21	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	-2	-	-	0	-	-	0	-
Peak Hour Factor	90	83	90	90	83	90	90	90	90	90	90	90
Heavy Vehicles, %	0	2	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	1	649	2	11	302	8	8	0	73	23	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	310	0	0	652	0	0	984	985	651	1018	983	306
Stage 1	-	-	-	-	-	-	653	653	-	329	329	-
Stage 2	-	-	-	-	-	-	331	332	-	689	654	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1262	-	-	944	-	-	229	250	472	218	251	739
Stage 1	-	-	-	-	-	-	460	467	-	688	650	-
Stage 2	-	-	-	-	-	-	687	648	-	439	466	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1262	-	-	944	-	-	225	246	472	182	247	739
Mov Cap-2 Maneuver	-	-	-	-	-	-	225	246	-	182	247	-
Stage 1	-	-	-	-	-	-	460	467	-	687	641	-
Stage 2	-	-	-	-	-	-	673	639	-	370	466	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	15.4	25.1
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	427	1262	-	-	944	-	-	207
HCM Lane V/C Ratio	0.19	0.001	-	-	0.012	-	-	0.134
HCM Control Delay (s)	15.4	7.9	0	-	8.9	0	-	25.1
HCM Lane LOS	C	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.7	0	-	-	0	-	-	0.5

Intersection	
Int Delay, s/veh	4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	377	19	103	573	33	96
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, %	2	-	-	-2	-2	-
Peak Hour Factor	92	50	86	88	68	67
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	410	38	120	651	49	143

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	448	0	1320	429
Stage 1	-	-	-	-	429	-
Stage 2	-	-	-	-	891	-
Critical Hdwy	-	-	4.1	-	6	6
Critical Hdwy Stg 1	-	-	-	-	5	-
Critical Hdwy Stg 2	-	-	-	-	5	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1123	-	202	645
Stage 1	-	-	-	-	693	-
Stage 2	-	-	-	-	446	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1123	-	168	645
Mov Cap-2 Maneuver	-	-	-	-	168	-
Stage 1	-	-	-	-	693	-
Stage 2	-	-	-	-	372	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.3	24.2
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	375	-	-	1123	-
HCM Lane V/C Ratio	0.512	-	-	0.107	-
HCM Control Delay (s)	24.2	-	-	8.6	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	2.8	-	-	0.4	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	9	464	671	52	31	5
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, %	-	2	-2	-	2	-
Peak Hour Factor	90	92	88	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	10	504	762	58	34	6

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	820	0	-	0	1315	791
Stage 1	-	-	-	-	791	-
Stage 2	-	-	-	-	524	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	818	-	-	-	152	376
Stage 1	-	-	-	-	412	-
Stage 2	-	-	-	-	564	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	818	-	-	-	149	376
Mov Cap-2 Maneuver	-	-	-	-	149	-
Stage 1	-	-	-	-	412	-
Stage 2	-	-	-	-	554	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	34.1
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	818	-	-	-	163
HCM Lane V/C Ratio	0.012	-	-	-	0.245
HCM Control Delay (s)	9.5	0	-	-	34.1
HCM Lane LOS	A	A	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.9

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	339	8	33	551	22	5	0	43	14	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	-2	-	-	0	-	-	0	-
Peak Hour Factor	90	92	90	90	88	90	90	90	90	90	90	90
Heavy Vehicles, %	0	2	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	4	368	9	37	626	24	6	0	48	16	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	651	0	0	377	0	0	1095	1106	373	1118	1098	638
Stage 1	-	-	-	-	-	-	382	382	-	712	712	-
Stage 2	-	-	-	-	-	-	713	724	-	406	386	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	945	-	-	1193	-	-	193	212	678	186	215	480
Stage 1	-	-	-	-	-	-	645	616	-	427	439	-
Stage 2	-	-	-	-	-	-	426	433	-	626	614	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	945	-	-	1193	-	-	184	201	678	166	203	480
Mov Cap-2 Maneuver	-	-	-	-	-	-	184	201	-	166	203	-
Stage 1	-	-	-	-	-	-	642	613	-	425	417	-
Stage 2	-	-	-	-	-	-	403	412	-	579	611	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.4	12.6	27
HCM LOS			B	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	530	945	-	-	1193	-	-	181
HCM Lane V/C Ratio	0.101	0.005	-	-	0.031	-	-	0.098
HCM Control Delay (s)	12.6	8.8	0	-	8.1	0	-	27
HCM Lane LOS	B	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0.3

Intersection	
Int Delay, s/veh	21.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	658	27	81	274	28	242
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	125	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	2	-	-	-2	-2	-
Peak Hour Factor	83	60	67	83	63	80
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	793	45	121	330	44	302

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	838	0	1387	815
Stage 1	-	-	-	-	815	-
Stage 2	-	-	-	-	572	-
Critical Hdwy	-	-	4.1	-	6	6
Critical Hdwy Stg 1	-	-	-	-	5	-
Critical Hdwy Stg 2	-	-	-	-	5	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	805	-	186	398
Stage 1	-	-	-	-	480	-
Stage 2	-	-	-	-	606	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	805	-	158	398
Mov Cap-2 Maneuver	-	-	-	-	158	-
Stage 1	-	-	-	-	480	-
Stage 2	-	-	-	-	515	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.8	97
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	333	-	-	805	-
HCM Lane V/C Ratio	1.042	-	-	0.15	-
HCM Control Delay (s)	97	-	-	10.3	-
HCM Lane LOS	F	-	-	B	-
HCM 95th %tile Q(veh)	12.3	-	-	0.5	-

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	3	897	347	15	46	8
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, %	-	2	-2	-	2	-
Peak Hour Factor	90	83	83	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	3	1081	418	17	51	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	435	0	-	0	1513	426
Stage 1	-	-	-	-	426	-
Stage 2	-	-	-	-	1087	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1135	-	-	-	113	618
Stage 1	-	-	-	-	632	-
Stage 2	-	-	-	-	289	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1135	-	-	-	112	618
Mov Cap-2 Maneuver	-	-	-	-	112	-
Stage 1	-	-	-	-	632	-
Stage 2	-	-	-	-	287	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	56.5
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1135	-	-	-	127
HCM Lane V/C Ratio	0.003	-	-	-	0.472
HCM Control Delay (s)	8.2	0	-	-	56.5
HCM Lane LOS	A	A	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	2.1

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	598	2	10	285	7	7	0	66	21	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	-2	-	-	0	-	-	0	-
Peak Hour Factor	90	83	90	90	83	90	90	90	90	90	90	90
Heavy Vehicles, %	0	2	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	1	720	2	11	343	8	8	0	73	23	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	351	0	0	723	0	0	1096	1097	722	1129	1094	347
Stage 1	-	-	-	-	-	-	724	724	-	369	369	-
Stage 2	-	-	-	-	-	-	372	373	-	760	725	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1219	-	-	889	-	-	193	215	430	183	216	701
Stage 1	-	-	-	-	-	-	420	433	-	655	624	-
Stage 2	-	-	-	-	-	-	653	622	-	401	433	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1219	-	-	889	-	-	189	212	430	150	213	701
Mov Cap-2 Maneuver	-	-	-	-	-	-	189	212	-	150	213	-
Stage 1	-	-	-	-	-	-	420	433	-	654	615	-
Stage 2	-	-	-	-	-	-	639	613	-	332	433	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	16.9	29.9
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	383	1219	-	-	889	-	-	172
HCM Lane V/C Ratio	0.212	0.001	-	-	0.012	-	-	0.161
HCM Control Delay (s)	16.9	8	0	-	9.1	0	-	29.9
HCM Lane LOS	C	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.8	0	-	-	0	-	-	0.6

Intersection	
Int Delay, s/veh	19.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	409	33	208	621	44	162
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	125	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	2	-	-	-2	-2	-
Peak Hour Factor	92	50	86	88	68	67
Heavy Vehicles, %	2	0	0	2	0	0
Mvmt Flow	445	66	242	706	65	242

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	511	0	1667	478
Stage 1	-	-	-	-	478	-
Stage 2	-	-	-	-	1189	-
Critical Hdwy	-	-	4.1	-	6	6
Critical Hdwy Stg 1	-	-	-	-	5	-
Critical Hdwy Stg 2	-	-	-	-	5	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1065	-	129	607
Stage 1	-	-	-	-	662	-
Stage 2	-	-	-	-	333	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1065	-	100	607
Mov Cap-2 Maneuver	-	-	-	-	100	-
Stage 1	-	-	-	-	662	-
Stage 2	-	-	-	-	257	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.4	104.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	293	-	-	1065	-
HCM Lane V/C Ratio	1.046	-	-	0.227	-
HCM Control Delay (s)	104.4	-	-	9.4	-
HCM Lane LOS	F	-	-	A	-
HCM 95th %tile Q(veh)	11.6	-	-	0.9	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	9	562	824	52	31	5
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, %	-	2	-2	-	2	-
Peak Hour Factor	90	92	88	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	10	611	936	58	34	6

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	994	0	-	0	1596	965
Stage 1	-	-	-	-	965	-
Stage 2	-	-	-	-	631	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	704	-	-	-	99	296
Stage 1	-	-	-	-	335	-
Stage 2	-	-	-	-	498	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	704	-	-	-	97	296
Mov Cap-2 Maneuver	-	-	-	-	97	-
Stage 1	-	-	-	-	335	-
Stage 2	-	-	-	-	487	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	57.5
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	704	-	-	-	107
HCM Lane V/C Ratio	0.014	-	-	-	0.374
HCM Control Delay (s)	10.2	0	-	-	57.5
HCM Lane LOS	B	A	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	1.5

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	385	8	33	610	22	5	0	43	14	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	-2	-	-	0	-	-	0	-
Peak Hour Factor	90	92	90	90	88	90	90	90	90	90	90	90
Heavy Vehicles, %	0	2	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	4	418	9	37	693	24	6	0	48	16	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	718	0	0	427	0	0	1212	1223	423	1235	1215	705
Stage 1	-	-	-	-	-	-	432	432	-	779	779	-
Stage 2	-	-	-	-	-	-	780	791	-	456	436	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	892	-	-	1143	-	-	160	181	635	155	183	440
Stage 1	-	-	-	-	-	-	606	586	-	392	409	-
Stage 2	-	-	-	-	-	-	391	404	-	588	583	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	892	-	-	1143	-	-	152	170	635	137	172	440
Mov Cap-2 Maneuver	-	-	-	-	-	-	152	170	-	137	172	-
Stage 1	-	-	-	-	-	-	602	582	-	390	387	-
Stage 2	-	-	-	-	-	-	368	382	-	540	580	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.4	13.5	32.2
HCM LOS			B	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	477	892	-	-	1143	-	-	150
HCM Lane V/C Ratio	0.112	0.005	-	-	0.032	-	-	0.119
HCM Control Delay (s)	13.5	9.1	0	-	8.3	0	-	32.2
HCM Lane LOS	B	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.4	0	-	-	0.1	-	-	0.4

PROJECTED HORIZON YEAR TRAFFIC CONDITIONS (WITH THE PROJECT)

Intersection	
Int Delay, s/veh	39.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	658	27	83	274	8	28	1	243	25	3	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	125	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	-2	-	-	-2	-	-	0	-
Peak Hour Factor	92	83	60	67	83	92	63	92	80	92	92	92
Heavy Vehicles, %	2	2	0	0	2	2	0	2	0	2	2	2
Mvmt Flow	0	793	45	124	330	9	44	1	304	27	3	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	339	0	0	838	0	0	1399	1402	815	1550	1420	334
Stage 1	-	-	-	-	-	-	815	815	-	582	582	-
Stage 2	-	-	-	-	-	-	584	587	-	968	838	-
Critical Hdwy	4.12	-	-	4.1	-	-	6.7	6.12	6	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	5.7	5.12	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.7	5.12	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.5	4.018	3.3	3.518	4.018	3.318
Pot Cap-1 Maneuver	1220	-	-	805	-	-	139	164	398	93	136	708
Stage 1	-	-	-	-	-	-	410	428	-	499	499	-
Stage 2	-	-	-	-	-	-	535	530	-	305	382	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1220	-	-	805	-	-	120	139	398	~ 19	115	708
Mov Cap-2 Maneuver	-	-	-	-	-	-	120	139	-	~ 19	115	-
Stage 1	-	-	-	-	-	-	410	428	-	499	422	-
Stage 2	-	-	-	-	-	-	448	448	-	72	382	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	2.8	132.6	$ 605.1
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	306	1220	-	-	805	-	-	22
HCM Lane V/C Ratio	1.141	-	-	-	0.154	-	-	1.433
HCM Control Delay (s)	132.6	0	-	-	10.3	-	-	$ 605.1
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	14.5	0	-	-	0.5	-	-	4.1

Notes

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

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	4	922	355	18	59	10
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, %	-	2	-2	-	2	-
Peak Hour Factor	90	83	83	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	1111	428	20	66	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	448	0	-	0	1558	438
Stage 1	-	-	-	-	438	-
Stage 2	-	-	-	-	1120	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1123	-	-	-	105	608
Stage 1	-	-	-	-	624	-
Stage 2	-	-	-	-	278	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1123	-	-	-	104	608
Mov Cap-2 Maneuver	-	-	-	-	104	-
Stage 1	-	-	-	-	624	-
Stage 2	-	-	-	-	275	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	79.7
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1123	-	-	-	118
HCM Lane V/C Ratio	0.004	-	-	-	0.65
HCM Control Delay (s)	8.2	0	-	-	79.7
HCM Lane LOS	A	A	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	3.4

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	598	2	10	286	7	7	0	66	21	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	-2	-	-	0	-	-	0	-
Peak Hour Factor	90	83	90	90	83	90	90	90	90	90	90	90
Heavy Vehicles, %	0	2	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	1	720	2	11	345	8	8	0	73	23	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	352	0	0	723	0	0	1097	1099	722	1131	1096	348
Stage 1	-	-	-	-	-	-	724	724	-	371	371	-
Stage 2	-	-	-	-	-	-	373	375	-	760	725	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1218	-	-	889	-	-	192	214	430	182	215	700
Stage 1	-	-	-	-	-	-	420	433	-	653	623	-
Stage 2	-	-	-	-	-	-	652	621	-	401	433	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1218	-	-	889	-	-	188	211	430	149	212	700
Mov Cap-2 Maneuver	-	-	-	-	-	-	188	211	-	149	212	-
Stage 1	-	-	-	-	-	-	420	433	-	652	614	-
Stage 2	-	-	-	-	-	-	638	612	-	332	433	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	16.9	30.3
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	383	1218	-	-	889	-	-	170
HCM Lane V/C Ratio	0.212	0.001	-	-	0.012	-	-	0.163
HCM Control Delay (s)	16.9	8	0	-	9.1	0	-	30.3
HCM Lane LOS	C	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.8	0	-	-	0	-	-	0.6

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	4	1	0	0	1	6	0	0	20	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	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	0	4	1	0	0	1	7	0	0	22	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	31	31	22	33	31	7	22	0	0	7	0	0
Stage 1	22	22	-	9	9	-	-	-	-	-	-	-
Stage 2	9	9	-	24	22	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	982	866	1061	979	866	1081	1607	-	-	1627	-	-
Stage 1	1002	881	-	1017	892	-	-	-	-	-	-	-
Stage 2	1017	892	-	999	881	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	981	865	1061	974	865	1081	1607	-	-	1627	-	-
Mov Cap-2 Maneuver	981	865	-	974	865	-	-	-	-	-	-	-
Stage 1	1001	881	-	1016	891	-	-	-	-	-	-	-
Stage 2	1016	891	-	995	881	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.4	8.7	1	0
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1607	-	-	1061	974	1627	-	-
HCM Lane V/C Ratio	0.001	-	-	0.004	0.001	-	-	-
HCM Control Delay (s)	7.2	0	-	8.4	8.7	0	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	15	4	18	54	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	10	-10	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	17	4	20	60	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	89	60	60	0	-	0
Stage 1	60	-	-	-	-	-
Stage 2	29	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	917	1011	1556	-	-	-
Stage 1	968	-	-	-	-	-
Stage 2	999	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	914	1011	1556	-	-	-
Mov Cap-2 Maneuver	914	-	-	-	-	-
Stage 1	968	-	-	-	-	-
Stage 2	996	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.6	1.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1556	-	1011	-	-
HCM Lane V/C Ratio	0.003	-	0.016	-	-
HCM Control Delay (s)	7.3	0	8.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	41.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	410	33	209	622	26	44	3	164	15	2	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	125	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	-2	-	-	-2	-	-	0	-
Peak Hour Factor	92	92	50	86	88	92	68	92	67	92	92	92
Heavy Vehicles, %	2	2	0	0	2	2	0	2	0	2	2	2
Mvmt Flow	2	446	66	243	707	28	65	3	245	16	2	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	735	0	0	512	0	0	1692	1704	479	1814	1723	721
Stage 1	-	-	-	-	-	-	483	483	-	1207	1207	-
Stage 2	-	-	-	-	-	-	1209	1221	-	607	516	-
Critical Hdwy	4.12	-	-	4.1	-	-	6.7	6.12	6	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	5.7	5.12	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.7	5.12	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.5	4.018	3.3	3.518	4.018	3.318
Pot Cap-1 Maneuver	870	-	-	1064	-	-	90	111	607	60	89	427
Stage 1	-	-	-	-	-	-	600	583	-	224	256	-
Stage 2	-	-	-	-	-	-	258	289	-	483	534	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	870	-	-	1064	-	-	72	85	607	29	68	427
Mov Cap-2 Maneuver	-	-	-	-	-	-	72	85	-	29	68	-
Stage 1	-	-	-	-	-	-	598	581	-	223	198	-
Stage 2	-	-	-	-	-	-	196	223	-	286	532	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	2.3	221	216.1
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	233	870	-	-	1064	-	-	33
HCM Lane V/C Ratio	1.342	0.002	-	-	0.228	-	-	0.593
HCM Control Delay (s)	221	9.1	0	-	9.4	-	-	216.1
HCM Lane LOS	F	A	A	-	A	-	-	F
HCM 95th %tile Q(veh)	16.9	0	-	-	0.9	-	-	2

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	12	577	850	67	43	7
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, %	-	2	-2	-	2	-
Peak Hour Factor	90	92	88	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	13	627	966	74	48	8

