Transportation Impact Analysis

Accokeek Furnace

Stafford County, Virginia

November 2017

Transportation Impact Analysis

Accokeek Furnace

Stafford County, Virginia

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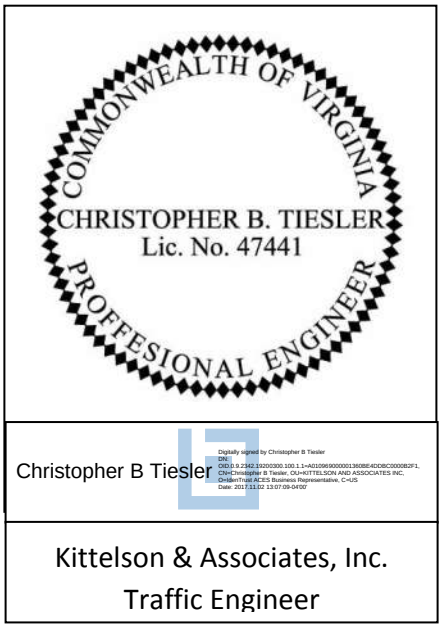

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Section 1
Executive Summary

EXECUTIVE SUMMARY

A traffic operations analysis has been conducted to confirm that the transportation system can adequately support the proposed Accokeek Furnace development, in fulfillment of Stafford County and Virginia Department of Transportation's (VDOT) requirements for traffic impact studies. The scope of the project analysis was developed in collaboration with County and VDOT staff.

Specifically, this analysis includes:

- Year 2017 existing land use and transportation system conditions within the site vicinity;
- Forecast year 2022 background traffic conditions (without site development) during the weekday a.m., weekday p.m., and Saturday midday peak periods including in-process/approved developments and regional growth;
- Trip generation and distribution estimates for the proposed development;
- Forecast year 2022 total traffic conditions based on full build out of the development including queuing;
- Design year 2028 total traffic conditions based on full build out of the development; and,
- Conclusions and recommendations.

Based on the results of the transportation impact analysis, the transportation system can accommodate full build-out of the proposed development and assuming provision of the recommended mitigations. The findings of this analysis and our recommendations are discussed below.

Existing Conditions

- All study intersections currently operate at LOS C or better with the following exceptions:
    - Mountain View Road/Kellogg Mill Road (#1): The critical northbound and southbound approaches at the all-way stop-controlled Mountain View Road/Kellogg Mill Road intersection operate at LOS F and LOS D during the weekday a.m. and p.m. peak hours, respectively.
        - A mini-roundabout with a 75-foot ICD is anticipated to operate under capacity under existing traffic volumes during the weekday a.m. and p.m. peak hours. As such, a mini-roundabout will be presented as a mitigation strategy at the Mountain View Road/Kellogg Mill Road intersection in all future year traffic analyses.
    - Ramoth Church Road/Kellogg Mill Road (#2): The critical northbound approach of the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road intersection currently operates at LOS D during the weekday a.m. peak hour.

- Courthouse Road/Woodcutters Road (#4): The stop-controlled northbound approach operates at LOS F and LOS E during the weekday a.m. and p.m. peak hours, respectively.
    - MUTCD signal warrants are met under existing conditions at this intersection. If signalized, the intersection is anticipated to operate at LOS C or better during the study time periods in its current configuration.

2022 Background Traffic Conditions

- Growth rates of three percent (Courthouse Road and Mountain View Road) and two percent (all other roads) were compounded annually and applied to account for near-term regional traffic growth.
- Forecast traffic from the Augustine Woods (95 single-family homes) was also added to the study network to develop year 2022 background traffic volumes.
- Two transportation improvements were identified for inclusion in the background 2022 analysis.
    - Widening of Courthouse Road to a 4-lane cross-section through the study area
    - Widening of Woodcutters Road to a 4-lane cross-section throughout the study area
- All study intersections are forecast to operate at LOS C or better with the following exceptions:
    - Mountain View Road/Kellogg Mill Road (#1): A mini-roundabout with a 75-foot ICD is anticipated to operate under capacity under 2022 background traffic volumes during the weekday a.m. and p.m. peak hours.
    - Ramoth Church Road/Kellogg Mill Road (#2): The critical northbound approach of the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road intersection is forecast to continue to operate at LOS D during the weekday a.m. peak hour.
    - Courthouse Road/Woodcutters Road (#4): The stop-controlled northbound approach is forecast to operate at LOS F and LOS E during the weekday a.m. and p.m. peak hours, respectively.
        - MUTCD signal warrants are met assuming a four-lane Courthouse Road at this intersection. If signalized, the intersection is anticipated to operate at LOS B or better during the study time periods.

Proposed Development

- Brookfield Homes is applying for a rezoning of approximately 72 acres of Agricultural (A1) land to Suburban Residential (R1) land to allow for the Accokeek Furnace development of 350 townhomes.

- The site proposes extend the existing Accokeek Furnace Road from its current terminus and develop a series of new public and private roadways. Access to the individual condominium/townhome lots are proposed to be provided via the new public and private roads.
- The development is estimated to generate approximately 1,913 net new weekday daily trips, 141 weekday a.m. (24 in, 117 out), and 168 weekday p.m. (113 in, 55 out) peak hour trips when fully built out in year 2022.

2022 Total Traffic Conditions

- All study intersections are forecast to operate at LOS C or better with the following exceptions:
    - Mountain View Road/Kellogg Mill Road (#1): A mini-roundabout with a 75-foot ICD is anticipated to operate under capacity under 2022 total traffic volumes during the weekday a.m. and p.m. peak hours.
    - Ramoth Church Road/Kellogg Mill Road (#2): The critical northbound approach of the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road intersection is forecast to continue to operate at LOS D during the weekday a.m. peak hour.
        - The development is projected to account for approximately 45 percent of the total volume at this intersection, which has been shown to be deficient under existing traffic conditions. Several possible mitigation strategies at this intersection were explored and are described briefly below.
            - Option 1 – Additional Turn Lanes: This option would add turn lanes at this intersection. Ultimately, it was determined that even with separate left-turn lanes on all approaches, the County's LOS standard (LOS C) would not be achievable. Widening both Kellogg Mill Road and Ramoth Church Road would also have right-of-way impacts to all four quadrants of the intersection. This option is not considered a feasible solution.
            - Option 2 – Single-Lane Roundabout: This option would construct a single-lane roundabout (Inscribed Circle Diameter of 150 feet) designed to accommodate a WB-62 or WB-67 design vehicle. While this option would satisfy the County's LOS standard, the resultant "footprint" of the roundabout would likely have right-of-way impacts to all four quadrants of the intersection.
            - Option 3 – Realignment of Eastern Portion of Kellogg Mill Road: This option contemplates the realignment of a portion of Kellogg Mill Road on the east side of Ramoth Church Road, creating a separate new "T" intersection to the north. The new intersection

would be constructed as a roundabout, and designed to incorporate a future fourth leg (Kellogg Mill Road west of Ramoth Church Road) to the west. This option would effectively implement one half of the County Transportation Plan to realign Kellogg Mill Road from its current location to the north. The existing eastern portion of Kellogg Mill Road would be retained to provide local access via Ramoth Church Road, but would be terminated via a cul de sac at the eastern end.

Roundabout control at the new intersection would operate acceptably, but demand for east-west travel on Kellogg Mill Road would still produce heavy turning movement volumes at the existing Ramoth Church Road/Kellogg Mill Road intersection.

- Option 4 – Complete Realignment of Kellogg Mill Road: This option would fully implement the County Comprehensive Plan realignment of Kellogg Mill Road (from 0.15 miles west of Ramoth Church Road to 0.35 miles east) and creation of a new intersection north of the existing Ramoth Church Road/Kellogg Mill Road intersection. Roundabout control at the new intersection would operate acceptably, and it is assumed that the exiting Kellogg Mill Road would be retained to provide local access to the church, local residences, and cemetery in the southwest quadrant of the intersection.

- Option 5 – Disconnect Kellogg Mill Road Between Ramoth Church Road and Woodcutters Road: This option would sever Kellogg Mill Road at a point just west of Woodcutters Road. Regional through traffic that today uses Woodcutters Road and Kellogg Mill Road to connect between Courthouse Road and Mountain View Road would be diverted to use Ramoth Church Road. This concept eliminate all non-local traffic on the segment of Kellogg Mill Road to the east of Ramoth Church Road (serving only the church and local residences in the area), but would still require improvements to the Kellogg Mill Road/Ramoth Church Road intersection to address existing operational deficiencies. This option is considered less desirable in that it is inconsistent with the County's transportation plan and could have other unintended consequences/impacts at other intersections beyond the scope of this study.

- Courthouse Road/Woodcutters Road (#4): The stop-controlled northbound approach is forecast to operate at LOS F and LOS E during the weekday a.m. and p.m. peak hours, respectively.
  - MUTCD signal warrants are met assuming a four-lane Courthouse Road at this intersection. If signalized, the intersection is anticipated to operate at LOS C or better during the study time periods.

2028 Total Traffic Conditions

- All study intersections are forecast to operate at LOS C or better with the following exceptions:
  - Mountain View Road/Kellogg Mill Road (#1): A mini-roundabout with a 75-foot ICD is anticipated to operate near or above capacity under 2028 total traffic volumes during the weekday a.m. and p.m. peak hours.
  - Ramoth Church Road/Kellogg Mill Road (#2): The critical approaches of the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road intersection is forecast to continue to operate at LOS E during the weekday a.m. and p.m. peak hours.
  - Courthouse Road/Woodcutters Road (#4): The stop-controlled northbound approach is forecast to operate at LOS F during both the weekday a.m. and p.m. peak hours.
    - MUTCD signal warrants are met assuming a four-lane Courthouse Road at this intersection. If signalized, the intersection is anticipated to operate at LOS C or better during the study time periods.

RECOMMENDATIONS

The following improvements are recommended to mitigate the impacts of the proposed Accokeek Furnace development.

- Contribute proffer dollars to an improvement for the Kellogg Mill Road/Ramoth Church Road to be determined prior to rezoning approval. In general, improvements that implement Stafford County's current Comprehensive Plan are considered more desirable than those that do not.

Section 2
Introduction

INTRODUCTION

Kittelson and Associates, Inc. (KAI) prepared this report to document analysis methodologies and assumptions with regard to the rezoning of approximately 72 acres of Agricultural (A1) land to Suburban Residential (R1) land to allow for the development of 350 townhomes. The proposed development, hereby referred to as Accokeek Furnace, is located northeast of the Woodcutters Road/Kellogg Mill Road/Accokeek Furnace Road intersection in Stafford County, Virginia. The site, shown in **Figure 1**, proposes extend the existing Accokeek Furnace Road from its current terminus and develop a series of new public and private roadways. Access to the individual condominium/townhome lots are proposed to be provided via the new public and private roads.

The area surrounding the site is generally rural with undeveloped properties and residential developments in the immediate vicinity of the site. The general topography for the study site can best be described as level to rolling-hill type terrain. **Figure 2** shows a preliminary conceptual site plan. **Figure 3** illustrates the current zoning map for Stafford County (Reference 1). The parcel on which the proposed development is located is currently zoned as Agricultural (A-1).