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1040	0	-	0	1657	1003
Stage 1	-	-	-	-	1003	-
Stage 2	-	-	-	-	654	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	676	-	-	-	91	280
Stage 1	-	-	-	-	320	-
Stage 2	-	-	-	-	485	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	676	-	-	-	88	280
Mov Cap-2 Maneuver	-	-	-	-	88	-
Stage 1	-	-	-	-	320	-
Stage 2	-	-	-	-	470	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	83.1
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	676	-	-	-	97
HCM Lane V/C Ratio	0.02	-	-	-	0.573
HCM Control Delay (s)	10.4	0	-	-	83.1
HCM Lane LOS	B	A	-	-	F
HCM 95th %tile Q(veh)	0.1	-	-	-	2.7

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	388	8	33	612	22	5	0	43	14	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	-2	-	-	0	-	-	0	-
Peak Hour Factor	90	92	90	90	88	90	90	90	90	90	90	90
Heavy Vehicles, %	0	2	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	4	422	9	37	695	24	6	0	48	16	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	720	0	0	431	0	0	1217	1228	426	1240	1221	708
Stage 1	-	-	-	-	-	-	435	435	-	781	781	-
Stage 2	-	-	-	-	-	-	782	793	-	459	440	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	891	-	-	1139	-	-	159	180	633	153	181	438
Stage 1	-	-	-	-	-	-	604	584	-	391	408	-
Stage 2	-	-	-	-	-	-	390	403	-	586	581	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	891	-	-	1139	-	-	151	169	633	135	170	438
Mov Cap-2 Maneuver	-	-	-	-	-	-	151	169	-	135	170	-
Stage 1	-	-	-	-	-	-	600	580	-	389	386	-
Stage 2	-	-	-	-	-	-	367	381	-	539	578	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.4	13.5	32.6
HCM LOS			B	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	475	891	-	-	1139	-	-	148
HCM Lane V/C Ratio	0.112	0.005	-	-	0.032	-	-	0.12
HCM Control Delay (s)	13.5	9.1	0	-	8.3	0	-	32.6
HCM Lane LOS	B	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.4	0	-	-	0.1	-	-	0.4

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	2	1	0	0	4	21	1	0	13	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	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	0	2	1	0	0	4	23	1	0	14	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	47	47	14	49	47	24	14	0	0	24	0	0
Stage 1	14	14	-	33	33	-	-	-	-	-	-	-
Stage 2	33	33	-	16	14	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	959	849	1072	956	849	1058	1617	-	-	1604	-	-
Stage 1	1011	888	-	988	872	-	-	-	-	-	-	-
Stage 2	988	872	-	1009	888	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	957	846	1072	952	846	1058	1617	-	-	1604	-	-
Mov Cap-2 Maneuver	957	846	-	952	846	-	-	-	-	-	-	-
Stage 1	1008	888	-	985	869	-	-	-	-	-	-	-
Stage 2	985	869	-	1007	888	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.4	8.8	1.1	0
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1617	-	-	1072	952	1604	-	-
HCM Lane V/C Ratio	0.003	-	-	0.002	0.001	-	-	-
HCM Control Delay (s)	7.2	0	-	8.4	8.8	0	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	14	18	61	36	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	10	-10	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	16	20	68	40	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	148	40	40	0	-	0
Stage 1	40	-	-	-	-	-
Stage 2	108	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	849	1037	1583	-	-	-
Stage 1	988	-	-	-	-	-
Stage 2	921	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	838	1037	1583	-	-	-
Mov Cap-2 Maneuver	838	-	-	-	-	-
Stage 1	988	-	-	-	-	-
Stage 2	909	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.5	1.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1583	-	1037	-	-
HCM Lane V/C Ratio	0.013	-	0.015	-	-
HCM Control Delay (s)	7.3	0	8.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

PROJECTED HORIZON YEAR TRAFFIC CONDITIONS
(WITH THE PROJECT & IMPROVEMENTS)

Intersection	
Intersection Delay, s/veh	12.7
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	838	463	349	32
Demand Flow Rate, veh/h	854	470	349	32
Vehicles Circulating, veh/h	155	45	837	505
Vehicles Exiting, veh/h	382	1141	172	10
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	14.5	6.1	17.8	4.7
Approach LOS	B	A	C	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	4.990	4.990	4.990	4.990
Entry Flow, veh/h	854	470	349	32
Cap Entry Lane, veh/h	1177	1318	586	823
Entry HV Adj Factor	0.981	0.986	1.000	1.000
Flow Entry, veh/h	838	463	349	32
Cap Entry, veh/h	1156	1299	586	823
V/C Ratio	0.725	0.357	0.596	0.039
Control Delay, s/veh	14.5	6.1	17.8	4.7
LOS	B	A	C	A
95th %tile Queue, veh	7	2	4	0

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	4	922	355	18	59	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	75	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	2	-
Peak Hour Factor	90	83	83	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	1111	428	20	66	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	428	0	-	0	1548	428
Stage 1	-	-	-	-	428	-
Stage 2	-	-	-	-	1120	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1142	-	-	-	107	616
Stage 1	-	-	-	-	631	-
Stage 2	-	-	-	-	278	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1142	-	-	-	106	616
Mov Cap-2 Maneuver	-	-	-	-	106	-
Stage 1	-	-	-	-	631	-
Stage 2	-	-	-	-	275	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	77.1
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1142	-	-	-	120
HCM Lane V/C Ratio	0.004	-	-	-	0.639
HCM Control Delay (s)	8.2	0	-	-	77.1
HCM Lane LOS	A	A	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	3.3

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	598	2	10	286	7	7	0	66	21	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	-2	-	-	0	-	-	0	-
Peak Hour Factor	90	83	90	90	83	90	90	90	90	90	90	90
Heavy Vehicles, %	0	2	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	1	720	2	11	345	8	8	0	73	23	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	352	0	0	723	0	0	1097	1099	722	1131	1096	348
Stage 1	-	-	-	-	-	-	724	724	-	371	371	-
Stage 2	-	-	-	-	-	-	373	375	-	760	725	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1218	-	-	889	-	-	192	214	430	182	215	700
Stage 1	-	-	-	-	-	-	420	433	-	653	623	-
Stage 2	-	-	-	-	-	-	652	621	-	401	433	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1218	-	-	889	-	-	188	211	430	149	212	700
Mov Cap-2 Maneuver	-	-	-	-	-	-	188	211	-	149	212	-
Stage 1	-	-	-	-	-	-	420	433	-	652	614	-
Stage 2	-	-	-	-	-	-	638	612	-	332	433	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	16.9	30.3
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	383	1218	-	-	889	-	-	170
HCM Lane V/C Ratio	0.212	0.001	-	-	0.012	-	-	0.163
HCM Control Delay (s)	16.9	8	0	-	9.1	0	-	30.3
HCM Lane LOS	C	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	0.8	0	-	-	0	-	-	0.6

Intersection	
Intersection Delay, s/veh	12.5
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	514	979	313	20
Demand Flow Rate, veh/h	523	993	313	20
Vehicles Circulating, veh/h	262	70	474	1029
Vehicles Exiting, veh/h	787	717	311	34
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.3	15.6	8.5	8.0
Approach LOS	A	C	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	4.990	4.990	4.990	4.990
Entry Flow, veh/h	523	993	313	20
Cap Entry Lane, veh/h	1055	1284	849	481
Entry HV Adj Factor	0.983	0.986	1.000	1.000
Flow Entry, veh/h	514	979	313	20
Cap Entry, veh/h	1037	1266	849	481
V/C Ratio	0.496	0.773	0.369	0.042
Control Delay, s/veh	9.3	15.6	8.5	8.0
LOS	A	C	A	A
95th %tile Queue, veh	3	8	2	0

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	12	577	850	67	43	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	75	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	2	-
Peak Hour Factor	90	92	88	90	90	90
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	13	627	966	74	48	8

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	966	0	-	0	1620	966
Stage 1	-	-	-	-	966	-
Stage 2	-	-	-	-	654	-
Critical Hdwy	4.1	-	-	-	6.8	6.4
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	721	-	-	-	96	295
Stage 1	-	-	-	-	335	-
Stage 2	-	-	-	-	485	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	721	-	-	-	93	295
Mov Cap-2 Maneuver	-	-	-	-	93	-
Stage 1	-	-	-	-	335	-
Stage 2	-	-	-	-	471	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	75
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	721	-	-	-	103
HCM Lane V/C Ratio	0.018	-	-	-	0.539
HCM Control Delay (s)	10.1	0	-	-	75
HCM Lane LOS	B	A	-	-	F
HCM 95th %tile Q(veh)	0.1	-	-	-	2.5

APPENDIX G

ADJACENT SUBDIVISION INFORMATION

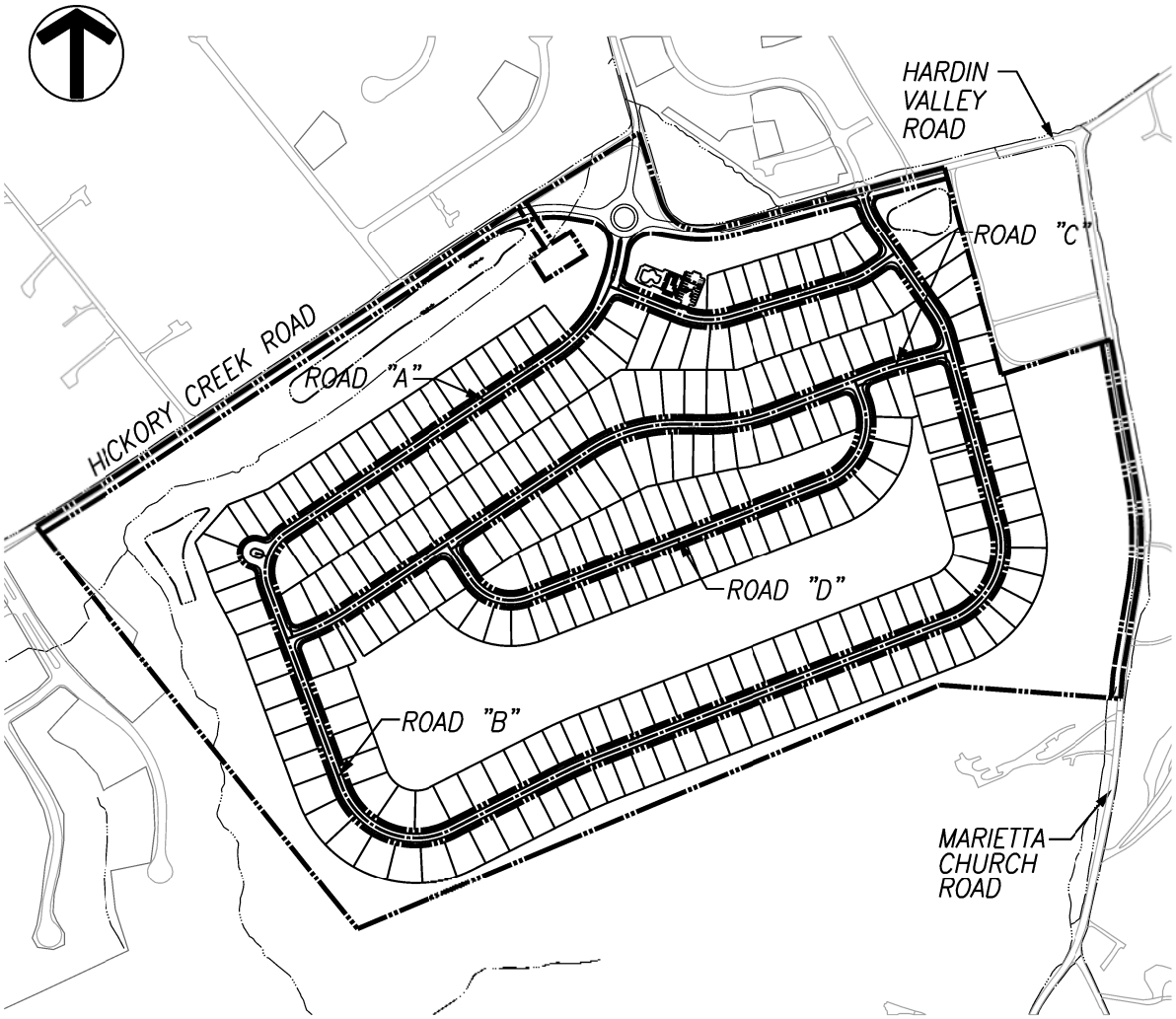
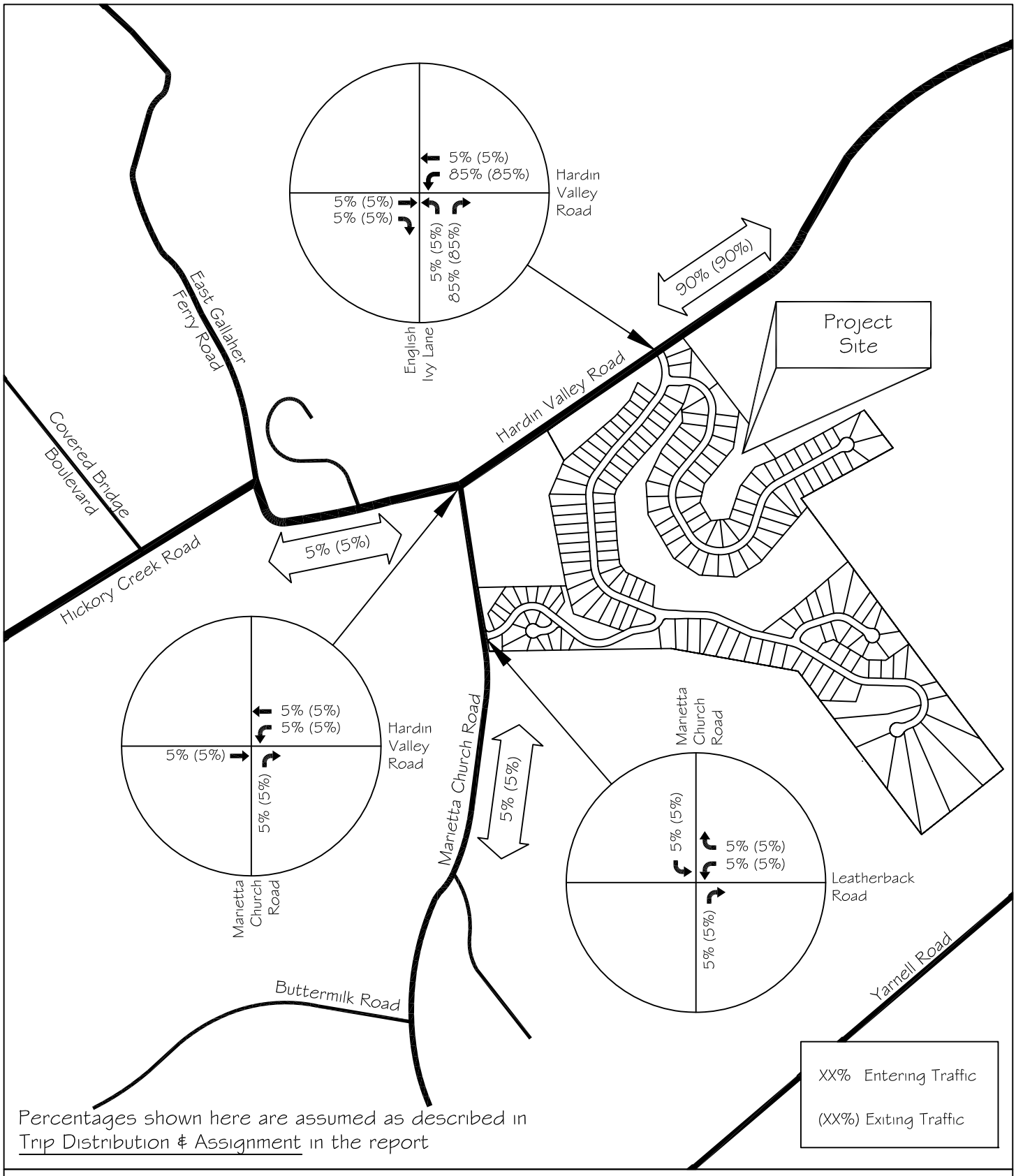


Figure 2: Site Plan



Percentages shown here are assumed as described in Trip Distribution & Assignment in the report

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

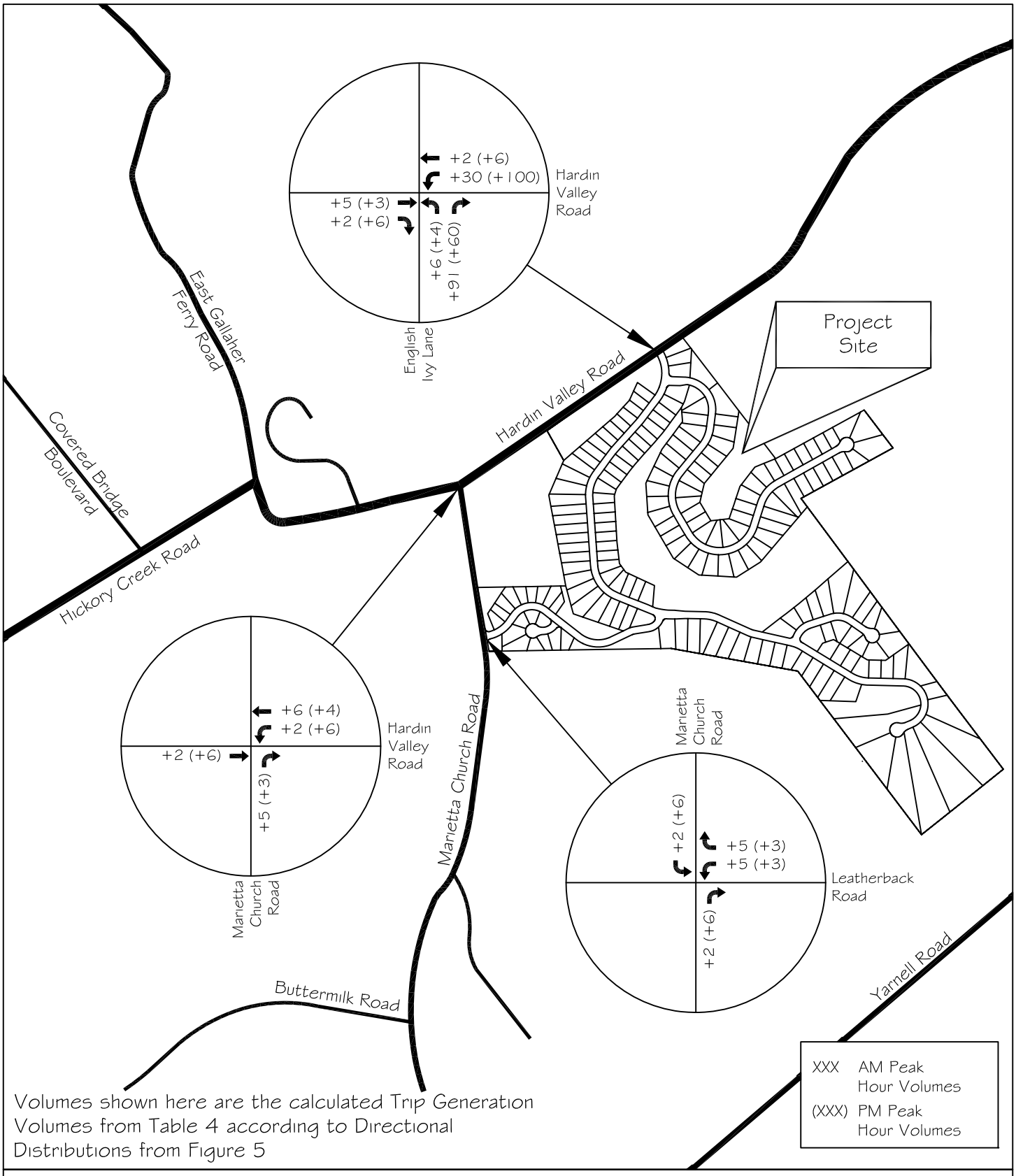
NOT TO SCALE

NORTH

FIGURE 5

Vining Mill Subdivision

Directional Distribution of Generated Traffic for Vining Hill



Volumes shown here are the calculated Trip Generation Volumes from Table 4 according to Directional Distributions from Figure 5

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Email: ajaxengineering@gmail.com

NOT TO SCALE

NORTH

FIGURE 6

Vining Mill Subdivision

Traffic Assignment of Generated Traffic for Vining Hill

Briggs Station Subdivision

Knoxville - Knox County - KUB Geographic Information System

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0 390 780 1,560

ft

APPENDIX H

ITE AND LOCAL TRIP GENERATION RATES

Land Use: 210
Single-Family Detached Housing

Description

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

Additional Data

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

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

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

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

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

Source Numbers

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

Single-Family Detached Housing
(210)

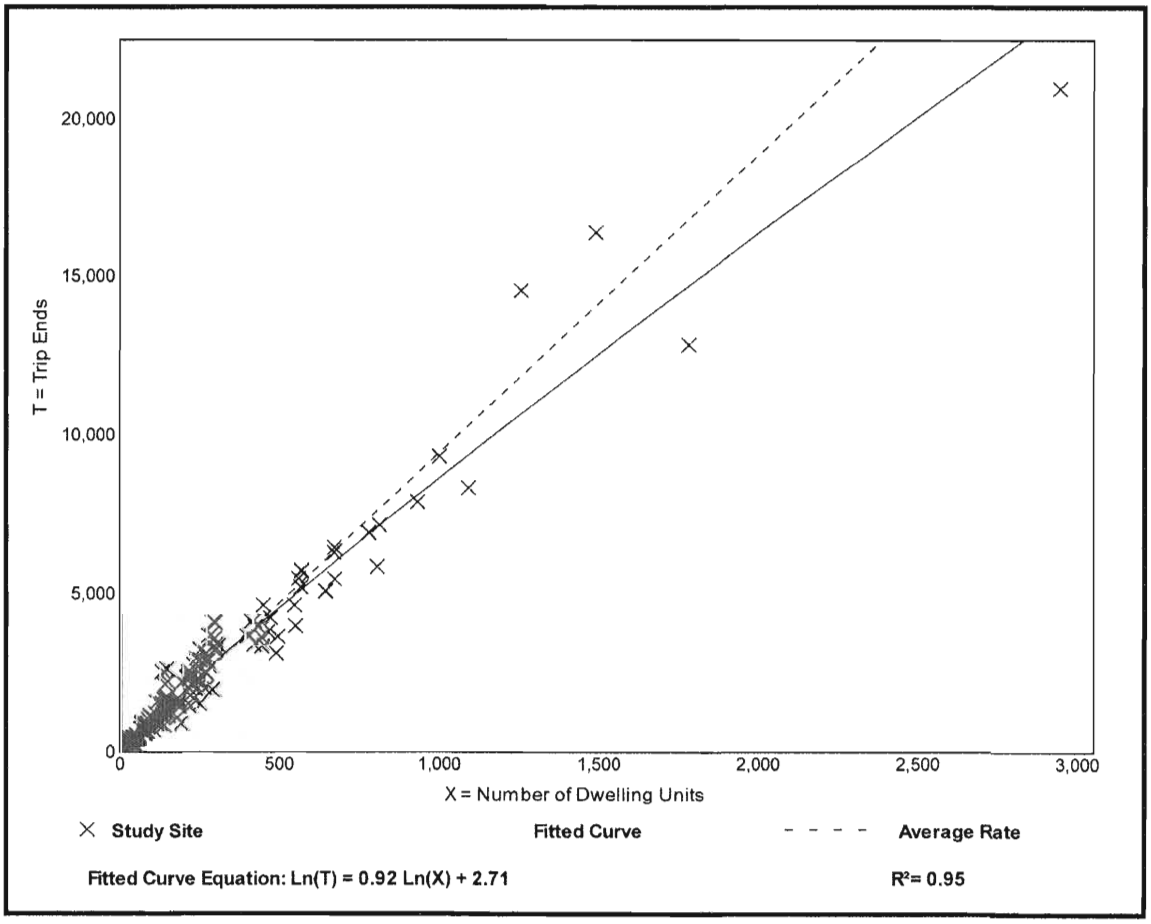
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

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

Vehicle Trip Generation per Dwelling Unit

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

Data Plot and Equation



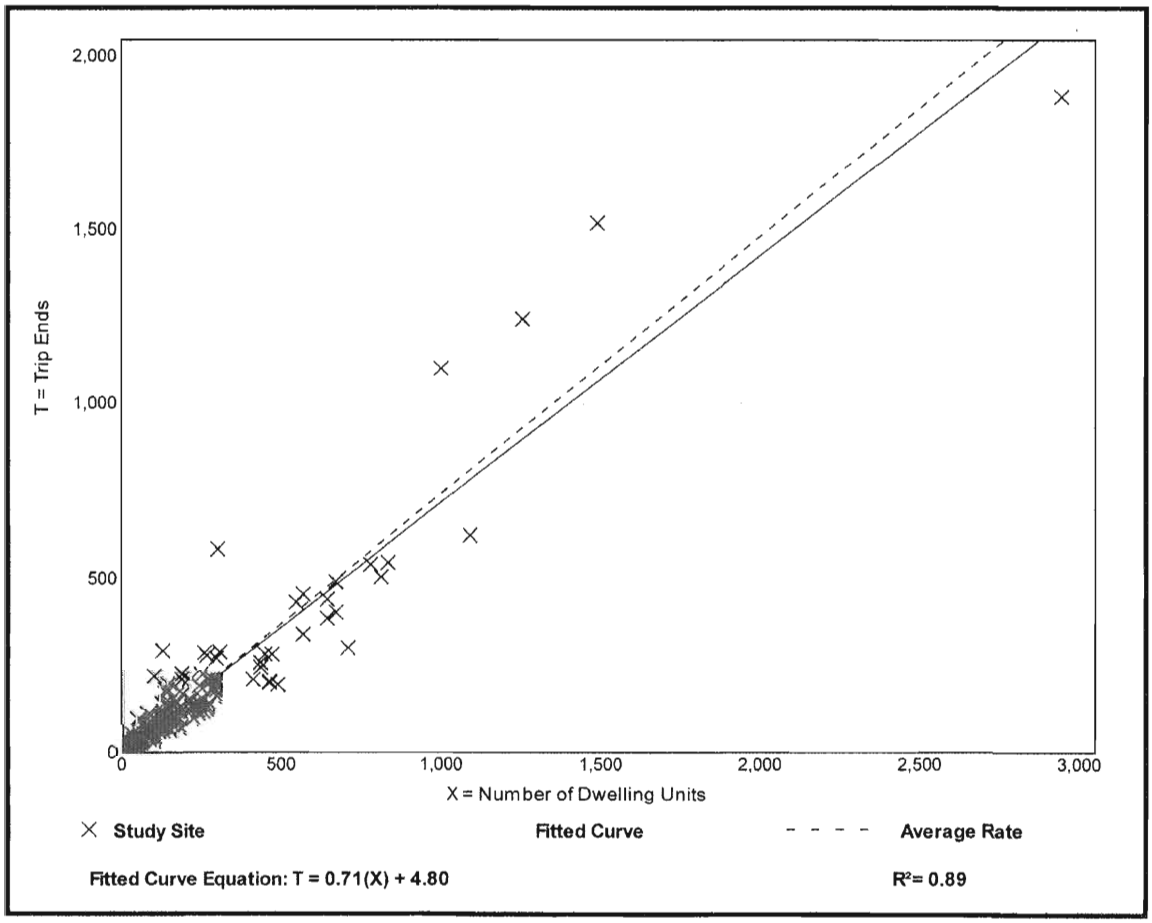
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 173
Avg. Num. of Dwelling Units: 219
Directional Distribution: 25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

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

Data Plot and Equation



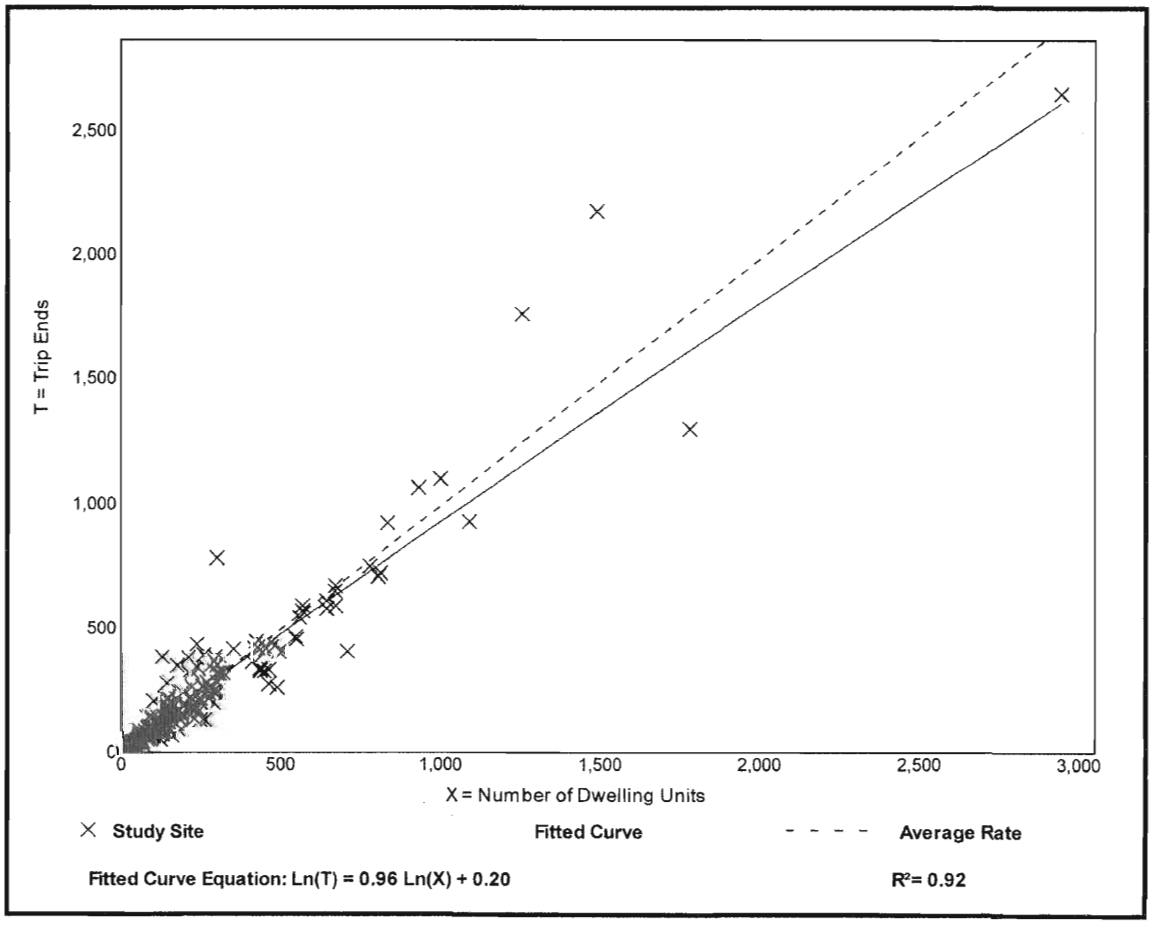
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 190
Avg. Num. of Dwelling Units: 242
Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

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

Data Plot and Equation



Local Apartment
Trip Generation Study

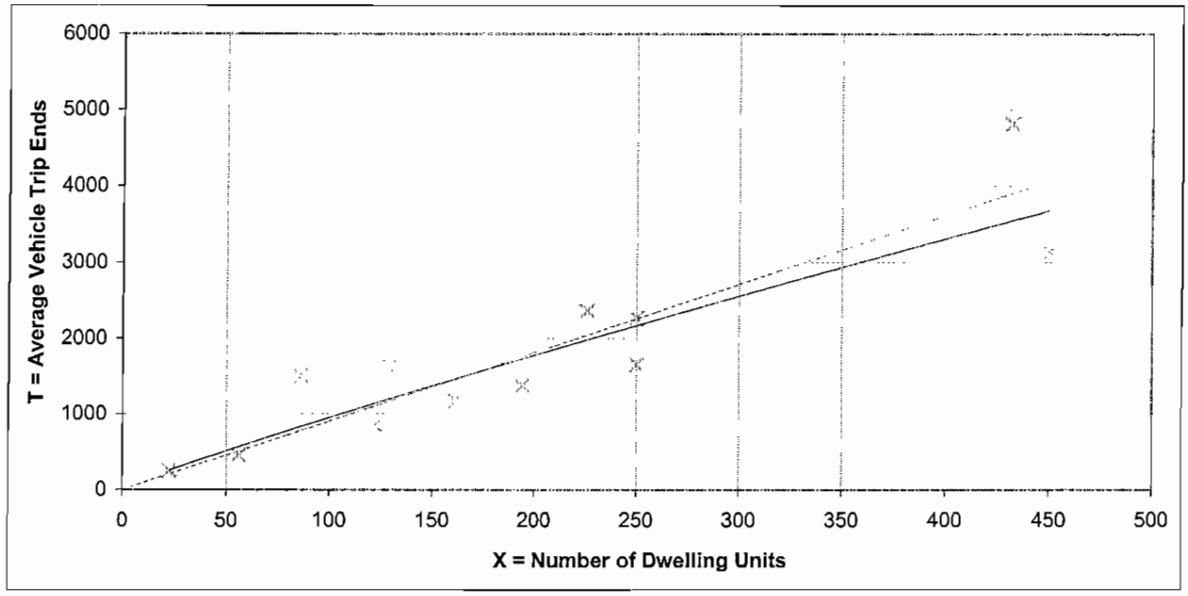
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

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

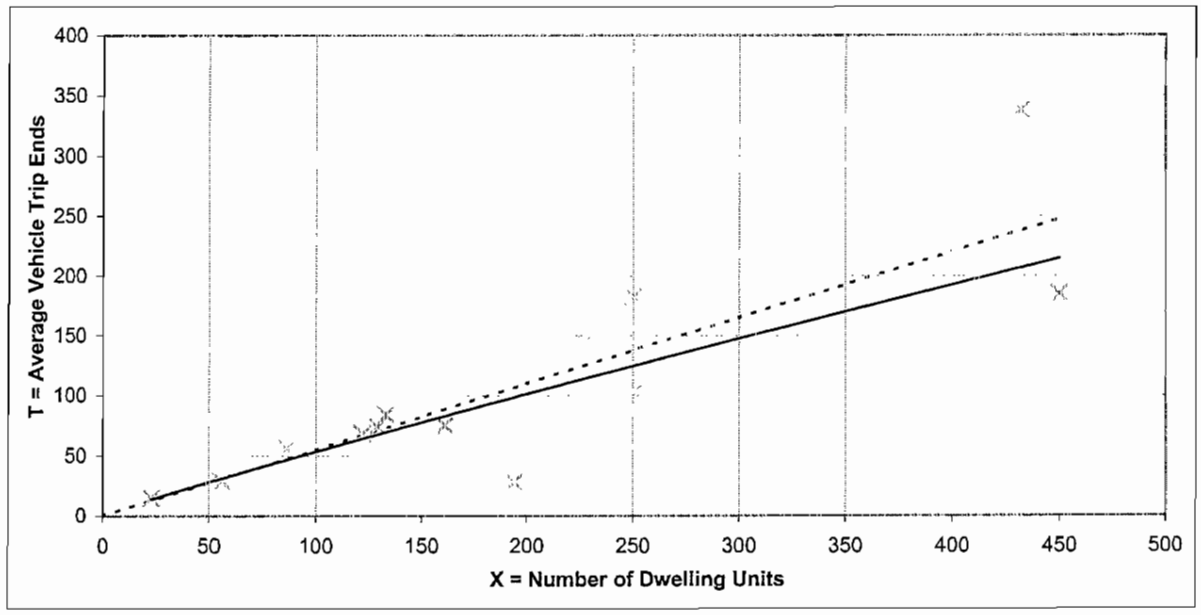
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