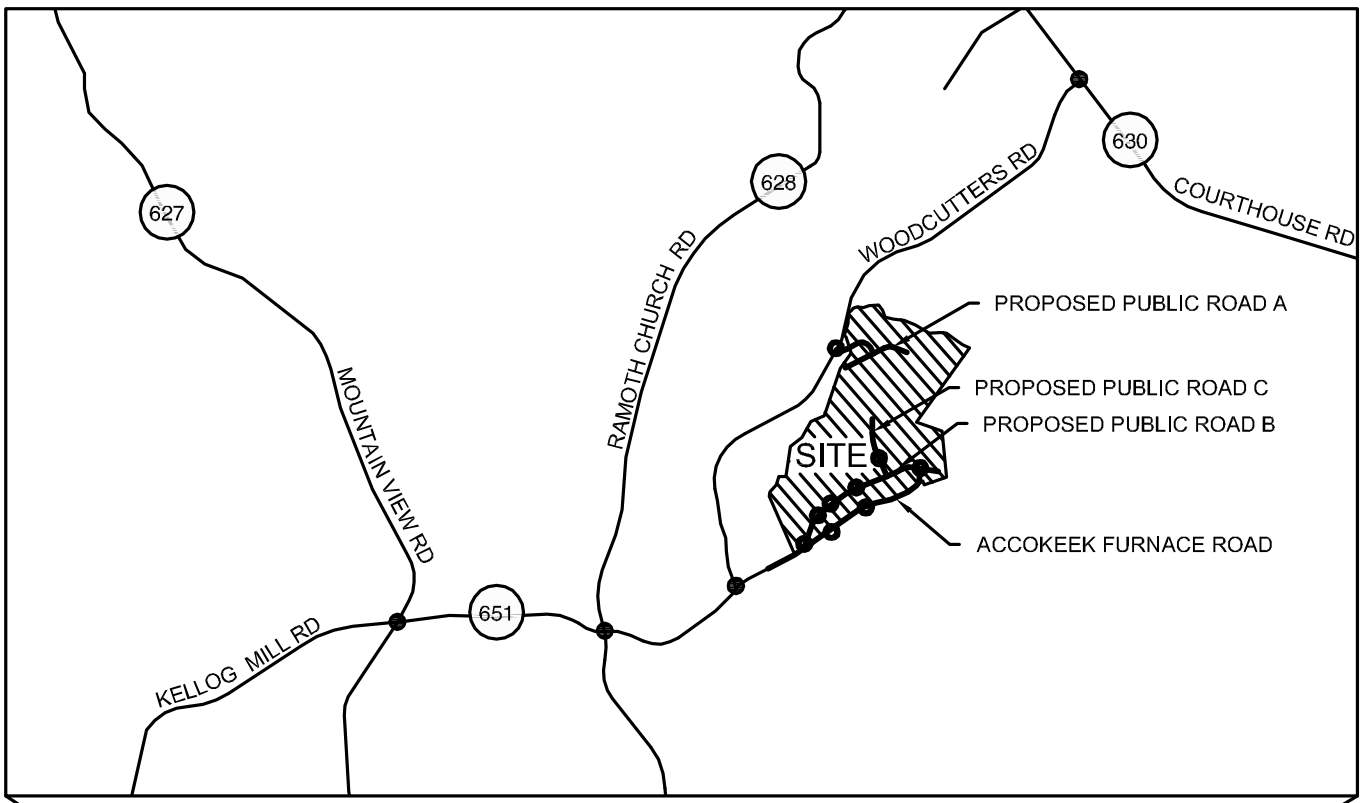
This analysis determines the transportation related impacts associated with the proposed development and was prepared in accordance with Stafford County and Virginia Department of Transportation (VDOT) requirements for traffic impact studies. The study intersections, time periods for analysis, and scope of this project were selected after County and VDOT staff were consulted. *A scoping letter provided for this project is provided in* ***Appendix A****.*

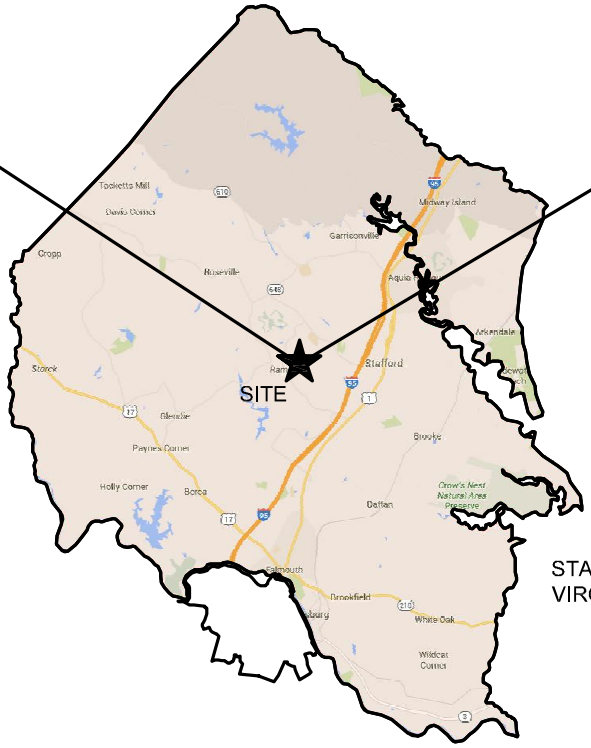
A traffic operations analysis has been conducted to confirm that the transportation system can adequately support the proposed development. Specifically, this analysis includes:

- Year 2018 existing land use and transportation system conditions within the site vicinity;
- Forecast year 2022 background traffic conditions (without site development) during the weekday a.m. and p.m. peak periods including in-process/approved developments and regional growth;
- Trip generation and distribution estimates for the proposed development;
- Forecast year 2022 total traffic conditions based on full build out of the development including queuing and turn lane analyses;
- Design year 2028 total traffic conditions based on full build out of the development; and,
- Conclusions and recommendations.

At the request of VDOT and County staff, the analysis also includes:

- Review of the anticipated operations of a mini-roundabout at the Mountain View Road/Kellogg Mill intersection when conditions deteriorate to unacceptable levels; and,
- Preliminary MUTCD signal warrant analysis at the Courthouse Road/Woodcutters Road intersection when conditions deteriorate to unacceptable levels.





STAFFORD COUNTY,
VIRGINIA

● - Study Intersections
○ - Future Study Intersections

Site Vicinity Map
Stafford County, Virginia

Figure
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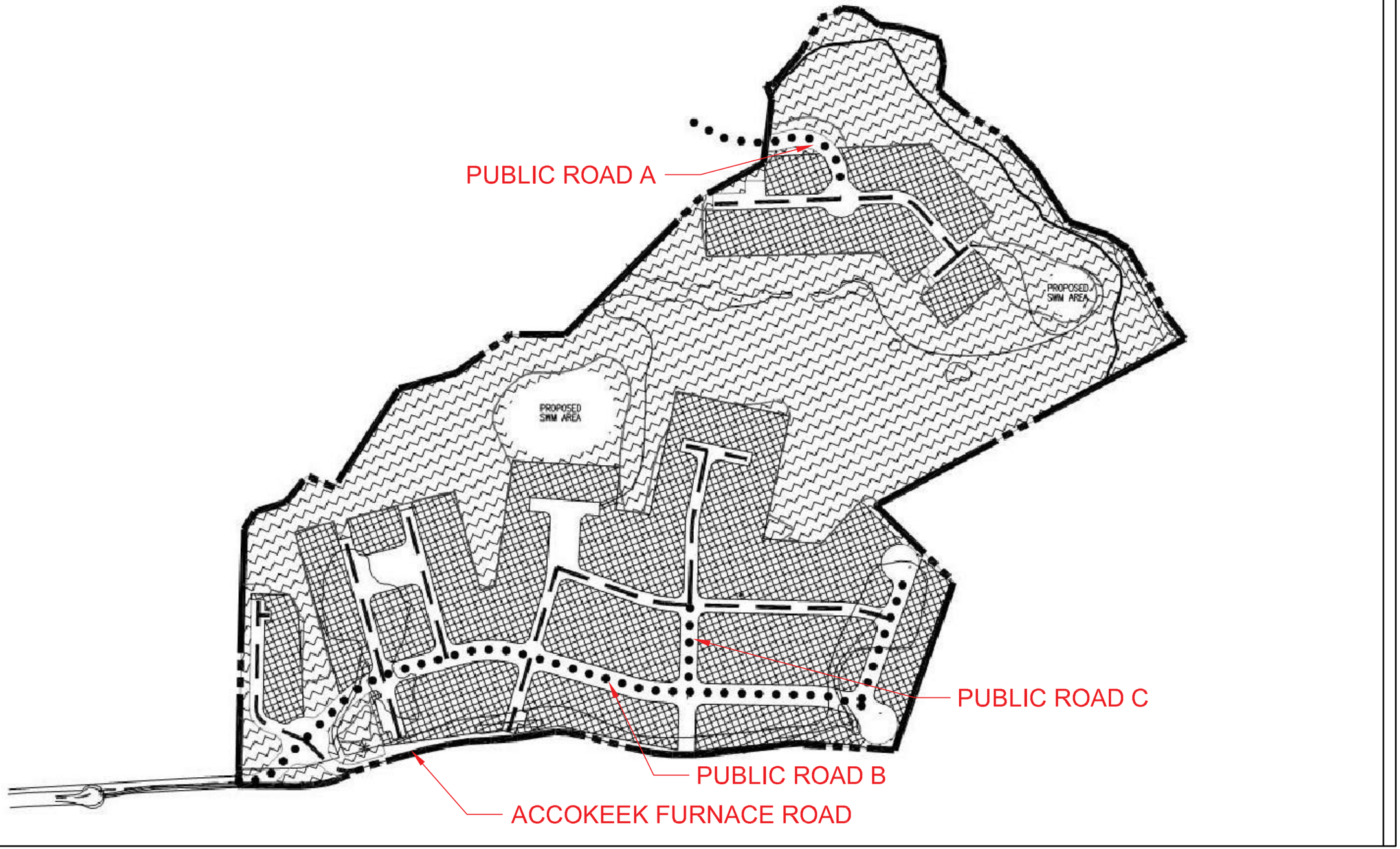

Proposed Site Plan
Developed by Dewberry (11/02/17)
Stafford County, Virginia

Figure
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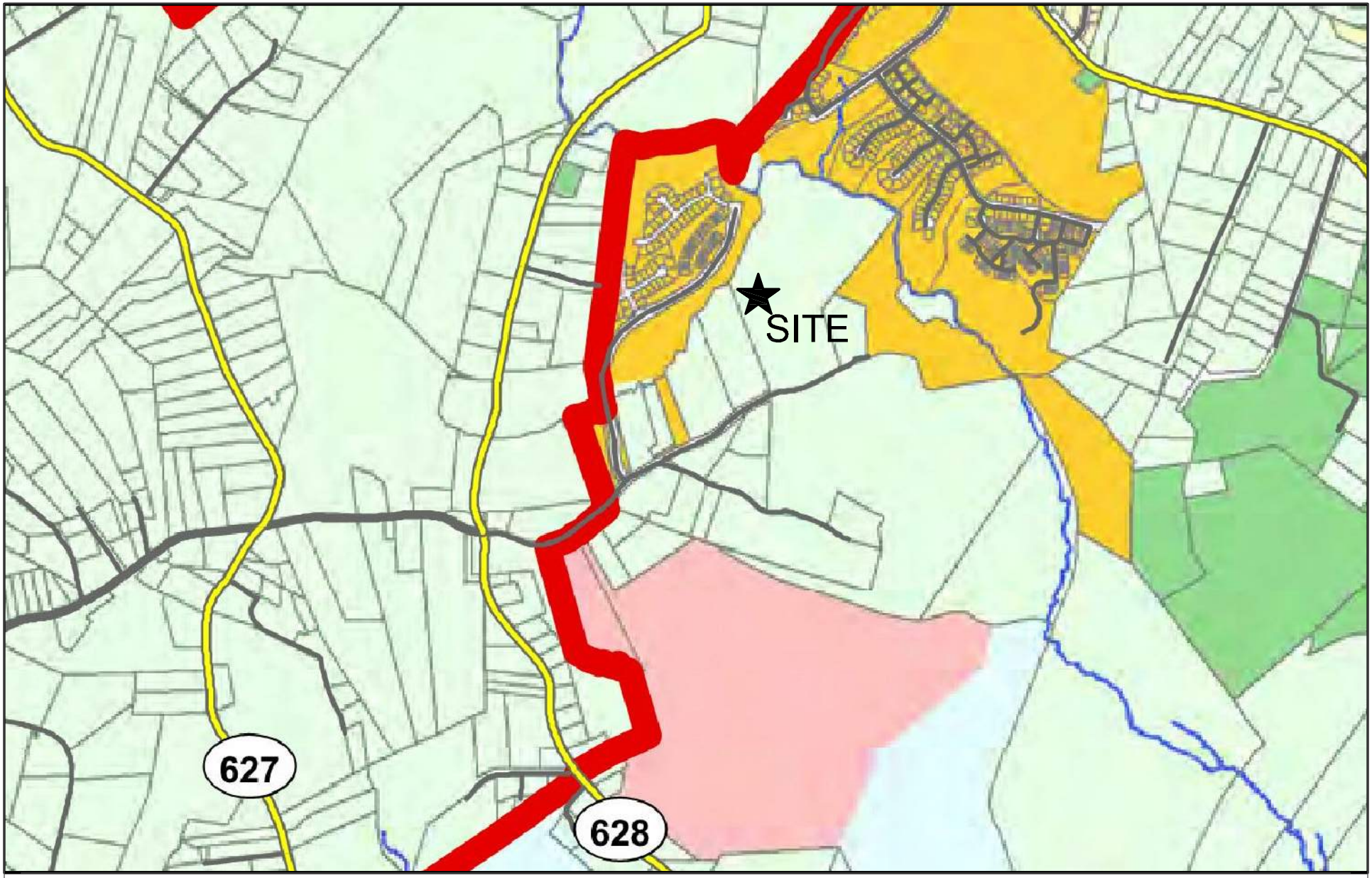

Stafford County Zoning Map
Provided by Stafford County
Stafford County, Virginia

Figure
3

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Section 3
Existing Conditions

EXISTING CONDITIONS

The existing conditions analysis identifies the site conditions and current operational and geometric characteristics of the roadways within the study area. These conditions will be compared with future conditions later in this report.

Kittelson & Associates, Inc. (KAI) staff visited and inventoried the proposed Accokeek Furnace Road development site and surrounding study area in September 2017. At that time, KAI collected information regarding site conditions, adjacent land uses, existing traffic operations, and transportation facilities in the study area.

Transportation Facilities

Table 1 summarizes the primary transportation facilities in the site vicinity. **Figure 4** shows the existing lane configurations and traffic control devices at the study intersections.

Table 1. Existing Transportation Facilities and Roadway Designations

Roadway	Classification[1]	Number of Lanes	Speed Limit (mph)	Median	Side-walks	Bicycle Lanes	On-Street Parking	Surface
Route 630 (Courthouse Road)	Major Collector	2	40	No	No	No	No	Paved
Route 627 (Mountain View Road)	Major Collector	2	40	No	No	No	No	Paved
Route 628 (Ramoth Church Road)	Minor Collector	2	40	No	No	No	No	Paved
Route 651 (Kellogg Mill Road)	Minor Collector	2	25/40	No	No	No	No	Paved
Woodcutters Road	Local	2-4	15/25/35[3]	Yes	Yes	No	No	Paved
Accokeek Furnace Road	Local	2	25	No	No	No	No	Paved

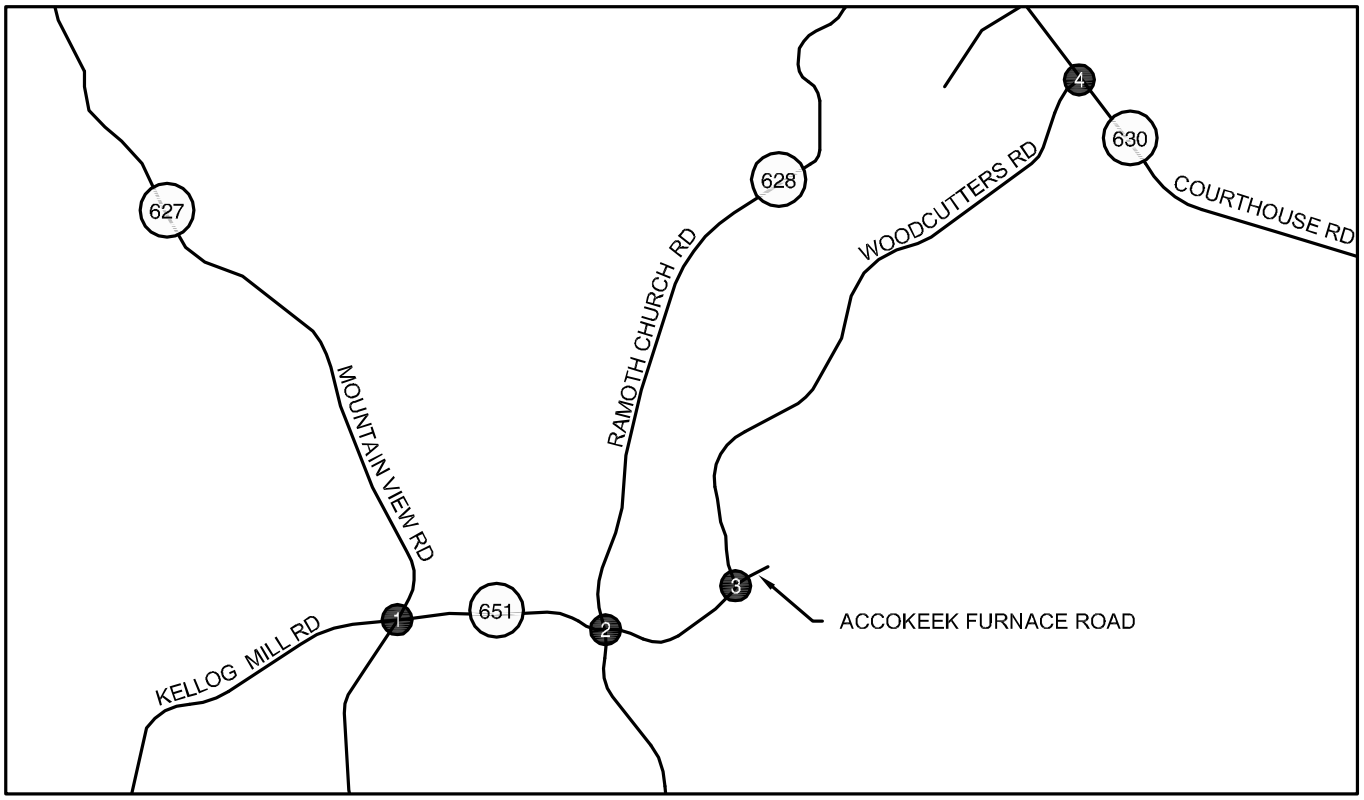
[1]Classifications based on VDOT's 2014 Functional Classification Map.
[2]Speed limit of 25 mph east of Ramoth Church Road, 40 mph west of Ramoth Church Road.
[3]Temporary speed limits of 15-25 mph in place near Kellogg Mill Road. Speed limit of 35 mph in northern segment with 4-lane cross-section.

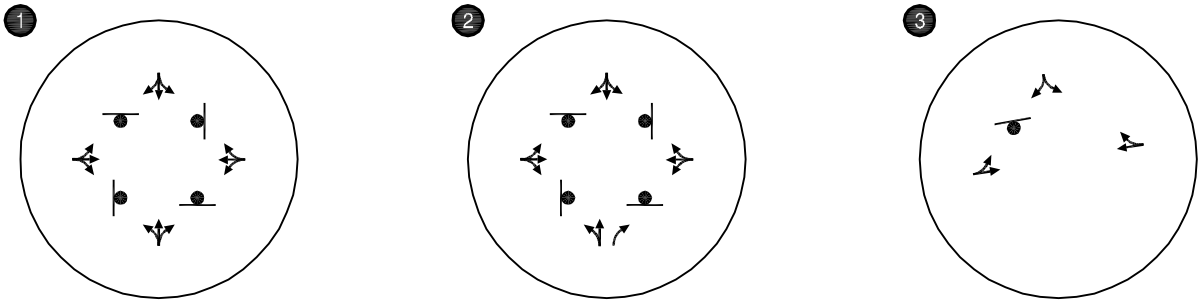
Pedestrian and Bicycle Facilities

Field observations taken in the site vicinity revealed low levels of pedestrian and bicycle activity along the study area roadways during most hours of the day.

Transit Facilities

No transit facilities are present within the study area.





- STOP SIGN
- TRAFFIC SIGNAL

Existing Lane Configurations and Traffic Control Devices Stafford County, Virginia

Figure **4**

Existing Traffic Volumes and Peak Hour Operations

Turning-movement counts were obtained in May 2017 at all existing study intersections. The counts were conducted on a typical weekday morning (6:00 – 9:00 a.m.) and weekday evening (4:00 – 7:00 p.m.) during peak time periods when school was in session. At the Courthouse Road/Woodcutters Road intersection, 13-hour (6:00 a.m. to 7:00 p.m.) turning movement counts were collected for the purposes on conducting a preliminary signal warrant analysis at the intersection. ***Appendix B*** *contains all turning movement count data sheets.*

Consistent with scoping requirements, operational analyses were performed at the following intersections:

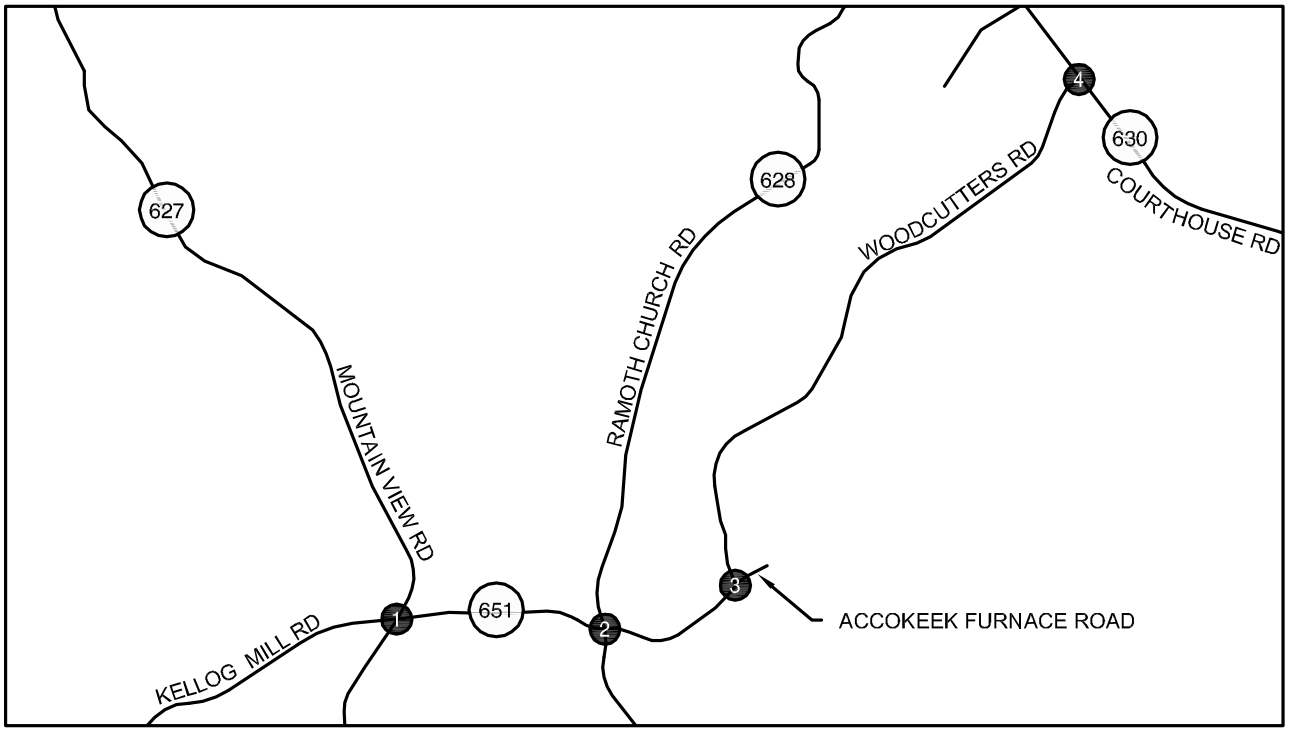
- Route 630 (Courthouse Road)/Woodcutters Road
- Route 627 (Mountain View Road)/Route 651 (Kellogg Mill Road)
- Route 628 (Ramoth Church Road)/Route 651 (Kellogg Mill Road)
- Woodcutters Road/Route 651 (Kellogg Mill Road)/Accokeek Furnace Road

Current Levels of Service and Volume-to-Capacity Ratios

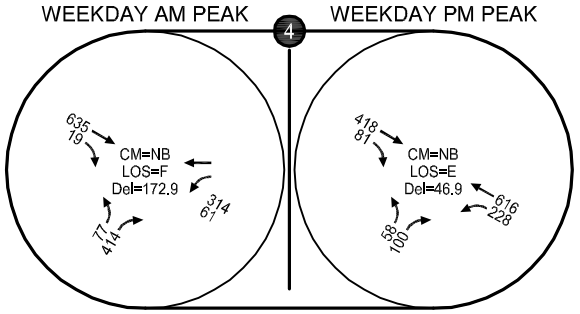
All level of service (LOS) analyses described in this report was performed in accordance with the procedures stated in the 2010 *Highway Capacity Manual* (HCM - Reference 2) and report HCM 2010 outputs. *A description of level of service and the criteria by which they are determined is presented in* ***Appendix C****.*

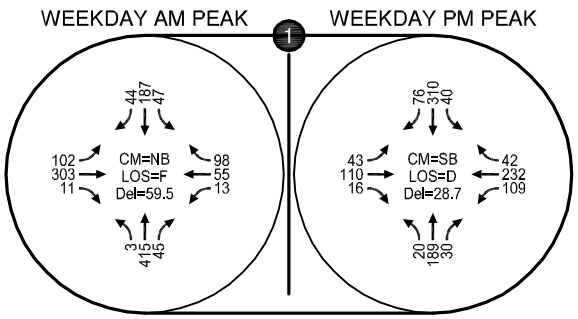
This analysis is based on the system hourly peak during each of the study periods to evaluate of all intersection levels-of-service. The weekday a.m. peak hour was found to be 6:45 a.m. to 7:45 a.m., while the weekday p.m. peak hour was found to be 4:45 p.m. to 5:45 p.m. Traffic operations were evaluated using Synchro 9 in accordance with VDOT's *Traffic Operations and Safety Analysis Manual v1.0* (TOSAM).