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

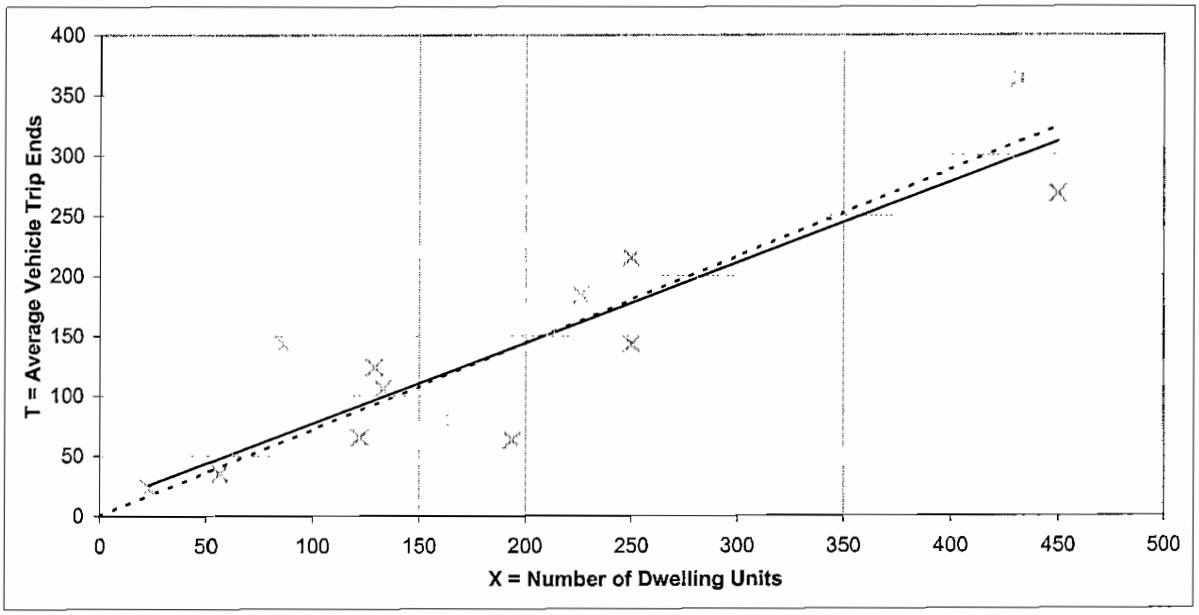
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

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 HOPPE PROPERTY SUBDIVISION

47 Single-Family Detached Houses and 33 Townhouses

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	47 Houses	519	25%	75%		63%	37%	
				9	29	38	31	18	49
Local Trip Rate	Townhouses	33 Townhouses	352	22%	78%		55%	45%	
				4	15	19	18	14	32
Total New Volume Site Trips			**871**	**13**	**44**	**57**	**49**	**32**	**81**

ITE Trip Generation Manual, 10th Edition and Local Trip Rates

Trips calculated by using Fitted Curve Equation

TRIP GENERATION FOR HOPPE PROPERTY AND S&E PROPERTY SUBDIVISION
47 Single-Family Detached Houses

47 Residential Houses = X

Weekday:

Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.71

Ln(T) = 0.92 * 3.85 + 2.71
Ln(T) = 6.25
T = 519 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T = 0.71 * 47 + 4.80
T = 38 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Fitted Curve Equation: Ln(T) = 0.96 Ln(X) + 0.2

Ln(T) = 0.96 * 3.85 + 0.20
Ln(T) = 3.90
T = 49 trips

TRIP GENERATION FOR HOPPE PROPERTY AND S&E PROPERTY SUBDIVISION
33 Townhouses

33 Residential Houses = X

Weekday:

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

T = 15 * 23.18
T = 352 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T = 0.758 * 25
T = 19 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

T = 0.669 * 33 + 10.07
T = 32 trips

TABLE 5b
TRIP GENERATION FOR ADJACENT SUBDIVISIONS

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Hunters Way (2016)	25 Houses	290	25%	75%		63%	37%	
				6	17	23	17	10	27
#210	Hunters Way (2021)	40 Houses	448	25%	75%		63%	37%	
				8	25	33	26	16	42
#210	Massey Creek (2021)	95 Houses	992	25%	75%		63%	37%	
				18	54	72	61	36	97
#210	Vining Mill (2021)	46 Houses	509	25%	75%		63%	37%	
				9	28	37	30	18	48
#210	Vining Mill (2023)	190 Houses	1,877	25%	75%		63%	37%	
				35	105	140	118	70	188

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

TRIP GENERATION FOR HUNTERS WAY SUBDIVISION (2016)

25 Single-Family Detached Houses

25 Residential Houses = X

Weekday:

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

$Ln(T) = 0.92 * 3.22 + 2.71$

$Ln(T) = 5.67$

T = 290 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

$T = 0.71 * 25 + 4.80$

T = 23 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

$Ln(T) = 0.96 * 3.22 + 0.20$

$Ln(T) = 3.29$

T = 27 trips

TRIP GENERATION FOR HUNTERS WAY SUBDIVISION (2021)

40 Single-Family Detached Houses

40 Residential Houses = X

Weekday:

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

$Ln(T) = 0.92 * 3.69 + 2.71$

$Ln(T) = 6.10$

T = 448 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

$T = 0.71 * 40 + 4.80$

T = 33 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

$Ln(T) = 0.96 * 3.69 + 0.20$

$Ln(T) = 3.74$

T = 42 trips

TRIP GENERATION FOR MASSEY CREEK SUBDIVISION (2021)

95 Single-Family Detached Houses

95 Residential Houses = X

Weekday:

Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.71

Ln(T) = 0.92 * 4.55 + 2.71

Ln(T) = 6.90

T = 992 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

T = 0.71 * 95 + 4.80

T = 72 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Fitted Curve Equation: Ln(T) = 0.96 Ln(X) + 0.2

Ln(T) = 0.96 * 4.55 + 0.20

Ln(T) = 4.57

T = 97 trips

TRIP GENERATION FOR VINING MILL SUBDIVISION (2021)

46 Single-Family Detached Houses

46 Residential Houses = X

Weekday:

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

$Ln(T) = 0.92 * 3.83 + 2.71$

$Ln(T) = 6.23$

T = 509 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

$T = 0.71 * 46 + 4.80$

T = 37 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

$Ln(T) = 0.96 * 3.83 + 0.20$

$Ln(T) = 3.88$

T = 48 trips

TRIP GENERATION FOR VINING MILL SUBDIVISION (2023)

190 Single-Family Detached Houses

190 Residential Houses = X

Weekday:

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

$Ln(T) = 0.92 * 5.25 + 2.71$

$Ln(T) = 7.54$

T = 1,877 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

$T = 0.71 * 190 + 4.80$

T = 140 trips

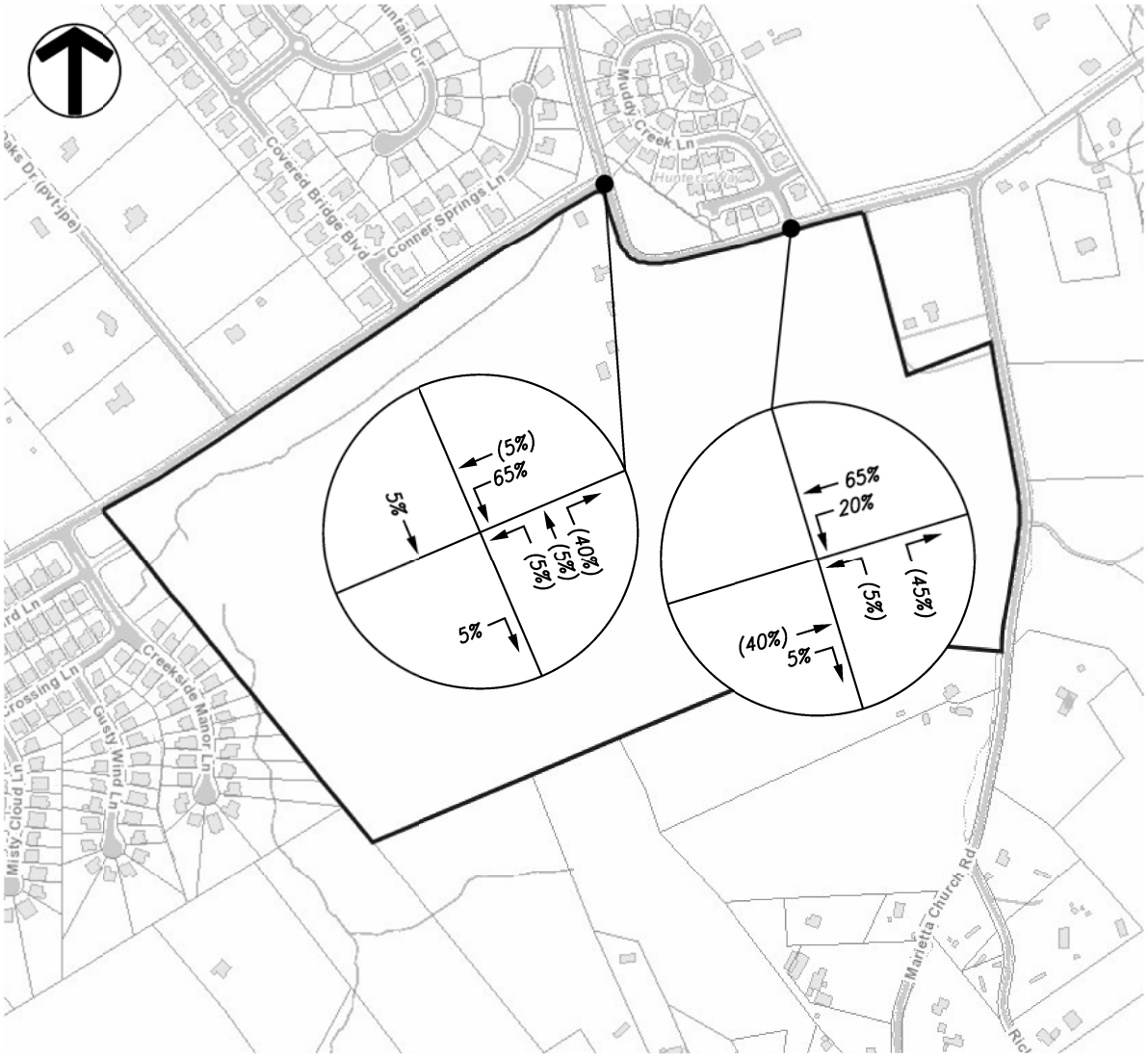
Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

$Ln(T) = 0.96 * 5.25 + 0.20$

$Ln(T) = 5.24$

T = 188 trips



LEGEND:

← 50% (50%) TRIP DISTRIBUTION ENTERING (EXITING)

Figure 8: Peak Hour Trip Distribution

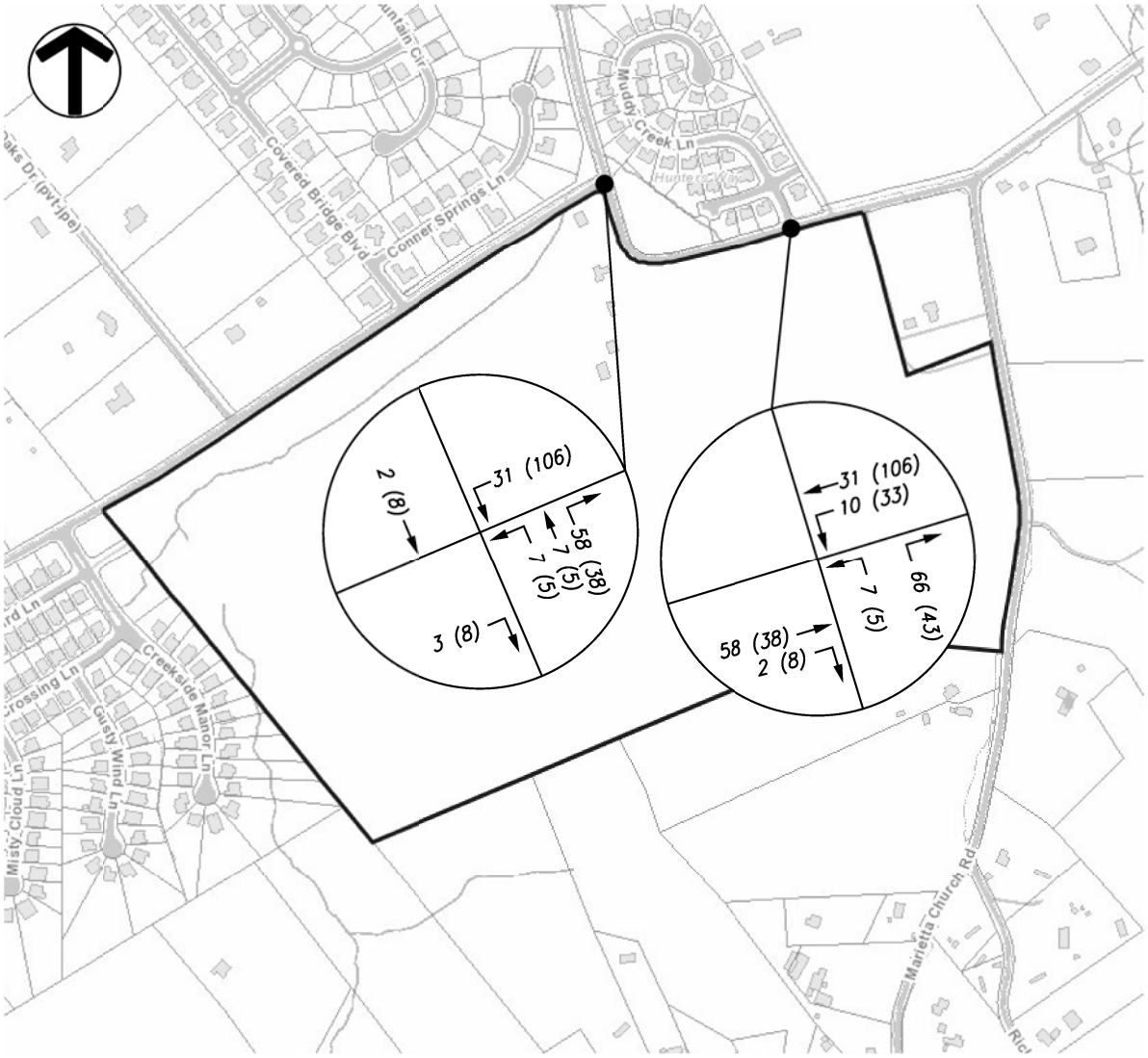
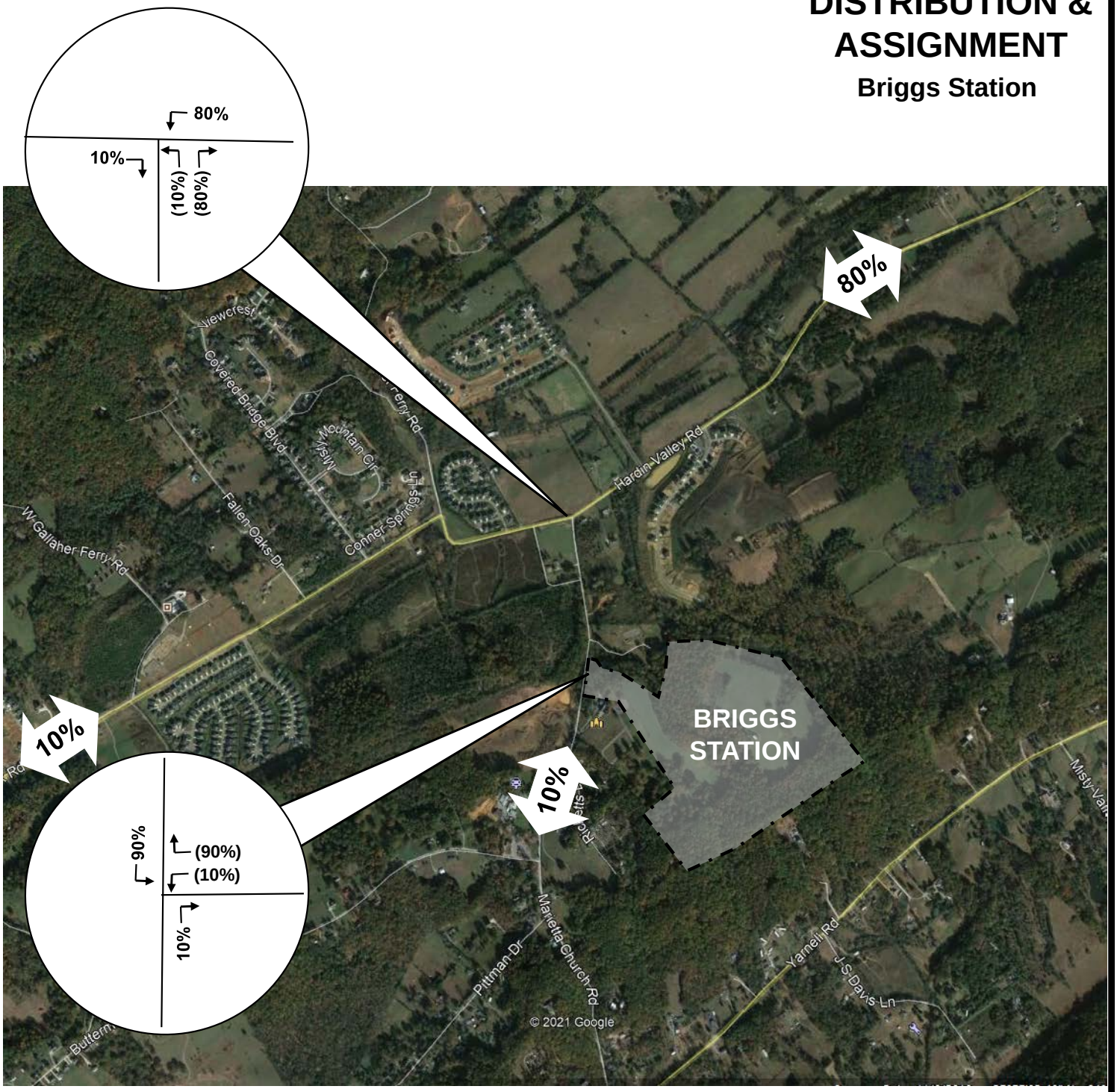