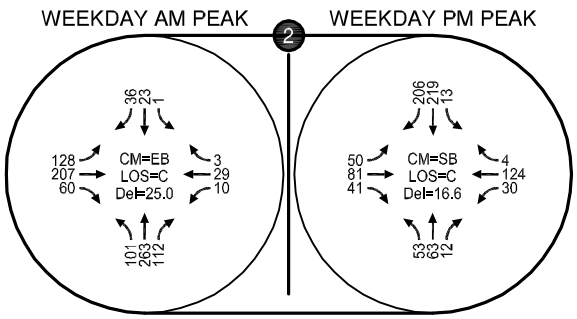
Figure 5 shows the overall intersection operational results of the existing traffic operations analysis for the weekday a.m. and weekday p.m. peak hours. **Figure 6** shows the lane group LOS. **Table 2** summarizes the Synchro 9 peak hour levels of service, 95th percentile back of queue, and delay for each lane group by intersection. ***Appendix D*** *contains the existing conditions level of service worksheets.*

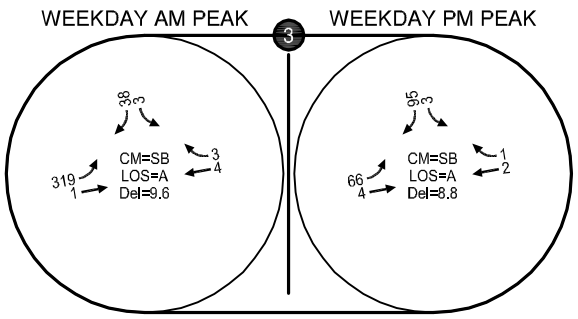


CM = CRITICAL MOVEMENT (TWSC)
LOS = INTERSECTION LEVEL OF SERVICE (AWSC) / CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del = INTERSECTION AVERAGE CONTROL DELAY (AWSC) / CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO
TWC = TWO-WAY STOP CONTROL
AWSC= ALL-WAY STOP CONTROL



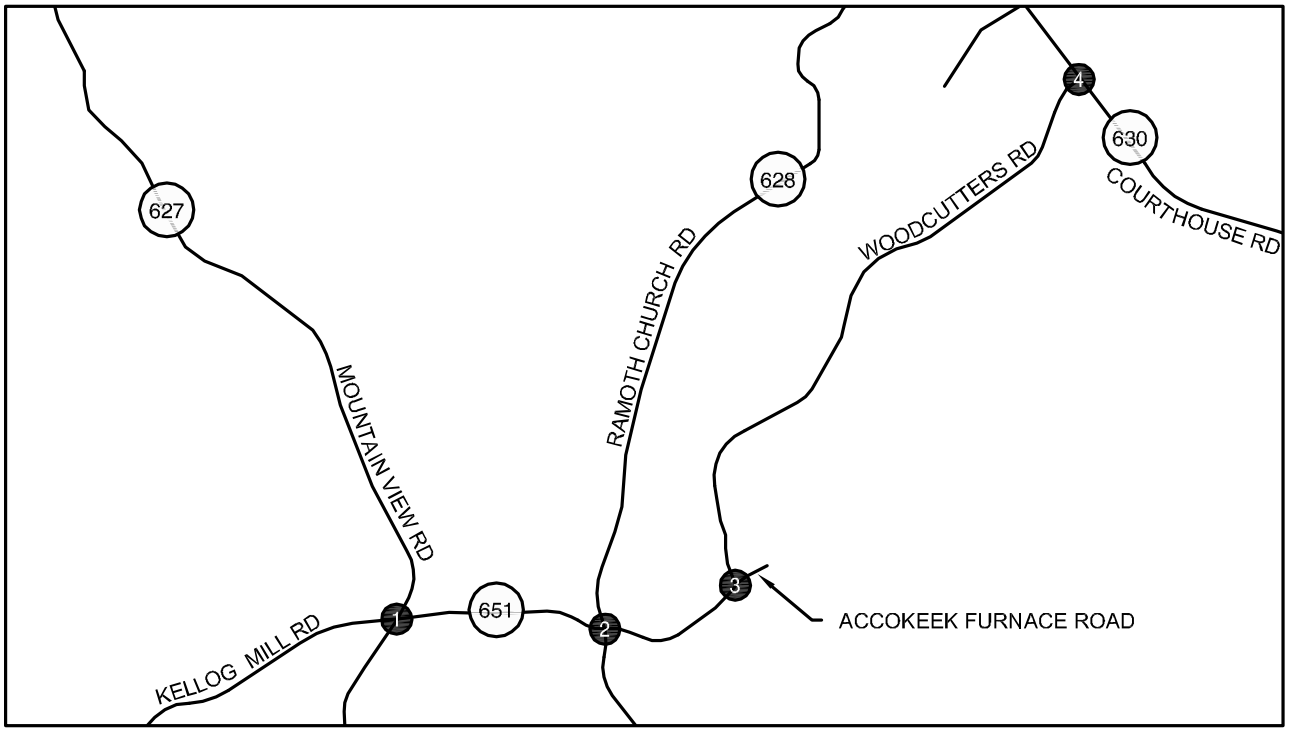






Existing Traffic Conditions
Weekday AM and PM Peak Hours
Stafford County, Virginia

Figure **5**



X - LANE GROUP LEVEL OF SERVICE

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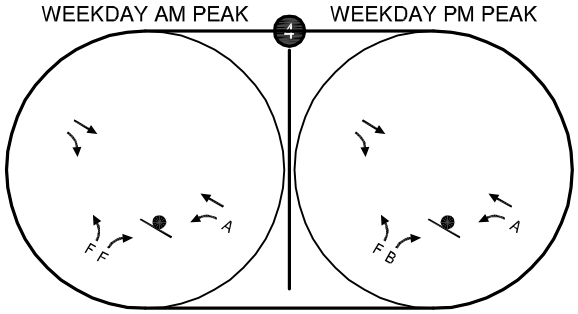

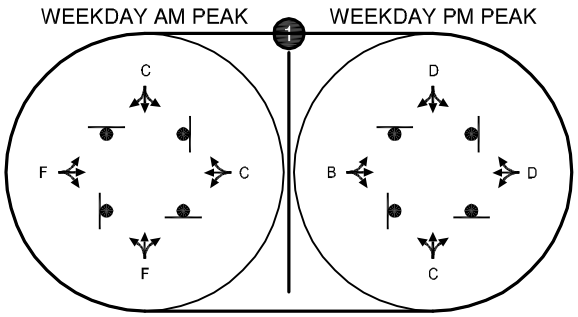

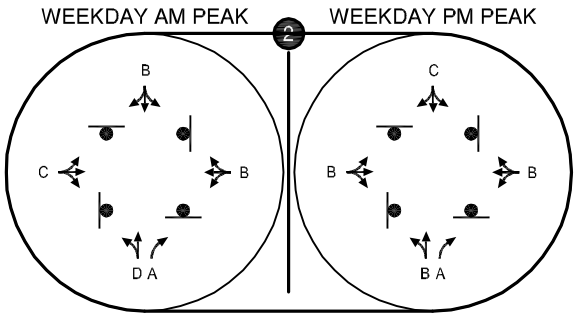

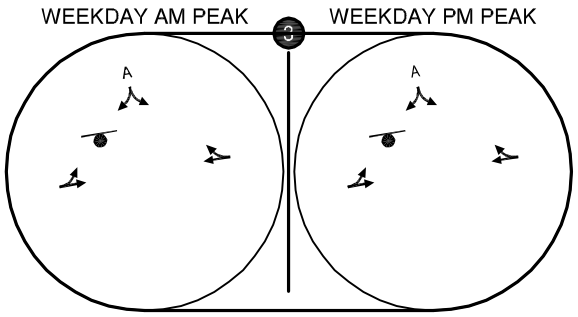

Existing Lane Group Level of Service
Weekday AM and PM Peak Hours
Stafford County, Virginia

Figure
6

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Table 2. Existing Conditions – Summary of Peak Hour Levels of Service, 95th Percentile Back of Queue, and Delay for Each Lane Group by Intersection

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Mountain View Road/ Kellogg Mill Road (#1)	Unsignalized (All-Way Stop)	EB	EBLTR	F	260	50.3	B	38	14.3
		EB Approach		F		50.3	B		14.3
		WB	WBLTR	C	48	16.6	D	153	26.2
		WB Approach		C		16.6	D		26.2
		NB	NBLTR	F	310	59.5	C	63	16.0
		NB Approach		F		59.5	C		16.0
		SB	SBLTR	C	105	23.2	D	180	28.7
		SB Approach		C		23.2	D		28.7
Ramoth Church Road/Kellogg Mill Road (#2)	Unsignalized (All-Way Stop)	EB	EBLTR	C	170	25.0	B	30	11.2
		EB Approach		C		25.0	B		11.2
		WB	WBLTR	B	8	10.4	B	28	11.2
		WB Approach		B		10.4	B		11.2
		NB	NBLT	D	173	27.6	B	20	11.0
			NBR	A	20	9.8	A	3	8.4
		NB Approach		C		23.4	B		10.8
		SB	SBLTR	B	13	12.5	C	118	16.6
		SB Approach		B		12.5	C		16.6
Woodcutters Road/Kellogg Mill Road/Accokeek Furnace Road (#3)	Unsignalized (TWSC)	EB	EBLT	A	25	7.9	A	3	7.3
		EB Approach				7.9			7.3
		WB	WBTR		0	0.0		0	0.0
		WB Approach				0.0			0.0
		SB	SBLR	A	5	9.6	A	8	8.8
		SB Approach		A		9.6	A		8.8
Courthouse Road/ Woodcutters Road (#4)	Unsignalized (TWSC)	EB	EBT		0	0.0		0	0.0
			EBR		0	0.0		0	0.0
		EB Approach				0.0			0.0
		WB	WBL	A	8	9.9	A	20	9.0
			WBT		0	0.0		0	0.0
		WB Approach				1.6			2.4
		NB	NBL	F	93	68.8	F	83	107.0
			NBR	F	600	192.3	B	15	12.0
		NB Approach		F		172.9	E		46.9

As shown in the figures and **Table 2**, study intersections are anticipated to operate at LOS C or better with the following exceptions:

Mountain View Road/Kellogg Mill Road

The critical northbound and southbound approaches at the all-way stop-controlled Mountain View Road/Kellogg Mill Road intersection operate at LOS F and LOS D during the weekday a.m. and p.m. peak hours, respectively. Stafford County's current standard for acceptable intersection operations is LOS C. As established through the scoping process, traffic operations of a mini-roundabout at the Mountain View Road/Kellogg Mill Road intersection were evaluated when operations deteriorated below acceptable levels. A brief discussion of the analysis methodology is presented below.

FHWA Mini-Roundabout Capacity Models

FHWA developed capacity models for mini-roundabouts which were published in the Institute of Transportation Engineers (ITE) Journal (Reference 3). Data of driver behaviors and travel characteristics at mini-roundabouts were observed at the Stevensville, Maryland mini-roundabout site, a microscopic traffic simulation model was developed and calibrated to simulate for multiple traffic flow scenarios, and a multilinear regression model was developed to fit the simulated data and estimate mini-roundabout capacities for both 50-foot and 75-foot inscribed circle diameter (ICD). **Figure 7** illustrates the simulated capacity of both 50-foot and 75-foot mini-roundabouts compared to a standard single-lane roundabout as reported in NCHRP Report 572 based on entering and circulating volume.

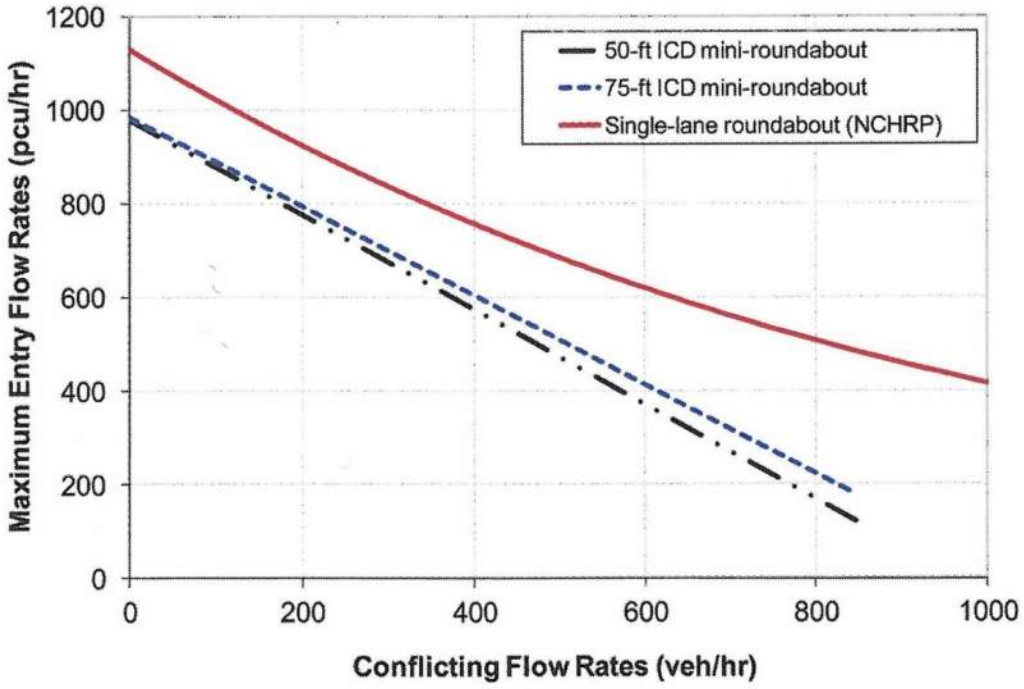


Figure 7. Comparison of FHWA Mini-Roundabout Capacity Models to Single-Lane Roundabout NCHRP 572 Capacity Equation

As shown in **Figure 7**, the FHWA mini-roundabout models predict a 13 to 40 percent lower capacity than a traditional single-lane roundabout.

Forecast Operations of Mini-Roundabout under Existing Conditions

The anticipated operations at the Mountain View Road/Kellogg Mill Road intersection were evaluated using the FHWA 75-foot ICD capacity model built into FHWA's *Capacity Analysis for Planning of Junctions* (CAP-X) tool. The 75-foot ICD capacity model was selected as the more appropriate of the

two FHWA models given the desired geometrics for the intersection. **Table 3** summarizes the anticipated operations.

Table 3. Operations of a Mini-Roundabout under Existing Traffic Volumes – Mountain View Road/Kellogg Mill Road

Scenario	Predicted Approach Capacity (passenger car equivalents per hour)	Critical Approach	Critical V/C Ratio
Weekday A.M. Peak Hour	598	NB	0.77
Weekday P.M. Peak Hour	668	SB	0.64

As shown in **Table 3**, a mini-roundabout with a 75-foot ICD is anticipated to operate under capacity under existing traffic volumes during the weekday a.m. and p.m. peak hours. As such, a mini-roundabout will be presented as a mitigation strategy at the Mountain View Road/Kellogg Mill Road intersection in all future year traffic analyses.

Ramoth Church Road/Kellogg Mill Road

The critical northbound approach of the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road intersection operates at LOS D during the weekday a.m. peak hour.

Courthouse Road/Woodcutters Road

The stop-controlled northbound approach operates at LOS F and LOS E during the weekday a.m. and p.m. peak hours, respectively. Per discussions with VDOT/County staff at scoping, a preliminary MUTCD signal warrant analysis will be conducted when the Courthouse Road/Woodcutters Road intersection operates below Stafford County's acceptable intersection operations threshold (LOS C).

Volume-Based MUTCD Signal Warrant Analyses

Volume-based traffic signal warrants were evaluated for the Courthouse Road/Woodcutters Road intersection under existing traffic conditions. The 2009 *Manual on Uniform Traffic Control Devices* (MUTCD) Minimum Volume Warrant, the Interruption of Continuous Traffic Flow Warrant, Four-Hour Warrant, and Peak Hour Warrant (Warrant 1 – Conditions A and B, Warrant 2, Warrant 3) were evaluated. As the 13-hour traffic counts on May 10, 2017 illustrates, the weekday a.m. peak hour represents the highest volume hour of the day.

Table 4 summarizes the analysis results data shown for Warrants 1, 2, and 3 for the respective eighth highest, fourth highest, and peak-hour volumes, in accordance with the methodology established in the MUTCD. ***Appendix E*** *contains the detailed MUTCD signal warrant evaluation sheets.*

Table 4. Existing Signal Warrant Analysis – Courthouse Road/Woodcutters Road

Signal Warrant	Number of Lanes		Required Volumes		Actual Volumes		Warrant Met?
	Major Street	Minor Street	Major Volumes Both Approaches	Minor Volume High Approach	Major Volumes Both Approaches	Minor Volume High Approach	
Warrant 1 – Condition A: Minimum Vehicular Volume	1	2	500	150	Varies	Varies	**Yes**
Warrant 1 – Condition B: Interruption of Continuous Traffic	1	2	750	75	Varies	Varies	
Warrant 2: Four-Hour Vehicular Volume	1	2	Varies	Varies	Varies	Varies	**Yes**
Warrant 3: Peak Hour Volume	1	2	1,000[1]	60[1]	1,110	456	**Yes**

[1]Corresponding values from Figure 4C-3 of the MUTCD

As shown in Table 4, MUTCD Signal Warrant 1, Warrant 2, and Warrant 3 are met under existing conditions. These warrants will be reevaluated later in this report under year 2022 background traffic conditions after completion of the four-lane cross-section on Courthouse Road.

Section 4
Transportation Impact Analysis

TRANSPORTATION IMPACT ANALYSIS

The transportation impact analysis identifies how the study area's transportation system will operate through total build out of the project. The Accokeek Furnace development is anticipated to be constructed and built out by year 2022. Traffic impacts of the proposed Accokeek Furnace Road development during the typical weekday a.m. and p.m. peak hours were examined as follows:

- Background traffic conditions were developed by:
    - Applying a three percent compound annual growth rate to traffic on Courthouse Road and Mountain View Road and a two percent compound annual growth rate to all other study roadways.
    - Adding anticipated trips ("in-process") generated by the Woods at Augustine development during the weekday a.m. and p.m. peak hours.
- Year 2022 background weekday a.m. and p.m. peak hour traffic conditions were analyzed at each of the study intersections.
- Site-generated trips were estimated for the proposed site plan.
- Site trip distribution patterns identified and confirmed through the scoping process were derived from existing traffic patterns and major trip origins and destinations in the study area.
- Year 2022 total traffic conditions were analyzed at each of the study intersections and site-access driveways during the weekday a.m. and p.m. peak hours.
- Design year 2028 total traffic conditions were analyzed at each of the study intersections and site-access driveways.

YEAR 2022 TRAFFIC CONDITIONS

In the 2022 background analysis, traffic operations prior to full build-out of the proposed development are analyzed for the purposes of establishing a baseline against which to measure the specific impacts of the proposed development. Background growth in traffic volumes is attributed to regional growth in the area as well as any specific development within the study area. These two components of growth are discussed below.

Regional Growth

A three percent annual growth rate for Courthouse Road and Mountain View Road and a two percent annual growth rate for all other roads were identified and confirmed through the scoping process to account for near-term regional traffic growth. These growth rates were compounded annually to forecast year 2022 background traffic volumes.

In-Process Development – Woods at Augustine

Consistent with the scoping document, anticipated traffic volumes generated by the Woods at Augustine development were added to the study network. The 95 single-family home development is

located along the northern side of Courthouse Road to the northwest of the study area. ***Appendix F*** *contains the trip generation and trip assignment information relating to the Woods at Augustine development.*

Transportation Improvements

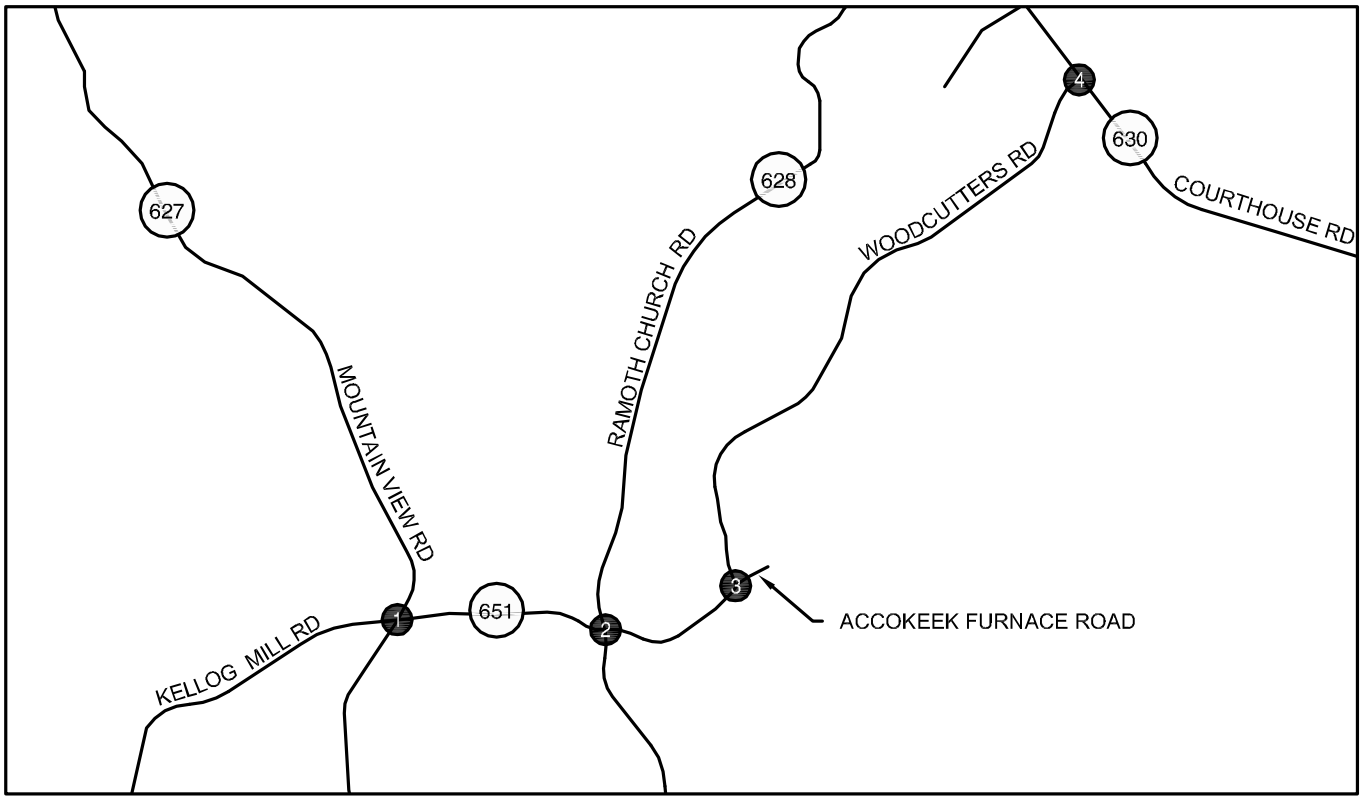
A number of transportation improvements are anticipated within the study network by the year 2022. These improvements include:

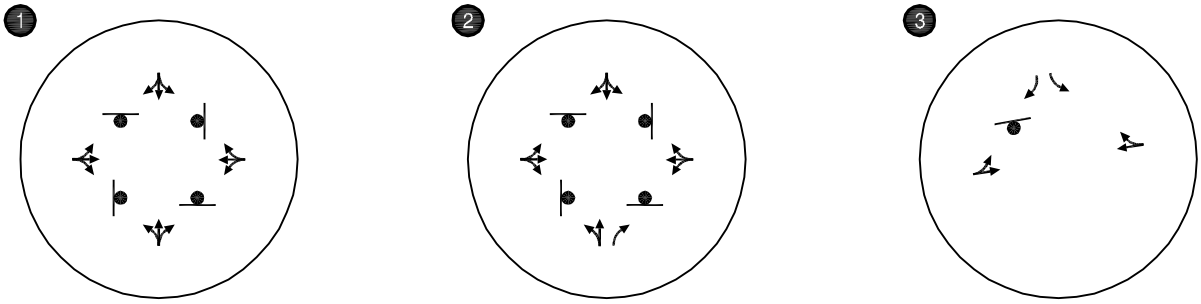
- Widening of Courthouse Road to a 4-lane cross-section through the study area
- Widening of Woodcutters Road to a 4-lane cross-section throughout the study area

Figure 8 shows the year 2022 assumed lane configurations and traffic control devices at the study intersections respective of these improvements.