Figure 9: Seal Property Subdivision Peak Hour Site Trips

TRIP DISTRIBUTION & ASSIGNMENT

Briggs Station



LEGEND

XX% Entering Trips

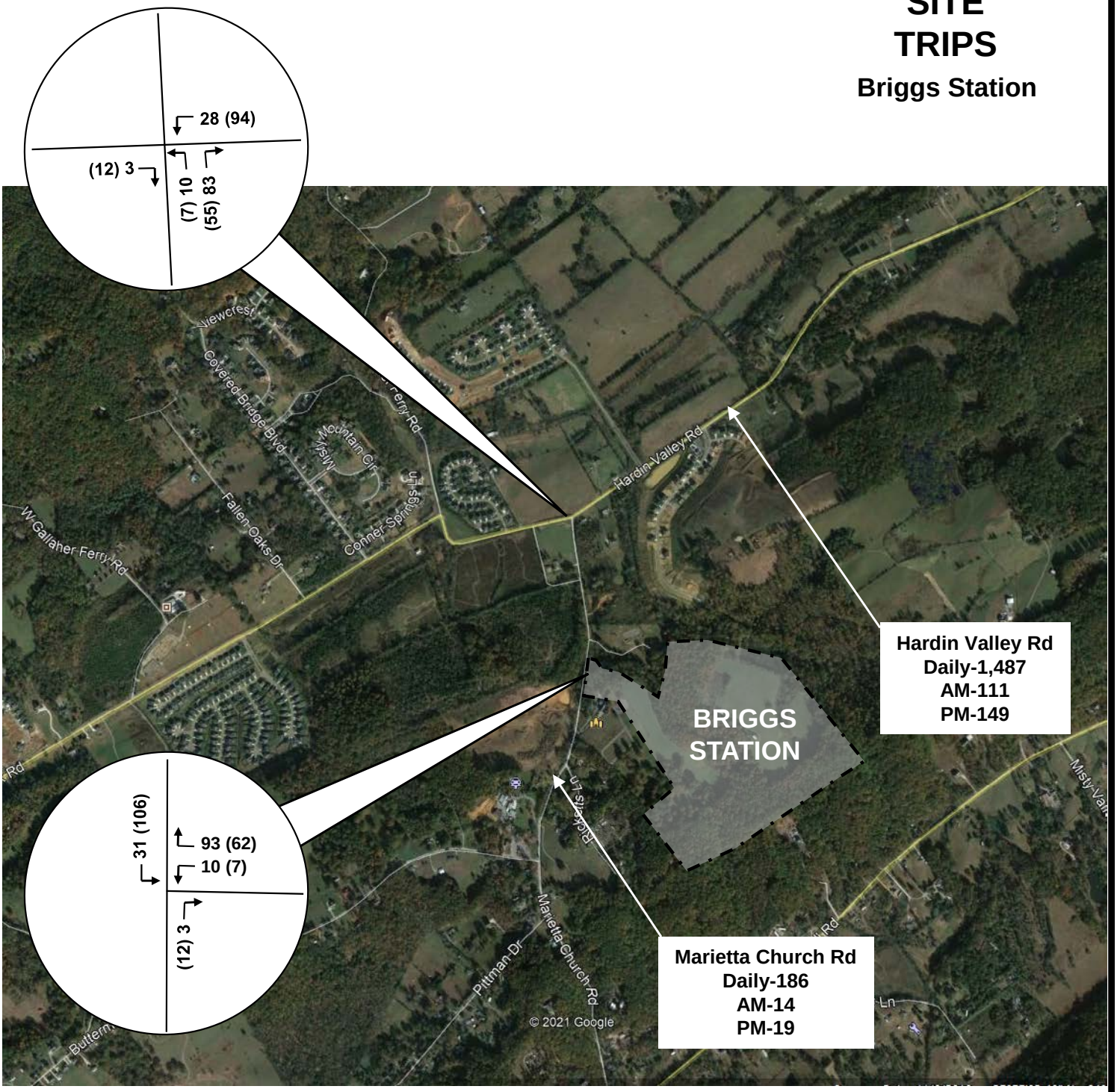
(XX%) Exiting Trips

N

Figure 6

SITE TRIPS

Briggs Station



LEGEND

XXX AM PEAK

(XXX) PM PEAK

N

Figure 7

APPENDIX I

2018 CENSUS BUREAU DATA

United States Census Bureau OnTheMap

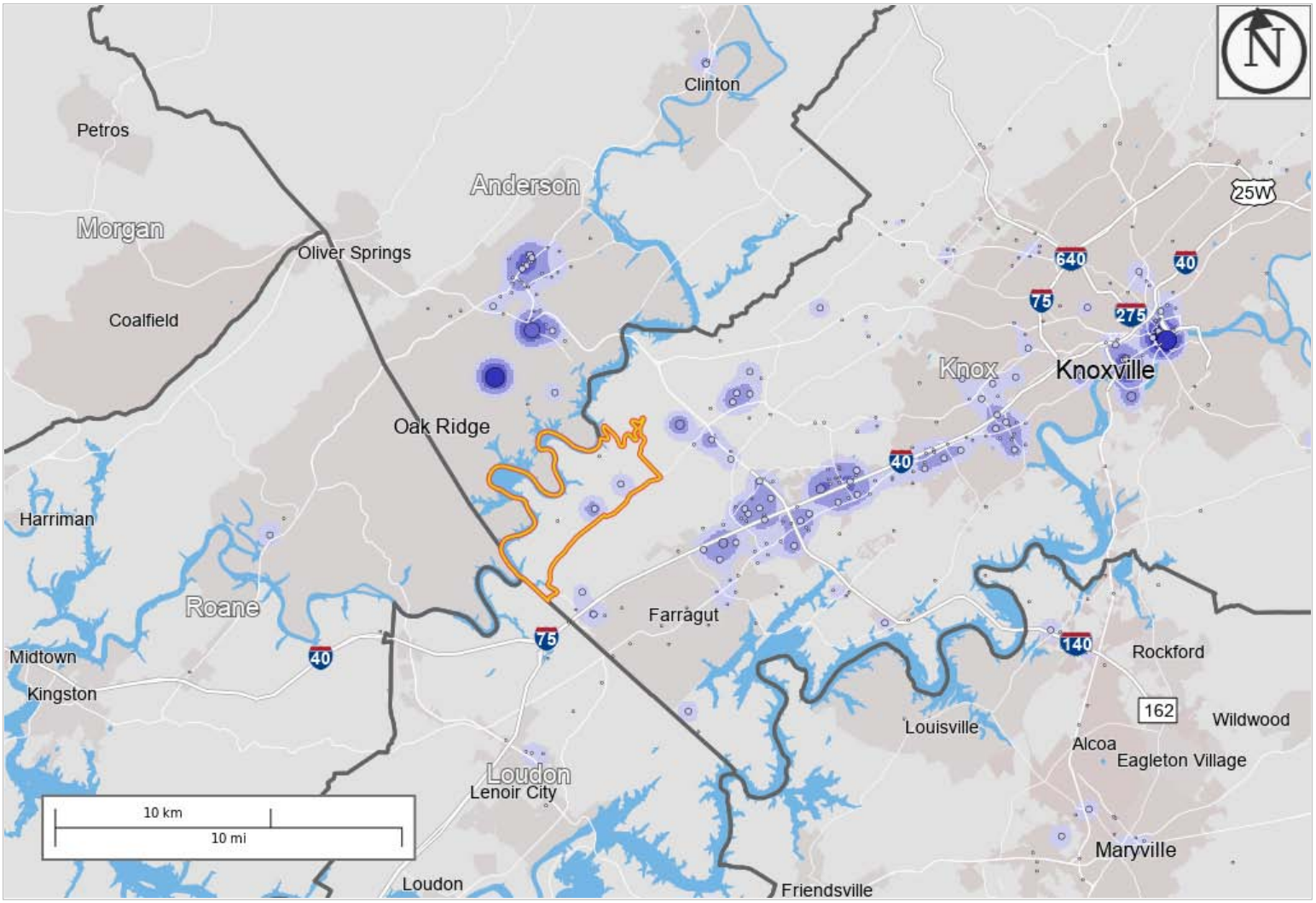
Distance/Direction Report - Home to Work

All Jobs for All Workers in 2018

Created by the U.S. Census Bureau's OnTheMap https://onthemap.ces.census.gov on 07/05/2021

Counts and Density of Work Locations for All Jobs in Home Selection Area in 2018

All Workers



Map Legend

Job Density [Jobs/Sq. Mile]

- 5 - 11
- 12 - 31
- 32 - 64
- 65 - 111
- 112 - 171

Job Count [Jobs/Census Block]

- 1 - 2
- 3 - 7
- 8 - 16
- 17 - 28
- 29 - 44

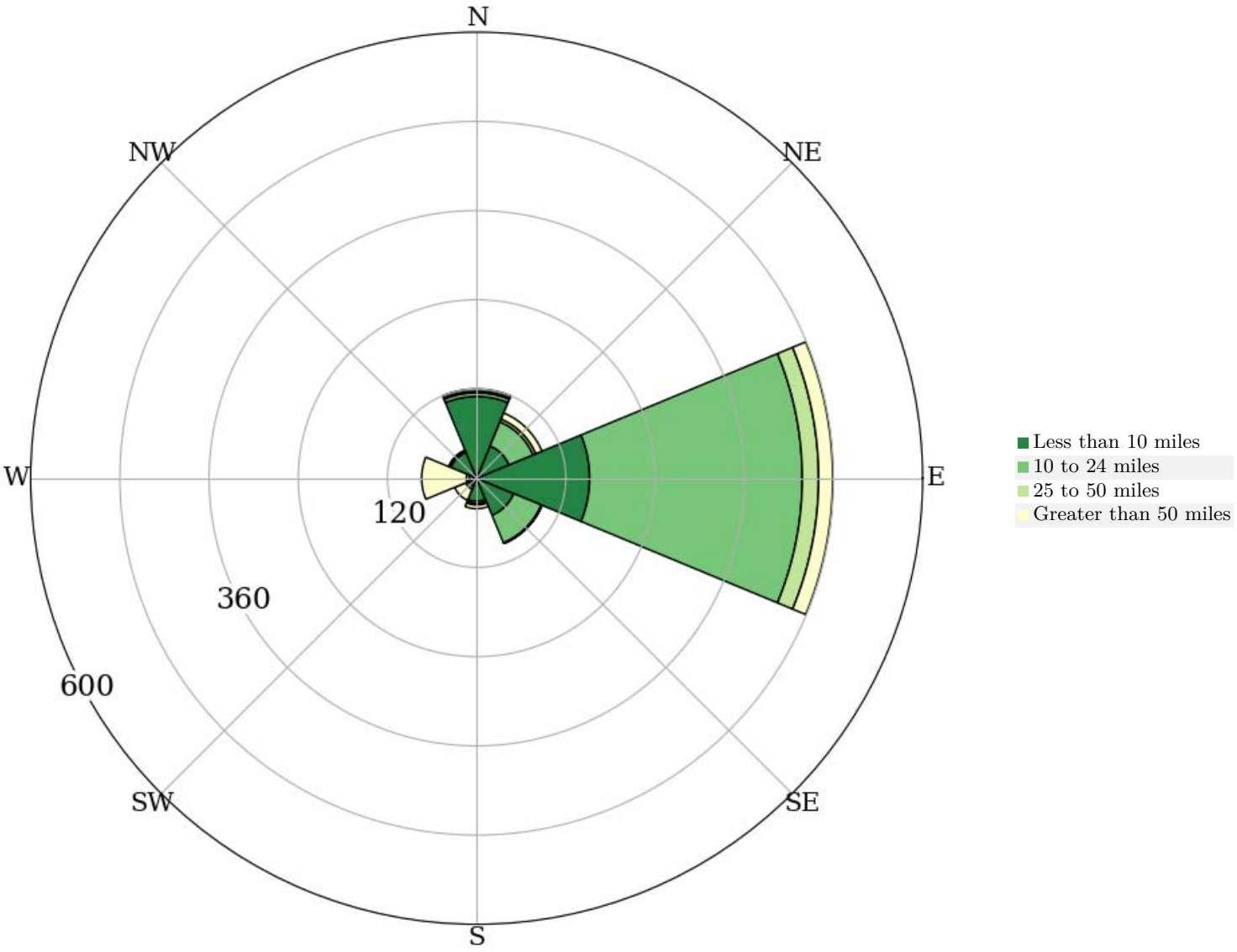
Selection Areas

- Analysis Selection

United States Census Bureau

All Jobs for All Workers in 2018

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



All Jobs for All Workers in 2018

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

Distance	2018 Count	2018 Share
Total All Jobs	977	100.0
Less than 10 miles	445	45.5
10 to 24 miles	378	38.7
25 to 50 miles	40	4.1
Greater than 50 miles	114	11.7

Additional Information

Analysis Settings

Analysis Type	Distance/Direction
Selection area as	Home
Year(s)	2018
Job Type	All Jobs
Selection Area	1 (Tract 59.06, Knox, TN) from Census Block Groups
Selected Census Blocks	31
Analysis Generation Date	07/05/2021 11:34 - OnTheMap 6.8
Code Revision	5dc8e60ec2609d78ebfa7d4b188db13aacbb1ba6
LODES Data Version	20201117_1559

Data Sources

Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2018).

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 and in 2018.

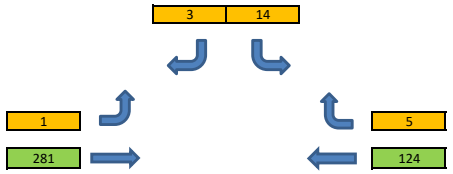
APPENDIX J

TRIP DISTRIBUTION AND ASSIGNMENT SPREADSHEET CALCULATIONS

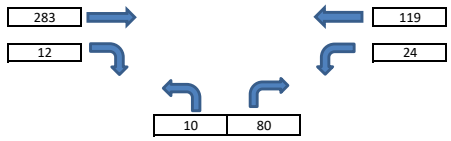
2016 AM PEAK HOUR

Addition and Subtractions Only
Trip Generation

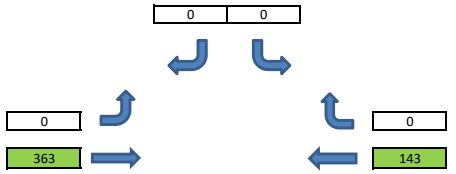
Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road



Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



Vining Mill

0
0

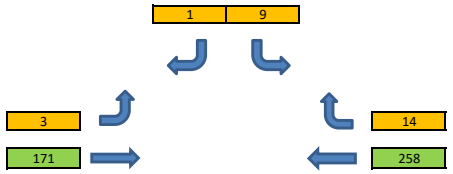
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Hunters Way (2016)	25 Houses	25%	75%		63%	37%	
			6	17	23	17	10	27

Trip Distribution for Hunters Way	5%	Hickory Creek Road (West)
	10%	Marietta Church Road (South)
	85%	Hardin Valley Road (East)

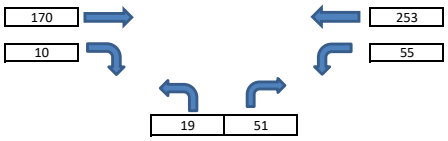
2016 PM PEAK HOUR

Addition and Subtractions Only
Trip Generation

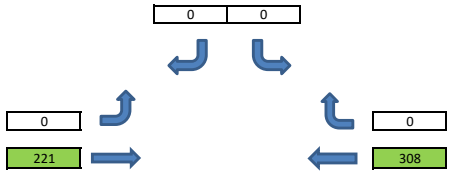
Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road



Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



Vining Mill

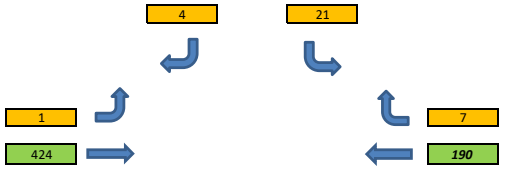
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Hunters Way (2016)	25 Houses	25%	75%		63%	37%	
			6	17	23	17	10	27

Trip Distribution for Hunters Way	5%	Hickory Creek Road (West)
	10%	Marietta Church Road (South)
	85%	Hardin Valley Road (East)

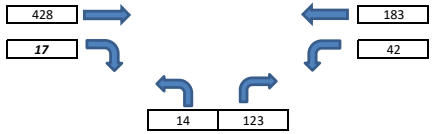
2021 AM PEAK HOUR

Addition and Subtractions Only
Trip Generation

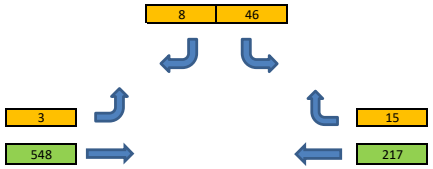
Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road



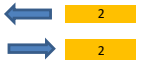
Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



Vining Mill



* Bold Italic = Hard Coded to Balance

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Hunters Way (2021)	40 Houses	25%	75%		63%	37%	
			8	25	33	26	16	42

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Massey Creek (2021)	95 Houses	25%	75%		63%	37%	
			18	54	72	61	36	97

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Vining Mill (2021)	46 Houses	25%	75%		63%	37%	
			9	28	37	30	18	48

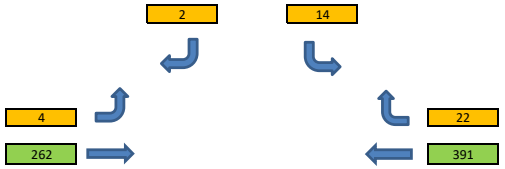
Trip Distribution for	5%	Hickory Creek Road (West)
Hunters Way	10%	Marietta Church Road (South)
Massey Creek	85%	Hardin Valley Road (East)

Trip Distribution for	5%	Hickory Creek Road (West)
Vining Mill	5%	Marietta Church Road (South)
	90%	Hardin Valley Road (East)

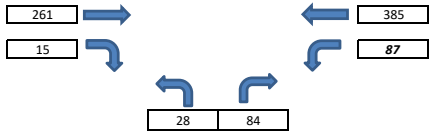
2021 PM PEAK HOUR

Addition and Subtractions Only
Trip Generation

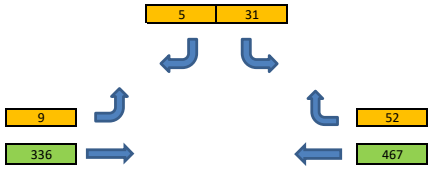
Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road



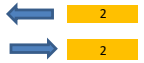
Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



Vining Mill



* Bold Italic = Hard Coded to Balance

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Hunters Way (2021)	40 Houses	25%	75%		63%	37%	
			8	25	33	26	16	42