2022 Background Traffic Conditions

Figure 9 shows the overall intersection operational results of the year 2022 background traffic operations analysis for the weekday a.m. and p.m. peak hours. **Figure 10** shows the lane group LOS. **Table 5** summarizes the peak hour levels of service, 95th percentile back of queue, and delay for each lane group by intersection. ***Appendix G*** *contains the 2022 background traffic (unmitigated) operational analysis worksheets.*

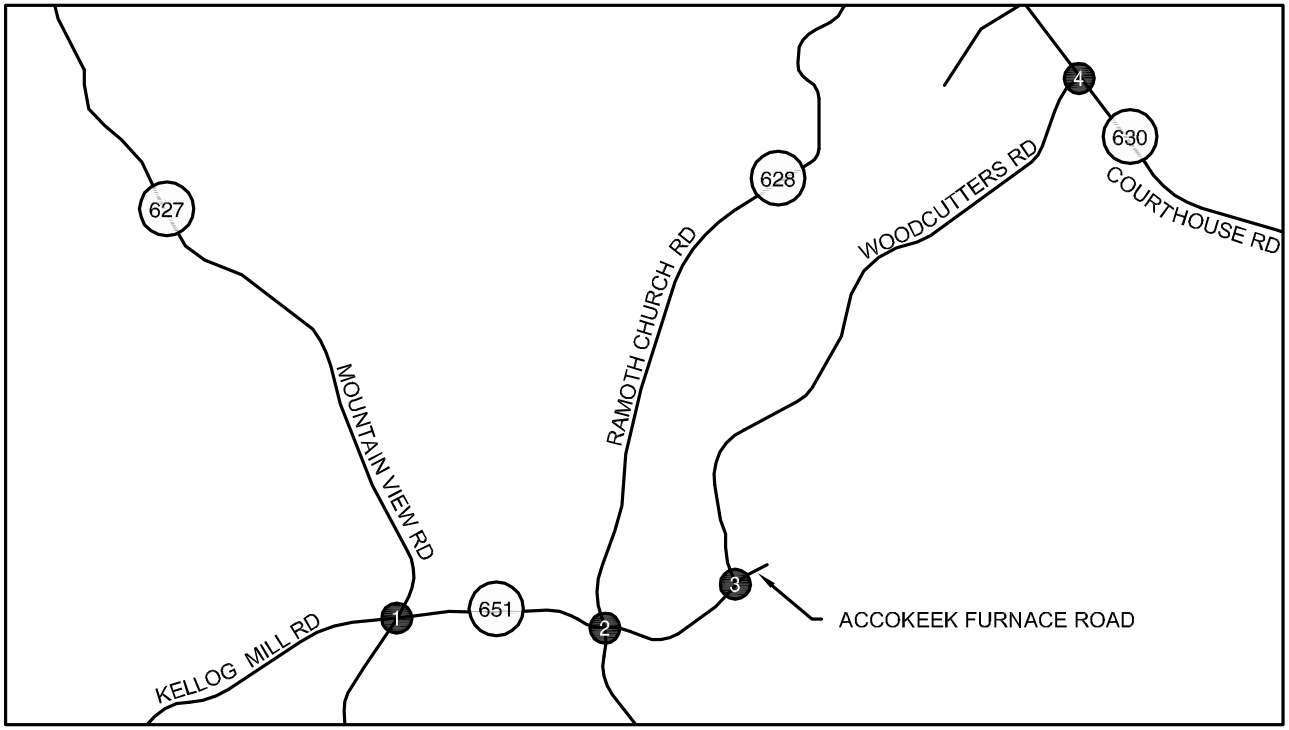




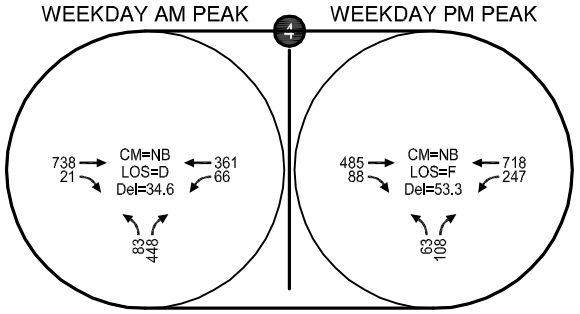
- STOP SIGN
- TRAFFIC SIGNAL

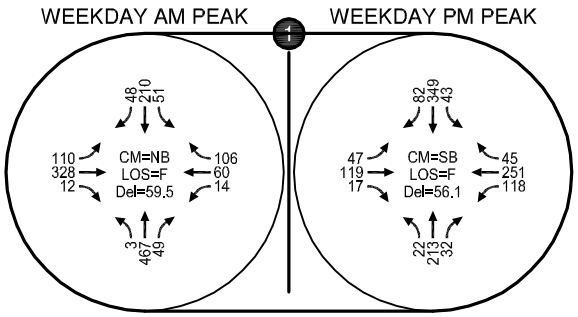
Year 2022 Background Assumed Lane Configurations and Traffic Control Devices Stafford County, Virginia

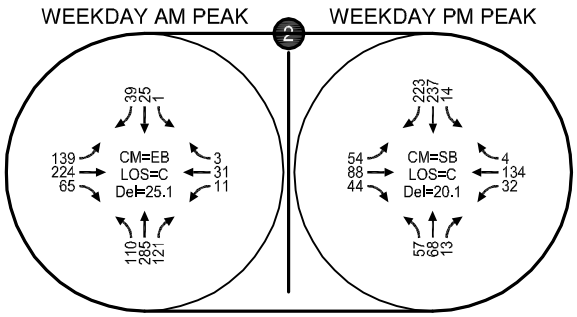
Figure **8**

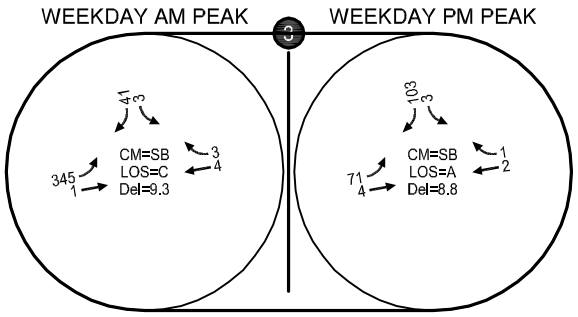


CM = CRITICAL MOVEMENT (TWSC)
LOS = INTERSECTION LEVEL OF SERVICE (AWSC) / CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del = INTERSECTION AVERAGE CONTROL DELAY (AWSC) / CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO
TWC = TWO-WAY STOP CONTROL
AWSC= ALL-WAY STOP CONTROL









Year 2022 Background Traffic Conditions
Weekday AM and PM Peak Hours
Stafford County, Virginia

Figure **9**

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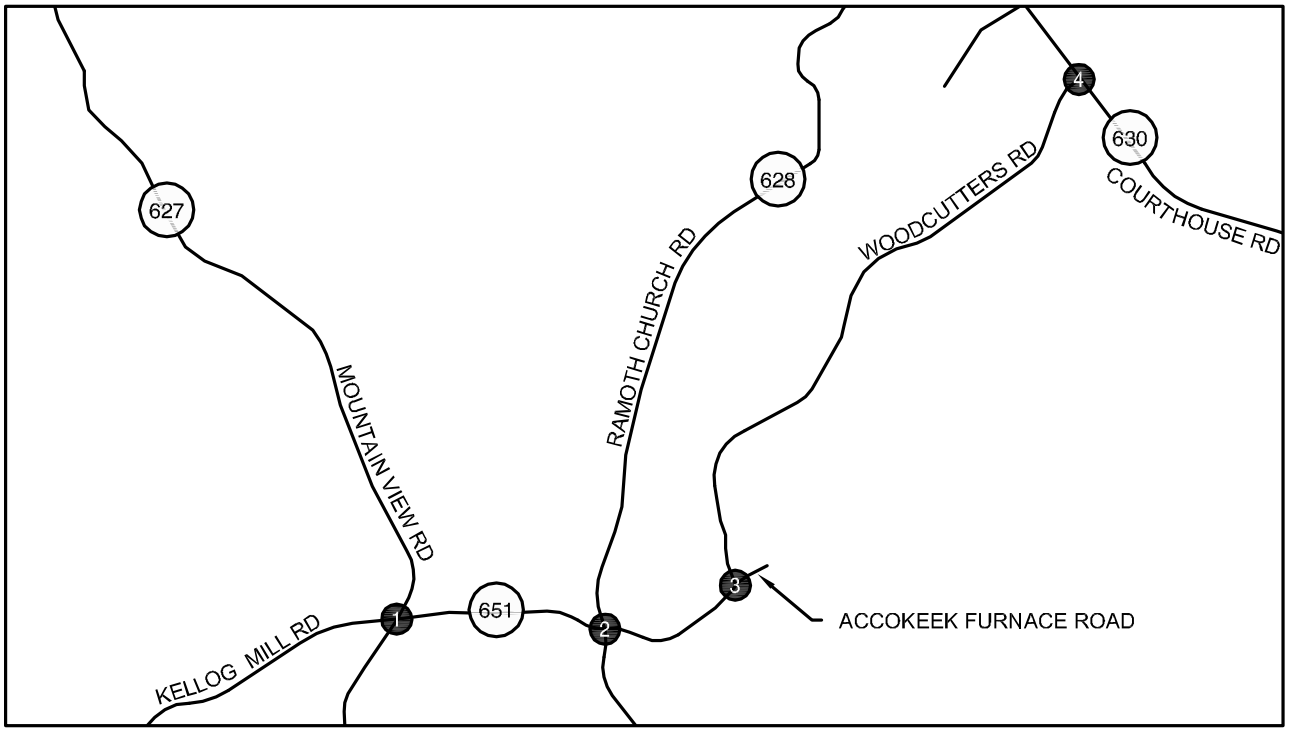
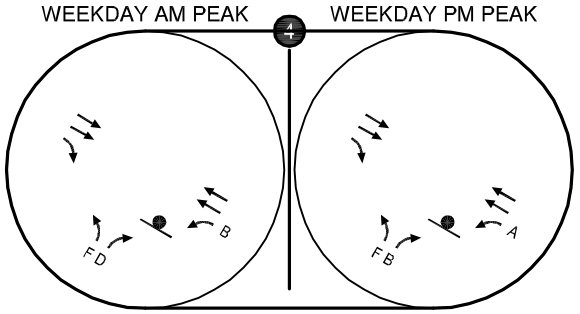
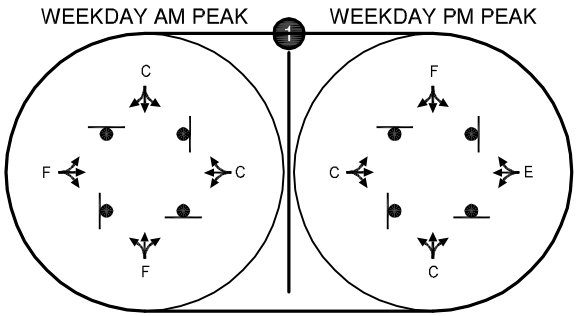


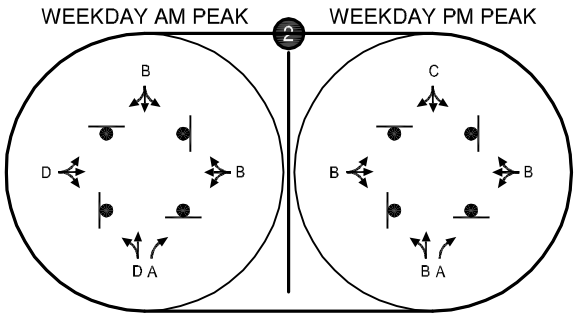
X - LANE GROUP LEVEL OF SERVICE

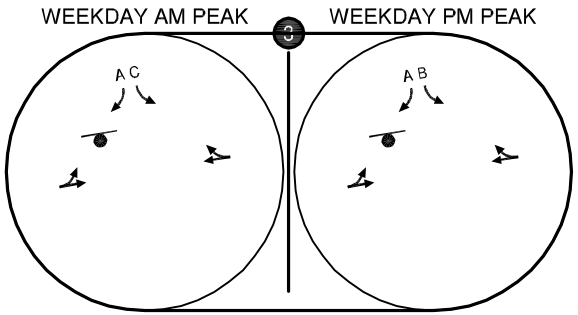
- STOP SIGN

- TRAFFIC SIGNAL









Year 2022 Background Lane Group Level of Service
Weekday AM and PM Peak Hours
Stafford County, Virginia

Figure **10**

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Table 5. Year 2022 Background Traffic Conditions – Summary of Peak Hour Levels of Service, 95th Percentile Back of Queue, and Delay for Each Lane Group by Intersection

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Mountain View Road/ Kellogg Mill Road (#1)	Unsignalized (All Way Stop)	EB	EBLTR	F	260	50.3	C	53	17.4
		EB Approach		F		50.3	C		17.4
		WB	WBLTR	C	48	16.6	E	233	43.3
		WB Approach		C		16.6	E		43.3
		NB	NBLTR	F	310	59.5	C	93	21.2
		NB Approach		F		59.5	C		21.2
		SB	SBLTR	C	105	23.2	F	303	56.1
		SB Approach		C		23.2	F		56.1
Ramoth Church Road/Kellogg Mill Road (#2)	Unsignalized (All Way Stop)	EB	EBLTR	D	170	25.1	B	35	11.9
		EB Approach		D		25.1	B		11.9
		WB	WBLTR	B	8	10.4	B	33	11.9
		WB Approach		B		10.4	B		11.9
		NB	NBLT	D	175	27.8	B	23	11.6
			NBR	A	20	9.8	A	3	8.6
		NB Approach		C		23.6	B		11.3
		SB	SBLTR	B	13	12.5	C	150	20.1
		SB Approach		B		12.5	C		20.1
Woodcutters Road/Kellogg Mill Road/Accokeek Furnace Road (#3)	Unsignalized (TWSC)	EB	EBLT	A	20	7.8	A	3	7.3
		EB Approach		A		7.8	A		7.3
		WB	WBTR		0	0.0		0	0.0
		WB Approach				0.0			0.0
		SB	SBL	C	0	19.5	B	0	10.4
			SBR	A	3	8.5	A	8	8.8
		SB Approach		A		9.3	A		8.8
Courthouse Road/ Woodcutters Road (#4)	Unsignalized (TWSC)	EB	EBT		0	0.0		0	0.0
			EBR		0	0.0		0	0.0
		EB Approach				0.0			0.0
		WB	WBL	B	8	10.0	A	25	9.5
			WBT		0	0.0		0	0.0
		WB Approach				1.6			2.4
		NB	NBL	F	73	52.1	F	98	126.4
			NBR	D	203	31.4	B	13	10.7
		NB Approach		D		34.6	F		53.3

As shown in the figures and Table 5, study intersections are anticipated to operate above LOS C with the following exceptions:

Mountain View Road/Kellogg Mill Road

The critical northbound and southbound approaches are anticipated to operate at LOS F during the weekday a.m. and p.m. peak hours, respectively, under year 2022 background traffic conditions. Similar to existing conditions, the operations of a mini-roundabout were evaluated at the intersection at the request of VDOT/County staff.

Forecast Operations of Mini-Roundabout under Year 2022 Background Conditions

The anticipated operations at the Mountain View Road/Kellogg Mill Road intersection were evaluated using the FHWA 75-foot ICD capacity model built into FHWA's *Capacity Analysis for Planning of*

Junctions (CAP-X) tool. The 75-foot ICD capacity model was selected as the more appropriate of the two FHWA models given the desired geometrics for the intersection. **Table 3** summarizes the anticipated operations.

Table 6. Operations of a Mini-Roundabout under Year 2022 Background Traffic Volumes – Mountain View Road/Kellogg Mill Road

Scenario	Predicted Approach Capacity (passenger car equivalents per hour)	Critical Approach	Critical V/C Ratio
Weekday A.M. Peak Hour	563	NB	0.92
Weekday P.M. Peak Hour	640	SB	0.74

As shown in Table 6, a mini-roundabout with an 75-foot ICD is anticipated to operate under capacity under year 2022 background traffic volumes during the weekday a.m. and p.m. peak hours.

Ramoth Church Road/Kellogg Mill Road

The critical eastbound approach at the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road operates at LOS D during the weekday a.m. peak hour.

Courthouse Road/Woodcutters Road

The stop-controlled northbound approach operates at LOS D and LOS F during the weekday a.m. and p.m. peak hours, respectively. Per discussions with VDOT/County staff at scoping, a preliminary MUTCD signal warrant analysis will be conducted when the Courthouse Road/Woodcutters Road intersection operates below County thresholds (LOS C).

Volume-Based MUTCD Signal Warrant Analyses

Volume-based traffic signal warrants were evaluated for the Courthouse Road/Woodcutters Road intersection under year 2022 background traffic conditions. The 2009 *Manual on Uniform Traffic Control Devices* (MUTCD) Minimum Volume Warrant, the Interruption of Continuous Traffic Flow Warrant, Four-Hour Warrant, and Peak Hour Warrant (Warrant 1 – Conditions A and B, Warrant 2, Warrant 3) were evaluated. As the 13-hour traffic counts on May 10, 2017 illustrated, the weekday a.m. peak hour represents the highest volume hour of the day.

Table 7 summarizes the analysis results data shown for Warrants 1, 2, and 3 for the respective eighth highest, fourth highest, and peak-hour volumes, in accordance with the methodology established in the MUTCD. ***Appendix H*** *contains the detailed MUTCD signal warrant evaluation sheets for background traffic conditions.*

Table 7. Year 2022 Background Signal Warrant Analysis – Courthouse Road/Woodcutters Road

Signal Warrant	Number of Lanes		Required Volumes		Actual Volumes		Warrant Met?
	Major Street	Minor Street	Major Volumes Both Approaches	Minor Volume High Approach	Major Volumes Both Approaches	Minor Volume High Approach	
Warrant 1 – Condition A: Minimum Vehicular Volume	2	2	500	150	Varies	Varies	Yes
Warrant 1 – Condition B: Interruption of Continuous Traffic	2	2	750	75	Varies	Varies	
Warrant 2: Four-Hour Vehicular Volume	2	2	Varies	Varies	Varies	Varies	Yes
Warrant 3: Peak Hour Volume	2	2	1,000[1]	60[1]	1,110	456	Yes

[1]Corresponding values from Figure 4C-3 of the MUTCD

As shown in **Table 7**, MUTCD Signal Warrant 1, Warrant 2, and Warrant 3 are anticipated to be met under year 2022 background conditions.

Forecast Operations of a Traffic Signal

The anticipated operations of a traffic signal were evaluated using Synchro 9 software and the parameters established in VDOT's TOSAM. **Table 8** shows the projected operations of the Courthouse Road/Woodcutters Road intersection under year 2022 background traffic volumes.

Table 8. Year 2022 Background Traffic Conditions – Signalized Courthouse Road/Woodcutters Road

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Courthouse Road/ Woodcutters Road (#4)	Signalized	EB	EBT	B	202	16.8	B	126	10.0
			EBR	A	9	4.0	A	16	5.9
		EB Approach		B		16.4	A		9.4
		WB	WBL	C	55	34.6	B	145	19.4
			WBT	A	39	8.4	A	71	3.0
		WB Approach		B		12.7	A		7.2
		NB	NBL	B	79	14.8	B	55	18.2
			NBR	C	205	21.3	B	21	11.0
		NB Approach		C		20.3	B		13.7
		Overall Intersection		B		16.7	A		8.6

Under signalized control, the Courthouse Road/Woodcutters Road intersection is anticipated to operate at LOS B and LOS A during the weekday a.m. and p.m. peak hours, respectively.

SimTraffic Queuing Analysis

SimTraffic microsimulations were performed at the Courthouse Road/Woodcutters Road intersection in accordance with the procedures outlined in Chapter 7 of VDOT's *Traffic Operations and Safety Analysis Manual* (TOSAM).

Table 9 below provides a queue comparison between background and total traffic conditions for each study time period.

Table 9. Maximum SimTraffic Queue – 2022 Background Traffic Conditions

Intersection	Mvmt	Storage (ft.)	Weekday AM	Weekday PM
Courthouse Road/ Woodcutters Road (#4)	EBT	Cont.	218	152
	EBR	300	52	68
	WBL	250	106	172
	WBT	Cont.	104	112
	NBL	Cont.	122	93
	NBR	Cont.	201	52

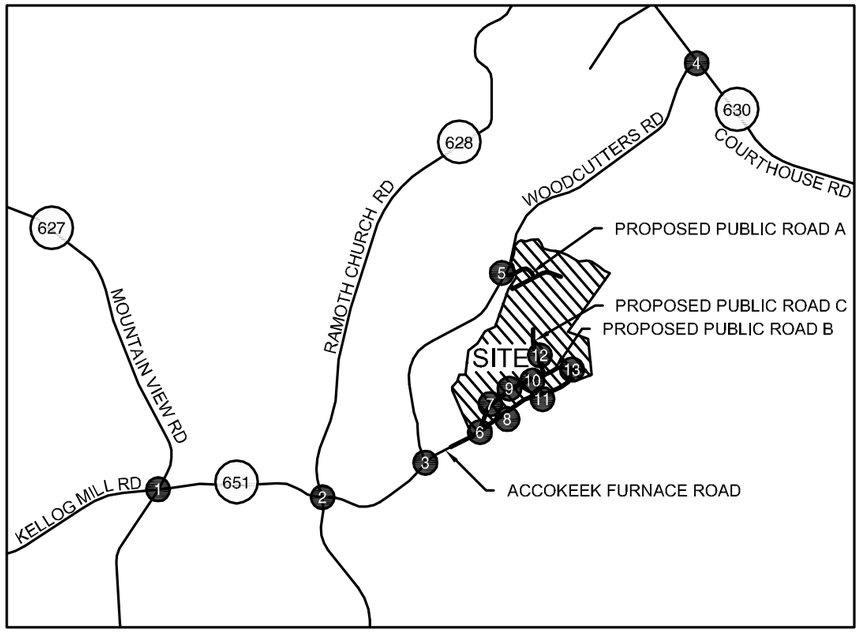
As shown in **Table 9**, the maximum peak hour queues are forecast to be accommodated for all movements.

Appendix I *contains the mitigated traffic operations and SimTraffic queuing worksheets for 2022 background traffic conditions.*

PROPOSED DEVELOPMENT

Brookfield Homes is applying for a rezoning of approximately 72 acres of Agricultural (A1) land to Suburban Residential (R1) land to allow for the Accokeek Furnace development of 350 townhomes. The site proposes extend the existing Accokeek Furnace Road from its current terminus and develop a series of new public and private roadways. Access to the individual condominium/townhome lots are proposed to be provided via the new public and private roads.

Figure 11 illustrates the assumed lane configurations and traffic control devices under year 2022 total traffic conditions.



Year 2022 Total Assumed Lane Configurations and Traffic Control Devices
Stafford County, Virginia

Figure **11**

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Trip Generation

Trip generation estimates for the proposed development were developed using the standard reference *Trip Generation, 9th Edition* (Reference 5) published by the Institute of Transportation Engineers (ITE). **Table 10** summarizes the trip generation estimates for the proposed development.

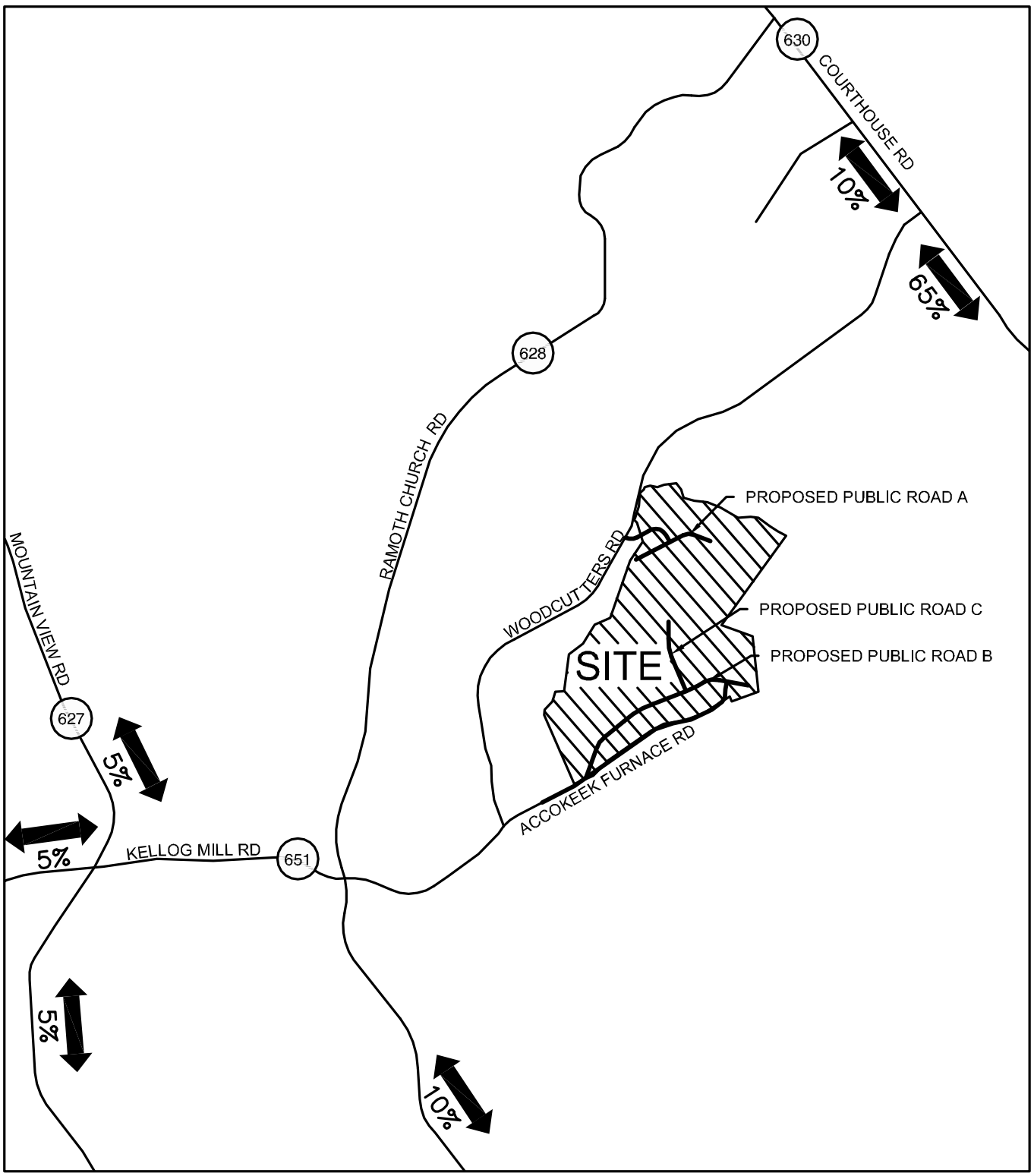
Table 10. Estimated Trip Generation

Land Use	ITE Code	Units		Weekday Daily	Peak Hour of Adjacent Street					
					Weekday AM Peak Hour			Weekday PM Peak Hour		
					Total	In	Out	Total	In	Out
Residential Condominium/Townhouse	230	350	Dwelling units	1,913	141	24	117	168	113	55
Net New Trips				**1,913**	**141**	**24**	**117**	**168**	**113**	**55**

As shown in **Table 10**, the development is estimated to generate approximately 1,913 net new weekday daily trips, 141 weekday a.m. (24 in, 117 out), and 168 weekday p.m. (113 in, 55 out) peak hour trips when fully built out in year 2022.