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Massey Creek (2021)	95 Houses	25%	75%		63%	37%	
			18	54	72	61	36	97

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Vining Mill (2021)	46 Houses	25%	75%		63%	37%	
			9	28	37	30	18	48

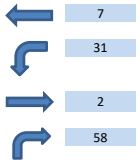
Trip Distribution for	5%	Hickory Creek Road (West)
Hunters Way	10%	Marietta Church Road (South)
Massey Creek	85%	Hardin Valley Road (East)

Trip Distribution for	5%	Hickory Creek Road (West)
Vining Mill	5%	Marietta Church Road (South)
	90%	Hardin Valley Road (East)

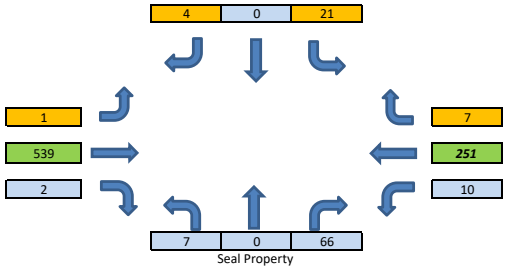
2023 AM PEAK HOUR

Addition and Subtractions Only
Trip Generation
Trip Generation from Seal Property

Seal Property at Roundabout

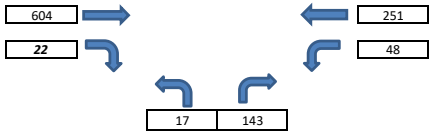


Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road

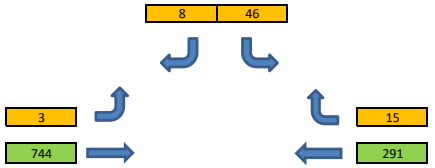


Seal Property

Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



Vining Mill

* Bold Italic = Hard Coded to Balance

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Hunters Way (2023)	40 Houses	25%	75%		63%	37%	
			8	25	33	26	16	42

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Massey Creek (2023)	95 Houses	25%	75%		63%	37%	
			18	54	72	61	36	97

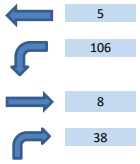
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Vining Mill (2023)	190 Houses	25%	75%		63%	37%	
			35	105	140	118	70	188

Trip Distribution for	5%	Hickory Creek Road (West)
Hunters Way	10%	Marietta Church Road (South)
Massey Creek	85%	Hardin Valley Road (East)
Trip Distribution for	5%	Hickory Creek Road (West)
Vining Mill	5%	Marietta Church Road (South)
	90%	Hardin Valley Road (East)
Trip Distribution for	10%	Hickory Creek Road (West)
Seal Property	5%	Marietta Church Road (South) - Assumed
	85%	Hardin Valley Road (East)

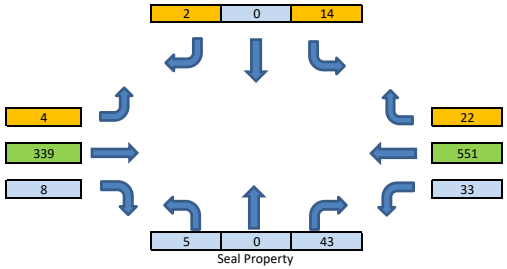
2023 PM PEAK HOUR

Addition and Subtractions Only
Trip Generation
Trip Generation from Seal Property

Seal Property at Roundabout

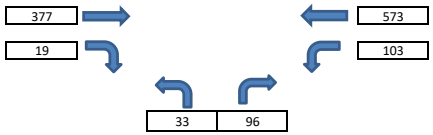


Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road

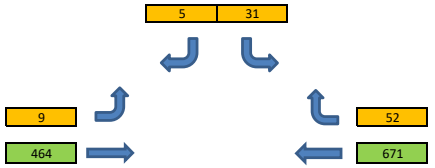


Seal Property

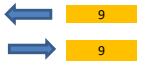
Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



Vining Mill



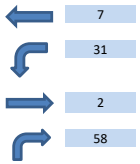
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Hunters Way (2023)	40 Houses	25%	75%		63%	37%	
			8	25	33	26	16	42
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Massey Creek (2023)	95 Houses	25%	75%		63%	37%	
			18	54	72	61	36	97
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Vining Mill (2023)	190 Houses	25%	75%		63%	37%	
			35	105	140	118	70	188

Trip Distribution for	5%	Hickory Creek Road (West)
Hunters Way	10%	Marietta Church Road (South)
Massey Creek	85%	Hardin Valley Road (East)
Trip Distribution for	5%	Hickory Creek Road (West)
Vining Mill	5%	Marietta Church Road (South)
	90%	Hardin Valley Road (East)
Trip Distribution for	10%	Hickory Creek Road (West)
Seal Property	5%	Marietta Church Road (South) - Assumed
	85%	Hardin Valley Road (East)

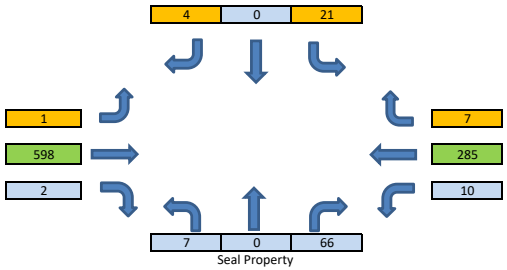
2025 AM PEAK HOUR

Addition and Subtractions Only
Trip Generation
Trip Generation from Seal Property
Trip Generation from Briggs Station

Seal Property at Roundabout

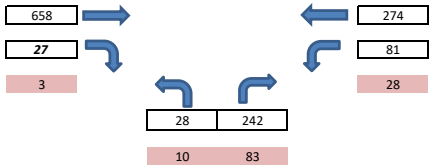


Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road

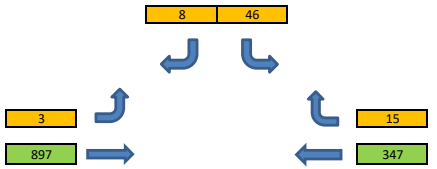


Seal Property

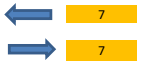
Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



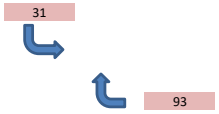
Vining Mill



* Bold Italic = Hard Coded to Balance

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Hunters Way (2025)	40 Houses	25%	75%		63%	37%	
			8	25	33	26	16	42
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Massey Creek (2025)	95 Houses	25%	75%		63%	37%	
			18	54	72	61	36	97
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Vining Mill (2025)	190 Houses	25%	75%		63%	37%	
			35	105	140	118	70	188

Briggs Station Subdivision Entrance

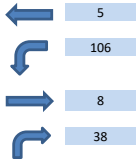


Trip Distribution for	5%	Hickory Creek Road (West)
Hunters Way	10%	Marietta Church Road (South)
Massey Creek	85%	Hardin Valley Road (East)
Trip Distribution for	5%	Hickory Creek Road (West)
Vining Mill	5%	Marietta Church Road (South)
	90%	Hardin Valley Road (East)
Trip Distribution for	10%	Hickory Creek Road (West)
Seal Property	5%	Marietta Church Road (South) - Assumed
	85%	Hardin Valley Road (East)

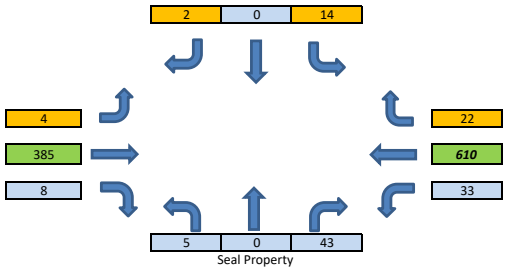
2025 PM PEAK HOUR

Addition and Subtractions Only
Trip Generation
Trip Generation from Seal Property
Trip Generation from Briggs Station

Seal Property at Roundabout

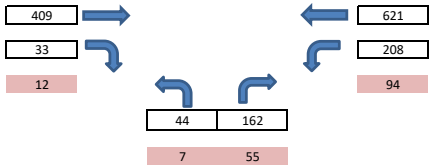


Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road

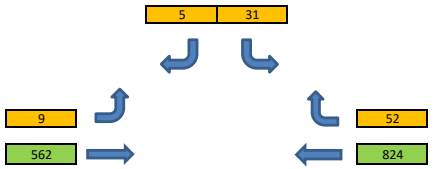


Seal Property

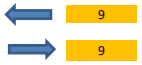
Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



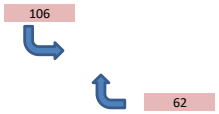
Vining Mill



* Bold Italic = Hard Coded to Balance

			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Hunters Way (2025)	40 Houses	25%	75%		63%	37%	
			8	25	33	26	16	42
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Massey Creek (2025)	95 Houses	25%	75%		63%	37%	
			18	54	72	61	36	97
			AM			PM		
			Enter	Exit		Enter	Exit	
#210	Vining Mill (2025)	190 Houses	25%	75%		63%	37%	
			35	105	140	118	70	188

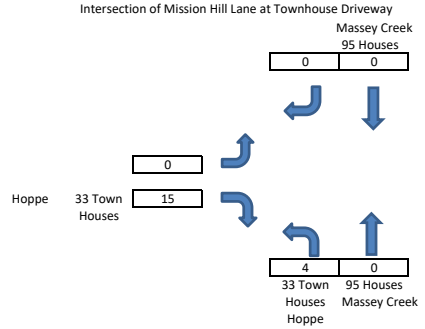
Briggs Station Subdivision Entrance



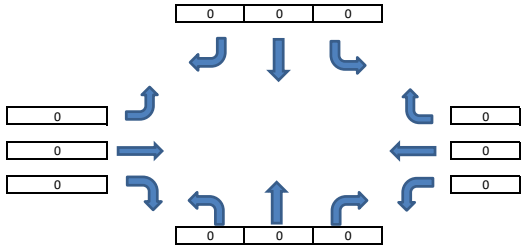
Trip Distribution for	5%	Hickory Creek Road (West)
Hunters Way	10%	Marietta Church Road (South)
Massey Creek	85%	Hardin Valley Road (East)
Trip Distribution for	5%	Hickory Creek Road (West)
Vining Mill	5%	Marietta Church Road (South)
	90%	Hardin Valley Road (East)
Trip Distribution for	10%	Hickory Creek Road (West)
Seal Property	5%	Marietta Church Road (South) - Assumed
	85%	Hardin Valley Road (East)

2025 AM PEAK HOUR WITH PROJECT WITH ROUNDABOUT OR TRAFFIC SIGNAL ASSIGNMENT

Massey Creek
Intersection of Mission Hill Lane at Townhouse Driveway

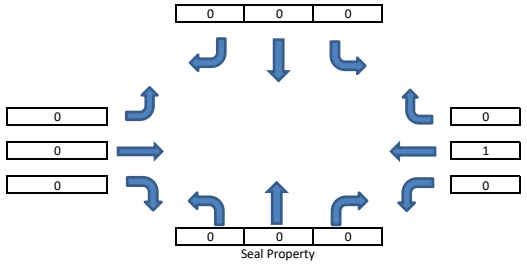


Hunters Way
Intersection of Muddy Creek Road at Deer Crossing Drive



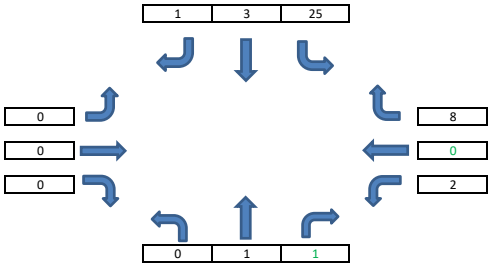
Intersection of Mission Hill Lane at New Driveway

Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road

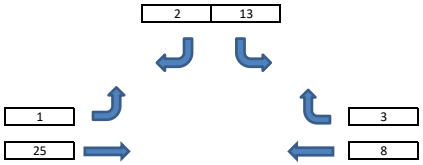


Seal Property

Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



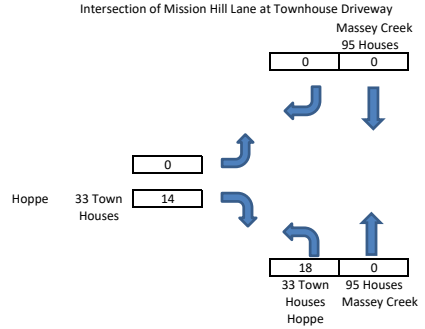
			AM		
			Enter	Exit	
#210	Hoppe Property (2025)	47 Houses	25%	75%	
			9	29	38

			AM		
		(Red)	Enter	Exit	
Local Rate	Hoppe Property (2025)	33 Townhouses	22%	78%	
			4	15	19

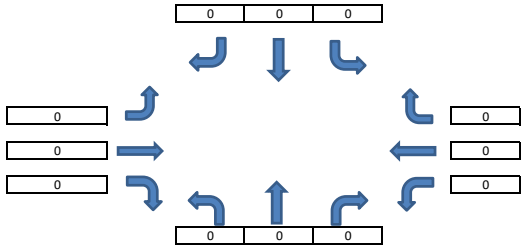
Trip Distribution for	5%	Hickory Creek Road (West)
Hoppe Property +	10%	Marietta Church Road (South)
S & E Property	85%	Hardin Valley Road (East)

2025 PM PEAK HOUR WITH PROJECT WITH ROUNDABOUT OR TRAFFIC SIGNAL ASSIGNMENT

Massey Creek
Intersection of Mission Hill Lane at Townhouse Driveway

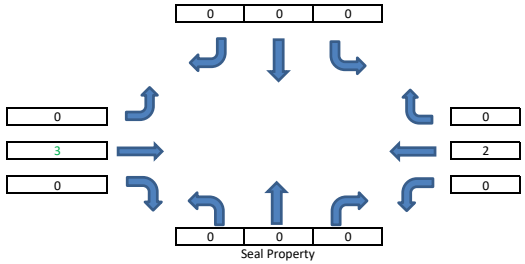


Hunters Way
Intersection of Muddy Creek Road at Deer Crossing Drive



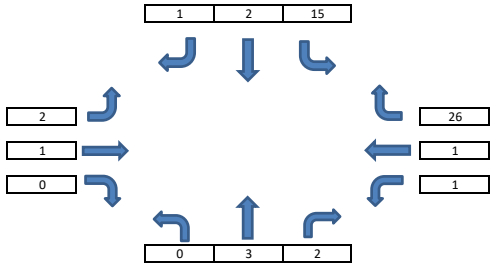
Intersection of Mission Hill Lane at New Driveway

Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road

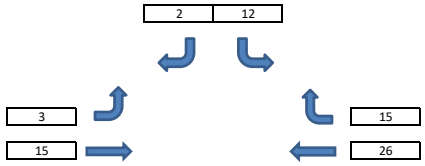


Seal Property

Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



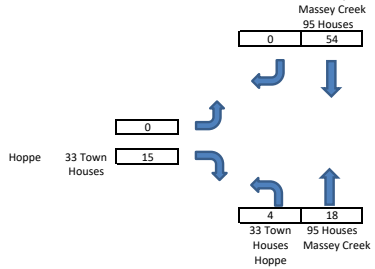
			PM		
			Enter	Exit	
#210	Hoppe Property (2025)	47 Houses	63%	37%	
			31	18	49

			PM		
		(Red)	Enter	Exit	
Local Rate	Hoppe Property (2025)	33 Townhouses	55%	45%	
			18	14	32

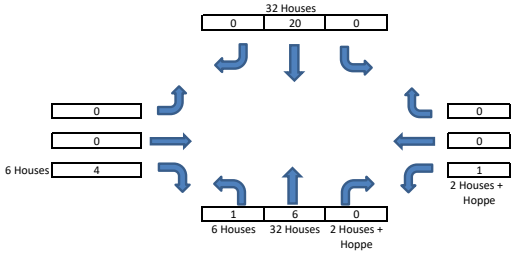
Trip Distribution for	5%	Hickory Creek Road (West)
Hoppe Property +	10%	Marietta Church Road (South)
S & E Property	85%	Hardin Valley Road (East)

2025 AM PEAK HOUR WITH PROJECT WITH ROUNDABOUT OR TRAFFIC SIGNAL

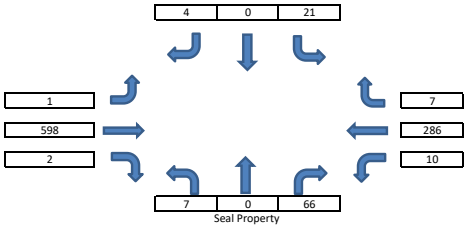
Massey Creek
Intersection of Mission Hill Lane at Townhouse Driveway



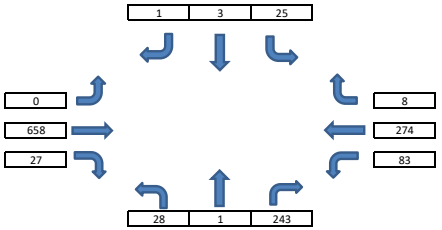
Hunters Way
Intersection of Muddy Creek Road at Deer Crossing Drive



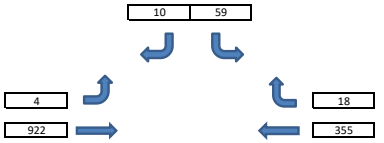
Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road



Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



			AM		
			Enter	Exit	
#210	Hunters Way (2025)	40 Houses	25%	75%	
			8	25	33

			AM		
			Enter	Exit	
#210	Massey Creek (2025)	95 Houses	25%	75%	
			18	54	72

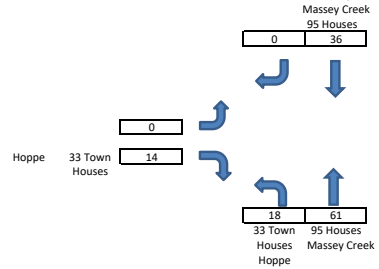
			AM		
			Enter	Exit	
#210	Hoppe Property (2025)	47 Houses	25%	75%	
			9	29	38

			AM		
		(Red)	Enter	Exit	
Local Rate	Hoppe Property (2025)	33 Townhouses	22%	78%	
			4	15	19

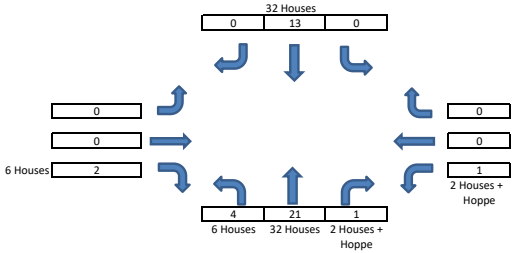
Trip Distribution for	5%	Hickory Creek Road (West)
Hoppe Property +	10%	Marietta Church Road (South)
S & E Property	85%	Hardin Valley Road (East)

2025 PM PEAK HOUR WITH PROJECT WITH ROUNDABOUT OR TRAFFIC SIGNAL

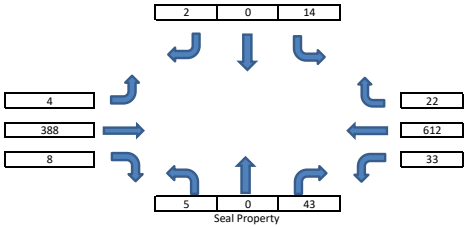
Massey Creek
Intersection of Mission Hill Lane at Townhouse Driveway



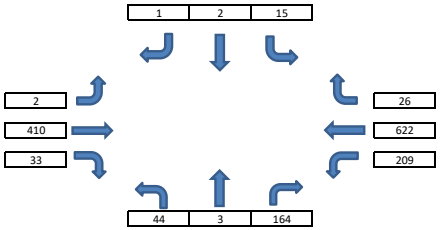
Hunters Way
Intersection of Muddy Creek Road at Deer Crossing Drive



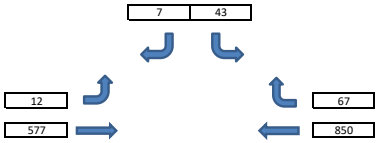
Hunters Way
Intersection of Hardin Valley Road at Muddy Creek Road



Intersection of Hardin Valley Road at Marietta Church Road



Massey Creek
Intersection of Hardin Valley Road at Mission Hill Lane



			PM		
			Enter	Exit	
#210	Hunters Way (2025)	40 Houses	63%	37%	
			26	16	42

			PM		
			Enter	Exit	
#210	Massey Creek (2025)	95 Houses	63%	37%	
			61	36	97

			PM		
			Enter	Exit	
#210	Hoppe Property (2025)	47 Houses	63%	37%	
			31	18	49

			PM		
		(Red)	Enter	Exit	
Local Rate	Hoppe Property (2025)	33 Townhouses	55%	45%	
			18	14	32

Trip Distribution for	5%	Hickory Creek Road (West)
Hoppe Property +	10%	Marietta Church Road (South)
S & E Property	85%	Hardin Valley Road (East)

APPENDIX K

KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS

TABLE 5A

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

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

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

347 + 15 = 362

897

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

WITHOUT HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Mission Hill Lane

2025 Projected AM EB Left Turns = 3

Left Turn Lane NOT Warranted

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

TABLE 5B

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

347

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					Yes	Yes
250 - 299						Yes
300 - 349				Yes	Yes	Yes
350 - 399				Yes	Yes	Yes
400 - 449				Yes	Yes	Yes
450 - 499				Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

WITHOUT HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Mission Hill Lane

2025 Projected AM WB Right Turns = 15

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	Yes
50 - 99				Yes	Yes	Yes
100 - 149			Yes	Yes	Yes	Yes
150 - 199		Yes	Yes	Yes	Yes	Yes
200 - 249	Yes	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 5A

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

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

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

824 + 52 = 876

562

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

WITHOUT HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Mission Hill Lane

2025 Projected PM EB Left Turns = 9

Left Turn Lane NOT Warranted

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

TABLE 5B

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

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

824

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

WITHOUT HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Mission Hill Lane

2025 Projected PM WB Right Turns = 52

Right Turn Lane Warranted

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

TABLE 5A

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

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

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

10 + 285 + 7 = 302

598 + 2 = 600

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

Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

2025 Projected AM EB Left Turns = 1

Left Turn Lane NOT Warranted

WITHOUT HOPPE PROPERTY SUBDIVISION

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

TABLE 5B

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

10 + 285 = 295

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						Yes
250 - 299					Yes	Yes
300 - 349				Yes	Yes	Yes
350 - 399			Yes	Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499			Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

2025 Projected AM WB Right Turns = 7

Right Turn Lane NOT Warranted

WITHOUT HOPPE PROPERTY SUBDIVISION

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	Yes
50 - 99				Yes	Yes	Yes
100 - 149			Yes	Yes	Yes	Yes
150 - 199		Yes	Yes	Yes	Yes	Yes
200 - 249	Yes	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 5A

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

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

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

33 + 610 + 22 = 665

385 + 8 = 393

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

WITHOUT HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

2025 Projected PM EB Left Turns = 4

Left Turn Lane NOT Warranted

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

TABLE 5B

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

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

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

33 + 610 = 643

Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

2025 Projected PM WB Right Turns = 22

Right Turn Lane NOT Warranted

WITHOUT HOPPE PROPERTY SUBDIVISION

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

TABLE 5A

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

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

658 + 287 = 685

274

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

WITHOUT HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Marietta Church Road

2025 Projected AM WB Left Turns = 81

Left Turn Lane Warranted

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

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

TABLE 5B

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

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

658

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

WITHOUT HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Marietta Church Road

2025 Projected AM EB Right Turns = 27

Right Turn Lane Warranted

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

TABLE 5A

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

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

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

409 + 33 = 442

621

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

WITHOUT HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Marietta Church Road

2025 Projected PM WB Left Turns = 208

Left Turn Lane Warranted

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

TABLE 5B

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

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

409

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

WITHOUT HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Marietta Church Road

2025 Projected PM EB Right Turns = 33

Right Turn Lane NOT Warranted

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

TABLE 5A

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

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

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

355+ 18 = 373

922

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

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Mission Hill Lane

2025 Projected AM EB Left Turns = 4

Left Turn Lane NOT Warranted

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

TABLE 5B

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

355

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

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Mission Hill Lane

2025 Projected AM WB Right Turns = 18

Right Turn Lane NOT Warranted

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

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

TABLE 5A

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

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

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

850 + 67 = 917

577

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149 150 - 199	70 60	60 55	50 45	45 40	40 35	35 30
200 - 249 250 - 299	55 50	50 4	40	35 30	30 30	30 30
300 - 349 350 - 399		4 3		30 25	25 25	25 20
400 - 449 450 - 499		3 2		25 20	20 20	20 20
500 - 549 550 - 599	25 25	2 2		20 20	20 20	15 15
600 - 649 650 - 699	25 20	20 20	20 20	20 20	20 20	15 15
700 - 749 750 or More	20 20	20 20	20 20	15 15	15 15	15 15

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Mission Hill Lane

2025 Projected PM EB Left Turns = 12

Left Turn Lane NOT Warranted

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

TABLE 5B

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

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

850

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

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Mission Hill Lane

2025 Projected PM WB Right Turns = 67

Right Turn Lane Warranted

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

TABLE 5A

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

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

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

10 + 286 + 7 = 303

598 + 2 = 600

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

Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

2025 Projected AM EB Left Turns = 1

Left Turn Lane NOT Warranted

WITH HOPPE PROPERTY SUBDIVISION

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

TABLE 5B

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

10 + 286 = 296

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						Yes
250 - 299					Yes	Yes
300 - 349				Yes	Yes	Yes
350 - 399			Yes	Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499			Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

2025 Projected AM WB Right Turns = 7

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	Yes
50 - 99				Yes	Yes	Yes
100 - 149			Yes	Yes	Yes	Yes
150 - 199		Yes	Yes	Yes	Yes	Yes
200 - 249	Yes	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 5A

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

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

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

33 + 612 + 22 = 667

388 + 8 = 396

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

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

2025 Projected PM EB Left Turns = 4

Left Turn Lane NOT Warranted

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

TABLE 5B

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

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

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

33 + 612 = 645

Hardin Valley Road at Muddy Creek Lane and Seal Property Entrance

2025 Projected PM WB Right Turns = 22

Right Turn Lane NOT Warranted

WITH HOPPE PROPERTY SUBDIVISION

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

TABLE 5A

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

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

0 + 658 + 27 = 685

274 + 8 = 282

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

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Marietta Church Road

2025 Projected AM WB Left Turns = 83

Left Turn Lane Warranted

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

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

TABLE 5B

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

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

0 + 658 = 658

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

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Marietta Church Road

2025 Projected AM EB Right Turns = 27

Right Turn Lane Warranted

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

TABLE 5A

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

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

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

2 + 410 + 33 = 445

622 + 26 = 648

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

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Marietta Church Road

2025 Projected PM WB Left Turns = 209

Left Turn Lane Warranted

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

TABLE 5B

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

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

2 + 410 = 412

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

WITH HOPPE PROPERTY SUBDIVISION

Hardin Valley Road at Marietta Church Road

2025 Projected PM EB Right Turns = 33

Right Turn Lane NOT Warranted

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

APPENDIX L

SIMTRAFFIC VEHICLE QUEUE LENGTHS

Intersection: 2: Marietta Church Road/Main Entrance & Hardin Valley Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	212	49	126	35
Average Queue (ft)	66	5	47	6
95th Queue (ft)	167	28	90	26
Link Distance (ft)	643	850	473	176
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Hardin Valley Road & Mission Hill Lane

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	23	100
Average Queue (ft)	1	36
95th Queue (ft)	14	75
Link Distance (ft)	850	245
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Seal Property Entrance/Muddy Creek Lane & Hardin Valley Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	6	55	65	46
Average Queue (ft)	0	6	31	16
95th Queue (ft)	5	30	57	42
Link Distance (ft)	181	643	155	211
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

Intersection: 2: Marietta Church Road/Hoppe Property Entrance & Hardin Valley Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	100	370	74	33
Average Queue (ft)	38	84	27	6
95th Queue (ft)	79	289	62	27
Link Distance (ft)	641	852	473	173
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Hardin Valley Road & Mission Hill Lane

Movement	EB	WB	SB
Directions Served	LT	R	LR
Maximum Queue (ft)	120	2	70
Average Queue (ft)	14	0	27
95th Queue (ft)	66	2	56
Link Distance (ft)	852		280
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		75	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: Seal Property Entrance/Muddy Creek Lane & Hardin Valley Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	29	66	54	44
Average Queue (ft)	2	9	27	12
95th Queue (ft)	17	39	50	37
Link Distance (ft)	230	641	171	197
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

APPENDIX M

MUTCD TRAFFIC SIGNAL WARRANT WORKSHEETS

TRAFFIC SIGNAL WARRANTS

PROJECTED FUTURE VOLUMES IN YEAR 2025 WITH TRAFFIC GROWTH AND GENERATED TRAFFIC
Hardin Valley Road at Marietta Church Road

	Main Entrance			Hardin Valley Road			Marietta Church Road			Hardin Valley Road			
TIME:	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND			
BEGIN	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT	LT	THRU	RT	
7:00 AM	0	0	0	4	13	0	2	0	17	0	56	1	Existing Volumes
7:15 AM	0	0	0	3	26	0	3	0	15	0	85	2	Existing Volumes
7:30 AM	0	0	0	9	31	0	4	0	17	0	78	5	Existing Volumes
7:45 AM	0	0	0	7	26	0	3	0	23	0	54	3	Existing Volumes
Sum	0	0	0	23	96	0	12	0	72	0	273	11	Sum
General Growth	0	0	0	20.7	86.4	0	10.8	0	64.8	0	245.7	9.9	Growth Rate of 10.0% for 9 years
				6.7	10.9		0.8		2.2		21.9	2.4	+2021 Trips
				3.7	42.7		2.3		1.2		118.2	6.9	+2023 Trips
	1.4	2.8	23.8	28.7	1.0	7.9	10.0	0.9	80.9	0.5	0.3	3.3	+2025 Trips
2025	1	3	24	83	237	8	36	1	221	0	659	34	Total Sum
8:00 AM	0	0	0	5	36	0	0	0	25	0	66	2	
8:15 AM	0	0	0	6	35	0	2	0	19	0	50	1	
8:30 AM	0	0	0	4	44	0	2	0	18	0	45	2	
8:45 AM	0	0	0	3	20	0	1	0	10	0	52	1	
Sum	0	0	0	18	135	0	5	0	72	0	213	6	
General Growth	0	0	0	16.2	121.5	0	4.5	0	64.8	0	191.7	5.4	
				6.2	10.0		0.7		2.1		20.1	2.2	
				3.4	39.1		2.1		1.1		108.4	6.3	
	1.3	2.6	21.8	26.4	0.9	7.3	9.2	0.9	74.1	0.4	0.3	3.1	
2025	1	3	22	70	307	7	22	1	214	0	533	23	
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													
2025	0	0	0	0	0	0	0	0	0	0	0	0	
12:00 PM													
12:15 PM													
12:30 PM													
12:45 PM													
2025	0	0	0	0	0	0	0	0	0	0	0	0	
2:00 PM	0	0	0	11	41	0	5	0	5	0	32	1	
2:15 PM	0	0	0	4	40	0	2	0	5	0	25	2	
2:30 PM	0	0	0	5	27	0	5	0	5	0	38	2	
2:45 PM	0	0	0	13	45	0	3	0	2	0	45	0	
Sum	0	0	0	33	153	0	15	0	17	0	140	5	
General Growth	0	0	0	29.7	137.7	0	13.5	0	15.3	0	126	4.5	
				2.9	17.1		1.8		5.0		12.0	1.1	
				1.6	88.8		5.1		2.8		54.0	3.0	
	0.6	1.2	10.4	60.9	0.5	17.8	4.4	2.1	36.4	1.0	0.6	7.5	
2025	1	1	10	128	397	18	40	2	76	1	333	21	
3:00 PM	0	0	0	13	40	0	4	0	10	0	28	3	
3:15 PM	0	0	0	6	39	0	2	0	6	0	40	0	
3:30 PM	0	0	0	16	38	0	7	0	8	0	25	2	
3:45 PM	0	0	0	24	55	0	4	0	4	0	31	2	
Sum	0	0	0	59	172	0	17	0	28	0	124	7	
General Growth	0	0	0	53.1	154.8	0	15.3	0	25.2	0	111.6	6.3	
				3.4	19.6		2.1		5.8		13.8	1.2	
				1.9	102.0		5.9		3.2		62.0	3.5	
	0.7	1.4	12.0	69.9	0.6	20.4	5.0	2.4	41.8	1.2	0.7	8.6	
2025	1	1	12	187	449	20	45	2	104	1	312	27	
4:00 PM	0	0	0	14	42	0	3	0	3	0	28	6	
4:15 PM	0	0	0	9	54	0	2	0	6	0	31	2	
4:30 PM	0	0	0	9	48	0	3	0	6	0	37	7	
4:45 PM	0	0	0	7	61	0	6	0	6	0	35	2	
Sum	0	0	0	39	205	0	14	0	21	0	131	17	
General Growth	0	0	0	35.1	184.5	0	12.6	0	18.9	0	117.9	15.3	
				3.9	22.7		2.4		6.7		16.0	1.4	
				2.1	117.9		6.8		3.7		71.6	4.0	
	0.8	1.6	13.8	80.8	0.7	23.6	5.8	2.8	48.3	1.4	0.8	9.9	
2025	1	2	14	161	531	24	42	3	99	1	337	48	
5:00 PM	0	0	0	13	60	0	2	0	19	0	37	3	
5:15 PM	0	0	0	16	66	0	5	0	17	0	46	0	
5:30 PM	0	0	0	14	55	0	7	0	6	0	44	5	
5:45 PM	0	0	0	12	72	0	5	0	9	0	43	2	
Sum	0	0	0	55	253	0	19	0	51	0	170	10	
General Growth	0	0	0	49.5	227.7	0	17.1	0	45.9	0	153	9	
				4.4	25.6		2.7		7.5		18.0	1.6	
				2.4	133.1		7.7		4.1		80.8	4.5	
	0.9	1.8	15.6	91.2	0.8	26.6	6.6	3.1	54.5	1.6	0.9	11.2	
2025	1	2	16	203	640	27	53	3	163	2	423	36	

Assumed Average Growth Rate (%)= 10.0%
Number of years = 9
Horizon Year = 2025

2021

Daily Trips Generated by	
Hunters Way (2021)	448
Massey Creek (2021)	992
Vining Mill (2021)	509

to = exit
from = enter

ITE #210

Entering and Exiting %'s (from ITE Rate):		Directional Distribution Assumptions for Hunters Way:		Directional Distribution Assumptions for Massey Creek:		Directional Distribution Assumptions for Vining Mill:	
25% Enter	AM Hours	85% to EB Thru	10% to EB Right	5% to WB Thru	10% to WB Left	5% to WB Thru	5% to WB Left
75% Exit		85% from WB Thru	10% from NB Left	5% from EB Thru	10% from NB Right	5% from EB Thru	5% from NB Right
50% Enter	Mid-Day Hours	85% to EB Thru	10% to EB Right	5% to WB Thru	10% to WB Left	5% to WB Thru	5% to WB Left
50% Exit	(assumed)	85% from WB Thru	10% from NB Left	5% from EB Thru	10% from NB Right	5% from EB Thru	5% from NB Right
63% Enter	PM Hours	85% to EB Thru	10% to EB Right	5% to WB Thru	10% to WB Left	5% to WB Thru	5% to WB Left
37% Exit		85% from WB Thru	10% from NB Left	5% from EB Thru	10% from NB Right	5% from EB Thru	5% from NB Right

2023

Daily Trips Generated by	
Seal Property	2,549
Vining Mill (2021)	1,368

ITE #210

Entering and Exiting %'s (from ITE Rate):		Directional Distribution Assumptions for Seal Property:		Directional Distribution Assumptions for Vining Mill:	
25% Enter	AM Hours	85% to EB Thru	5% to EB Right	5% to WB Thru	5% to WB Left
75% Exit		85% from WB Thru	5% from NB Left	5% from EB Thru	5% from NB Right
50% Enter	Mid-Day Hours	85% to EB Thru	5% to EB Right	5% to WB Thru	5% to WB Left
50% Exit	(assumed)	85% from WB Thru	5% from NB Left	5% from EB Thru	5% from NB Right
63% Enter	PM Hours	85% to EB Thru	5% to EB Right	5% to WB Thru	5% to WB Left
37% Exit		85% from WB Thru	5% from NB Left	5% from EB Thru	5% from NB Right

2025

Daily Trips Generated by	
Briggs Station	1,859
Hoppe Property Single-Family	519

ITE #210

Entering and Exiting %'s (from ITE Rate):		Directional Distribution Assumptions for Briggs Station:		Directional Distribution Assumptions for Hoppe Property:		
25% Enter	AM Hours	80% to NB Right	10% to NB Left	5% to SB Right	85% to SB Left	10% to SB Thru
75% Exit		80% from WB Left	10% from EB Right	5% from EB Left	85% from WB Right	10% from NB Thru
50% Enter	Mid-Day Hours	80% to NB Right	10% to NB Left	5% to SB Right	85% to SB Left	10% to SB Thru
50% Exit	(assumed)	80% from WB Left	10% from EB Right	5% from EB Left	85% from WB Right	10% from NB Thru
63% Enter	PM Hours	80% to NB Right	10% to NB Left	5% to SB Right	85% to SB Left	10% to SB Thru
37% Exit		80% from WB Left	10% from EB Right	5% from EB Left	85% from WB Right	10% from NB Thru

2025

Daily Trips Generated by	
Hoppe Property Townhouses	352

Local Trip Rate

Entering and Exiting %'s:		Directional Distribution Assumptions for Hoppe Property:	
22% Enter	AM Hours	5% to WB Thru	10% to WB Left
78% Exit		5% from EB Thru	10% from NB Right
50% Enter	Mid-Day Hours	5% to WB Thru	10% to WB Left
50% Exit	(assumed)	5% from EB Thru	10% from NB Right
55% Enter	PM Hours	5% to WB Thru	10% to WB Left
45% Exit		5% from EB Thru	10% from NB Right

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%

For example, 7-8 AM for SB Right Turns:
Volume = (847 Daily Trips * (1/5)) * 75% Exiting * 20% Trips from SB RT * 9.03% Trips (at 7-8 AM)
Volume = 169.4 x .75 x .20 x .093

This spreadsheet is used to estimate the future project hourly volumes to determine if a intersection will meet traffic signal warrants

Traffic Signal Warrant Analysis

Project Name	**Hoppe Property Subdivision**
Project/File #	**#2111**
Scenario	**2025 - Projected Traffic Volumes (0% Right Turn Volumes)**

Intersection Information	
Major Street Name	Hardin Valley Road
North/South or East/West	E/W
Speed Limit > 40 mph	No
# of Approach Lanes	1
% of Right Turn Traffic to Include	0%
Minor Street Name	Marietta Church Road/Main Entrance
# of Approach Lanes	1
% of Right Turn Traffic to Include	0%
Isolated Community < 10,000 pop	No

Additional Warrants to Consider	
Warrant 3, Peak Hour (A - Volume and Delay)	Yes
All-Way Stop Warrant	No

Traffic Signal Warrant Analysis

Hardin Valley Road (Major 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	0	659	34	
8 - 9 AM	0	533	23	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM				
12 - 1 PM				
1 - 2 PM				
2 - 3 PM	1	333	21	
3 - 4 PM	1	312	27	
4 - 5 PM	1	337	48	
5 - 6 PM	2	423	36	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			2,791	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	83	237	8	
8 - 9 AM	70	307	7	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM				
12 - 1 PM				
1 - 2 PM				
2 - 3 PM	128	397	18	
3 - 4 PM	187	449	20	
4 - 5 PM	161	531	24	
5 - 6 PM	203	640	27	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,497	0

Marietta Church Road/Main Entrance (Minor 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	36	1	221	
8 - 9 AM	22	1	214	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM				
12 - 1 PM				
1 - 2 PM				
2 - 3 PM	40	2	76	
3 - 4 PM	45	2	104	
4 - 5 PM	42	3	99	
5 - 6 PM	53	3	163	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			1,127	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	1	3	24	
8 - 9 AM	1	3	22	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM				
12 - 1 PM				
1 - 2 PM				
2 - 3 PM	1	1	10	
3 - 4 PM	1	1	12	
4 - 5 PM	1	2	14	
5 - 6 PM	1	2	16	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			116	0

Traffic Signal Warrant Analysis

Warrants 1 - 3 (Volume Warrants)

Project Name	Hoppe Property Subdivision
Project/File #	#2111
Scenario	2025 - Projected Traffic Volumes (0% Right Turn Volumes)

Intersection Information			
Major Street (E/W Road)	Hardin Valley Road	Minor Street (N/S Road)	Marietta Church Road/Main Entrance
Analyzed with	1 approach lane	Analyzed with	1 Approach Lane
Total Approach Volume	6288 vehicles	Total Approach Volume	1243 vehicles
Total Ped/Bike Volume	0 crossings	Total Ped/Bike Volume	0 crossings
Right turn reduction of	1 percent applied	Right turn reduction of	1 percent applied

No speed or isolated community reduction applied to the warrant thresholds

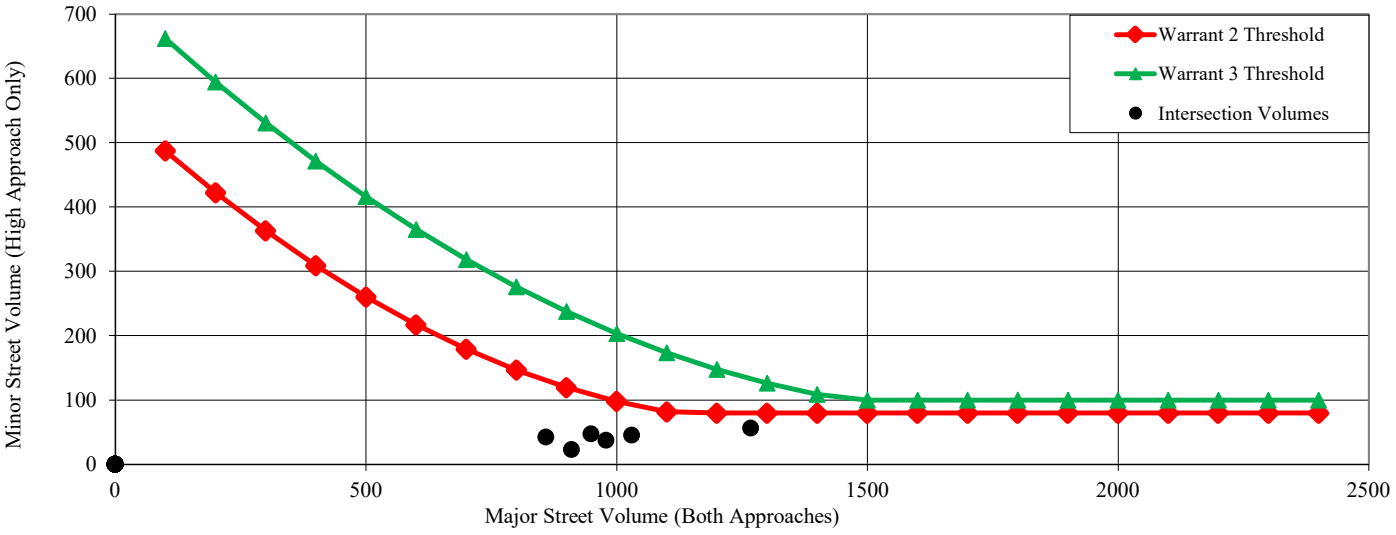
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	**Condition B**	**Condition A+B***
Condition Satisfied?	**Not satisfied**	**Not satisfied**	**Not satisfied**
Required values reached for	0 hours	0 hours	0 (Cond. A) & 0 (Cond. B)
Criteria - Major Street (veh/hr)	500	750	400 (Cond. A) & 600 (Cond. B)
Criteria - Minor Street (veh/hr)	150	75	120 (Cond. A) & 60 (Cond. B)

* Should be applied only after an adequate trail of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Warrant 2, Four Hour Vehicular Volume	
Condition Satisfied?	**Not satisfied**
Required values reached for	0 hours
Criteria	See Figure Below

Warrant 3, Peak Hour Vehicular Volume		
	Condition A	**Condition B**
Condition Satisfied?	**Satisfied**	**Not Satisfied**
Required values reached for	799 total, 150 minor, 6.3 delay	0 hours
Criteria - Total Approach Volume (veh in one hour)	650	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	150	
Criteria - Minor Street High Side Delay (veh-hrs)	5	

Figure 4C-1 (Warrant 2) & Figure 4C-3 (Warrant 3)



Traffic Signal Warrant Analysis

Project Name	**Hoppe Property Subdivision**
Project/File #	**#2111**
Scenario	**2025 - Projected Traffic Volumes (100% Right Turn Volumes)**

Intersection Information	
Major Street Name	Hardin Valley Road
North/South or East/West	E/W
Speed Limit > 40 mph	No
# of Approach Lanes	1
% of Right Turn Traffic to Include	100%
Minor Street Name	Marietta Church Road/Main Entrance
# of Approach Lanes	1
% of Right Turn Traffic to Include	100%
Isolated Community < 10,000 pop	No

Additional Warrants to Consider	
Warrant 3, Peak Hour (A - Volume and Delay)	Yes
All-Way Stop Warrant	No

Traffic Signal Warrant Analysis

Hardin Valley Road (Major 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	0	659	34	
8 - 9 AM	0	533	23	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM				
12 - 1 PM				
1 - 2 PM				
2 - 3 PM	1	333	21	
3 - 4 PM	1	312	27	
4 - 5 PM	1	337	48	
5 - 6 PM	2	423	36	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			2,791	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	83	237	8	
8 - 9 AM	70	307	7	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM				
12 - 1 PM				
1 - 2 PM				
2 - 3 PM	128	397	18	
3 - 4 PM	187	449	20	
4 - 5 PM	161	531	24	
5 - 6 PM	203	640	27	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,497	0

Marietta Church Road/Main Entrance (Minor 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	36	1	221	
8 - 9 AM	22	1	214	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM				
12 - 1 PM				
1 - 2 PM				
2 - 3 PM	40	2	76	
3 - 4 PM	45	2	104	
4 - 5 PM	42	3	99	
5 - 6 PM	53	3	163	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			1,127	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	1	3	24	
8 - 9 AM	1	3	22	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM				
12 - 1 PM				
1 - 2 PM				
2 - 3 PM	1	1	10	
3 - 4 PM	1	1	12	
4 - 5 PM	1	2	14	
5 - 6 PM	1	2	16	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			116	0

Traffic Signal Warrant Analysis

Warrants 1 - 3 (Volume Warrants)

Project Name	Hoppe Property Subdivision
Project/File #	#2111
Scenario	2025 - Projected Traffic Volumes (100% Right Turn Volumes)

Intersection Information			
Major Street (E/W Road)	Hardin Valley Road	Minor Street (N/S Road)	Marietta Church Road/Main Entrance
Analyzed with	1 approach lane	Analyzed with	1 Approach Lane
Total Approach Volume	6288 vehicles	Total Approach Volume	1243 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 speed or isolated community reduction applied to the warrant thresholds

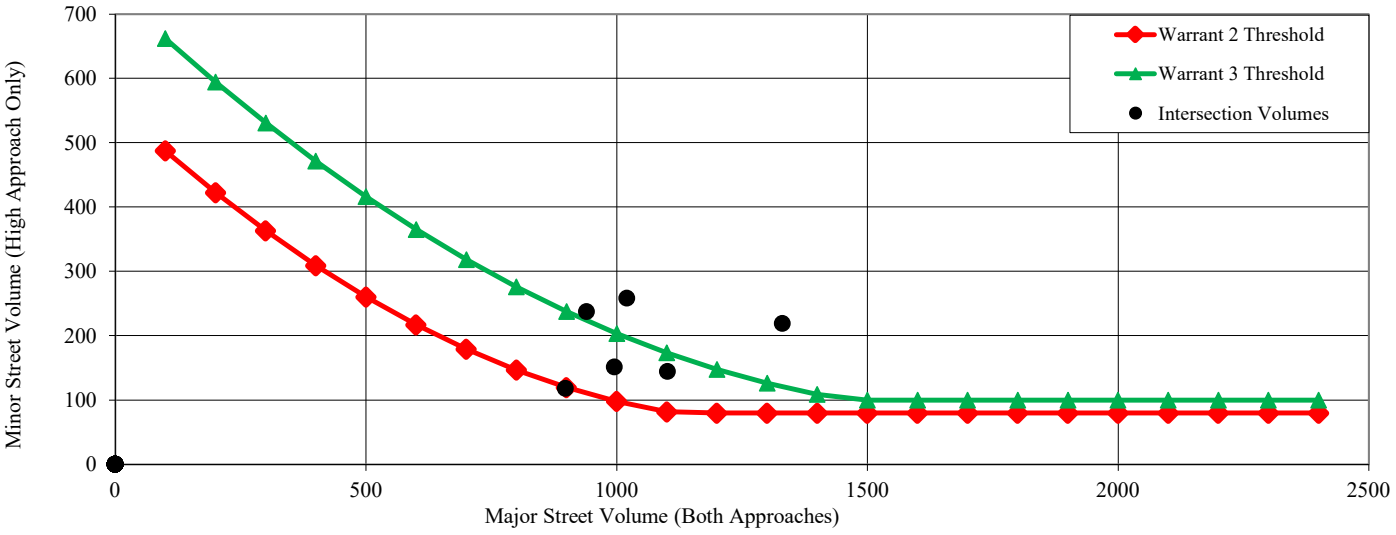
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	**Condition B**	**Condition A+B***
Condition Satisfied?	**Not satisfied**	**Not satisfied**	**Not satisfied**
Required values reached for	4 hours	6 hours	5 (Cond. A) & 6 (Cond. B)
Criteria - Major Street (veh/hr)	500	750	400 (Cond. A) & 600 (Cond. B)
Criteria - Minor Street (veh/hr)	150	75	120 (Cond. A) & 60 (Cond. B)

* Should be applied only after an adequate trail of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Warrant 2, Four Hour Vehicular Volume	
Condition Satisfied?	**Satisfied**
Required values reached for	5 hours
Criteria	See Figure Below

Warrant 3, Peak Hour Vehicular Volume		
	Condition A	**Condition B**
Condition Satisfied?	**Satisfied**	**Satisfied**
Required values reached for	799 total, 150 minor, 6.3 delay	3 hours
Criteria - Total Approach Volume (veh in one hour)	650	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	150	
Criteria - Minor Street High Side Delay (veh-hrs)	5	

Figure 4C-1 (Warrant 2) & Figure 4C-3 (Warrant 3)



APPENDIX N

RESPONSE LETTER TO ADDRESS REVIEW COMMENTS

AJAX ENGINEERING
CIVIL ENGINEERING / TRAFFIC ENGINEERING

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

August 23, 2021

PROJECT NAME: Hoppe Property Subdivision TIS

TO: Knoxville-Knox County Planning

SUBJECT: TIS Comment Response Document for Hoppe Property Subdivision (9-SB-21-C/9-C-21-UR)
Review Comments dated August 13, 2021

Dear Knoxville-Knox County Planning Staff:

The following comment response document is submitted to address comments from a letter and email dated August 13, 2021, and this letter is added to the end of the revised report.

1. **The site plan that was submitted for Concept Plan review does not match the one that was included/referenced in the TIS so please update the TIS with the correct site plan along with updating the associated analyses based on its access point locations. Note, the "S&E Property" subdivision site plan has also changed from what is shown in the TIS and is now proposed to directly access Hardin Valley Road instead of Mission Hill Lane.**

   Response: The report has been revised throughout to reflect this request and it matches the current site plan proposed for the development.

2. **As additional follow-up to comment #1 specifically regarding the intersection of Marietta Church Road at Hardin Valley Road – now that it is proposed as the main access to this subdivision, please ensure that it is fully analyzed beyond the preliminary level of review that was provided in this version of the TIS to include signal warrants, sight distance, turn lane warrants, roundabout considerations, etc. for all scenarios (existing, background growth and full development).**

   Response: Since the site plan was changed, showing the Main Entrance at the intersection of Hardin Valley Road at Marietta Church Road, the report has been revised to reflect this change. The report now includes a full

analysis of this proposed modified intersection, including traffic signal warrants, sight distance, etc.

3. **A few minor text corrections are needed to improve clarity as follows:**
   a. **In the middle of the 3rd paragraph on page 2 you reference the proposed new roundabout for the Seal Property saying that it is to the east of this proposed development however it should say "west" instead.**
   b. **Page 3 under "Study Results", 2nd bullet- in the 3rd sentence please add the name of the road stub (Deer Crossing Drive).**
   c. **Page 18 states that there are two permanent traffic count locations – the term "permanent count" typically refers to a continuous traffic count location that is collecting data on a 24/7/365 basis and used to determine seasonal adjustment factors. These locations should instead be referred to as annual "short duration" count stations or similar terminology to avoid any confusion.**

Response: a. In the middle of the 3rd paragraph on page 2, the reference to the proposed new roundabout for the Seal Property stating that it is to the east of this proposed development has been changed to say "west".

b. On Page 3, under "Study Results", 2nd bullet- in the 3rd sentence, the name of the road stub (Deer Crossing Drive) was added.

c. On Page 18, the traffic count location discussion has been changed and they are described as "annual".

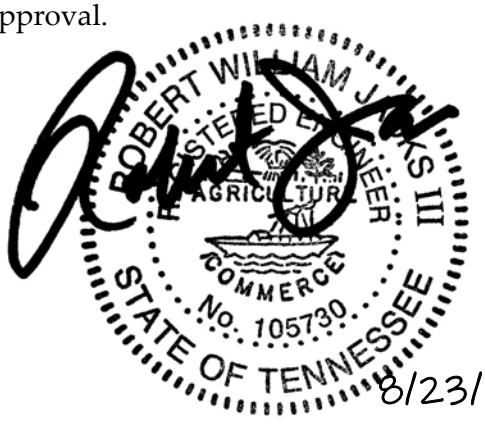
In addition to the requested revisions, other changes in the report include the following:

- Updated Title Page
- Updated Table of Contents
- Updated Page Footers
- Revised Figures 1a, 1b, 3, 4a, 4b, 5a, 5b, 6, 7a, 7b, 8a, 8b
- Deleted Figures 9 and 10
- Revised Tables 5a, 6, 7a- 7c, 8 -14
- Revised Appendix F, H, J, K, L
- Added Appendix M
- Added Appendix N 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.



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