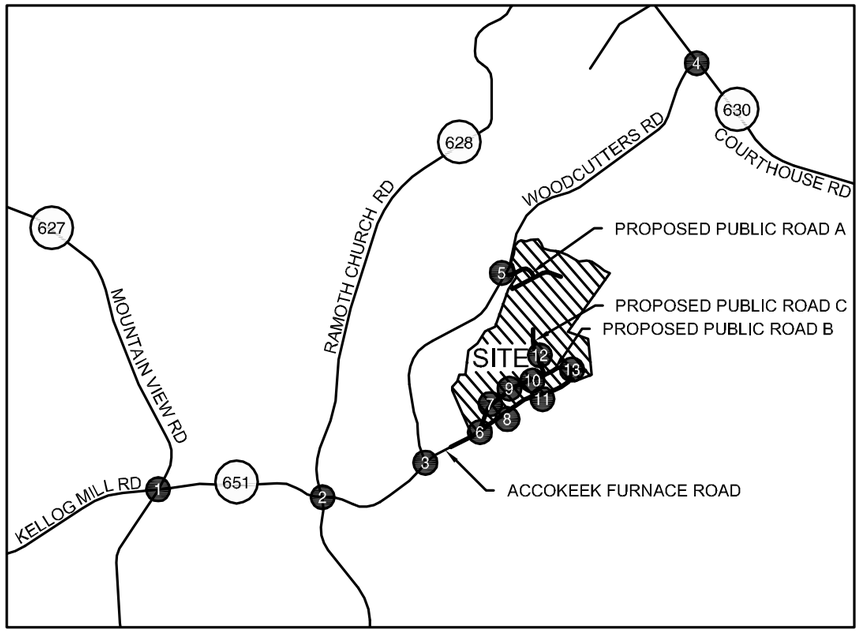
Trip Distribution and Trip Assignment

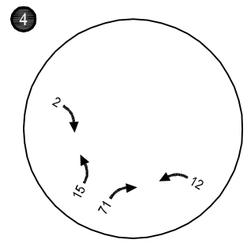
Trip distribution estimates for the proposed project were developed based on anticipated future travel patterns observed near the site and a major origin/destination patterns in the site vicinity. For the purposes of this analysis, 50 units were assumed to be located in the northern pod, with the balance in the southern portion of the site served by Accokeek Furnace Road. **Figure 12** illustrates the estimated trip distribution pattern, which was confirmed through the scoping process. **Figure 13** and **Figure 14** illustrate the assignment of site-generated trips to the surrounding roadway network during the weekday a.m. and weekday p.m. peak hours, respectively.

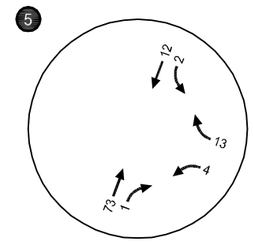


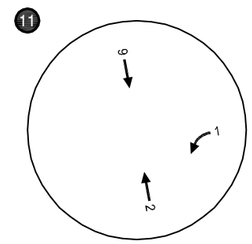
Estimated Trip Distribution Pattern
Accokeek Furnace Development
Stafford County, Virginia

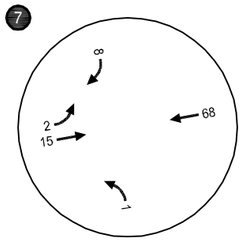
Figure
12

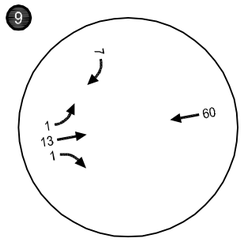


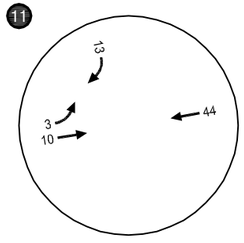


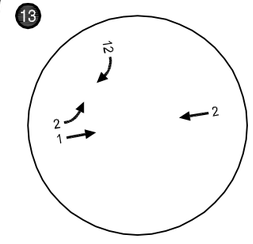


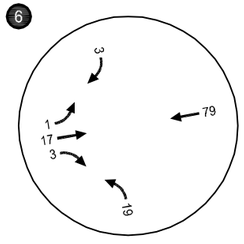


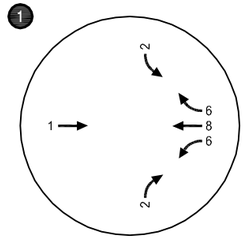


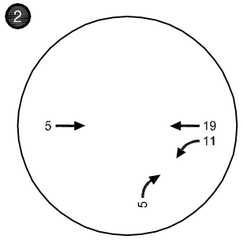


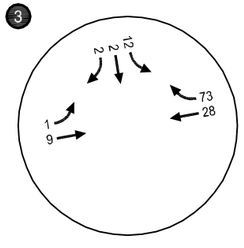


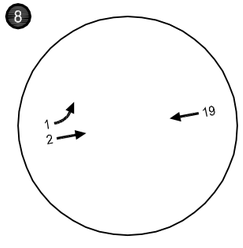


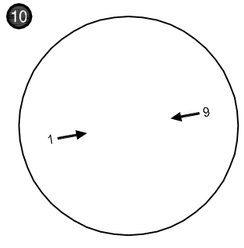








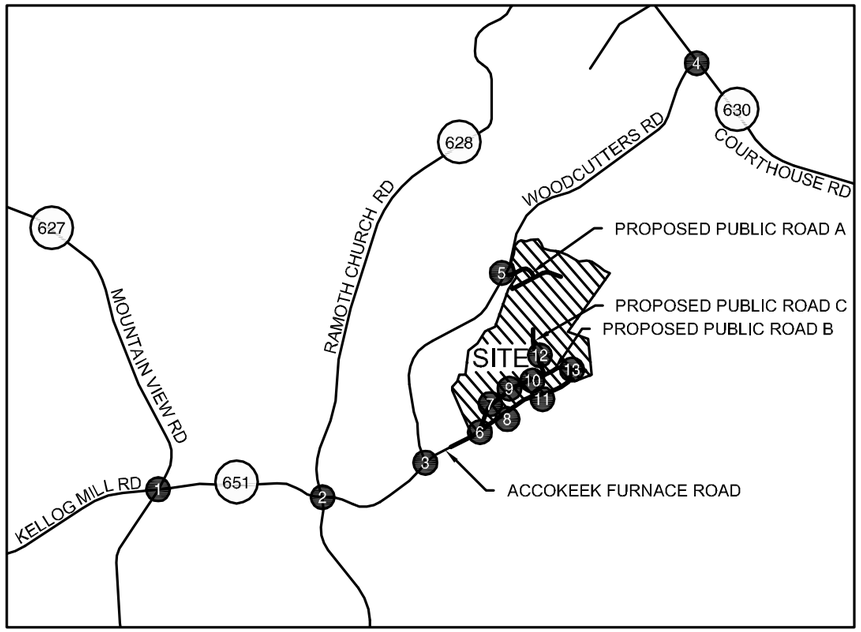


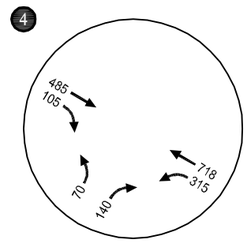


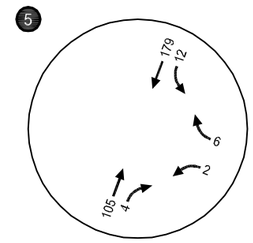
Net New Site-Generated Trips
Weekday AM Peak Hour
Stafford County, Virginia

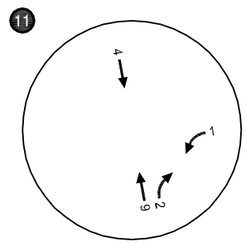
Figure
13

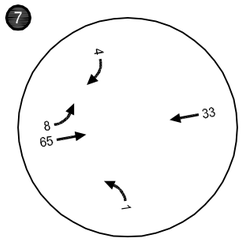
KITTELSON & ASSOCIATES

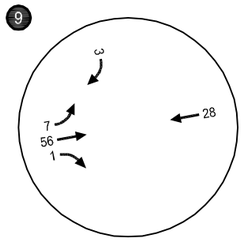


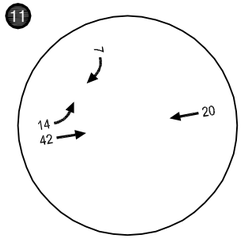


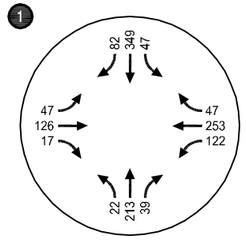


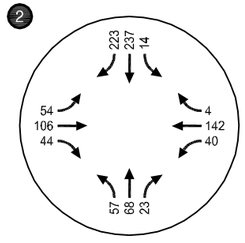


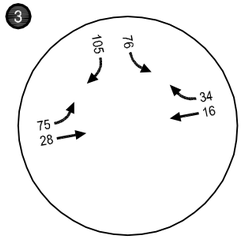


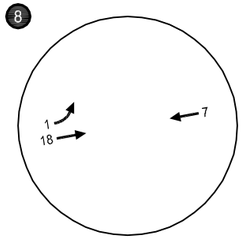


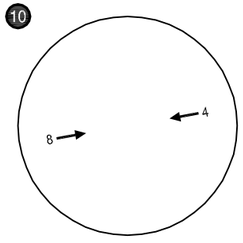










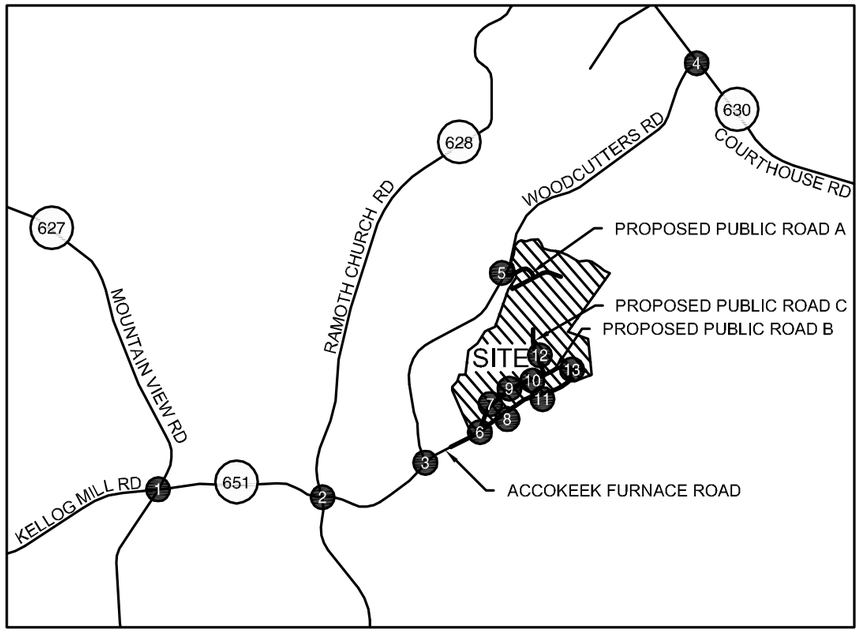


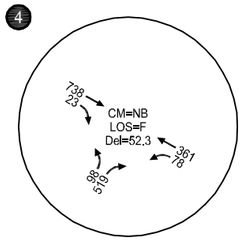
Net New Site-Generated Trips
Weekday PM Peak Hour
Stafford County, Virginia

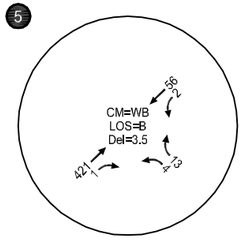
Figure **14**

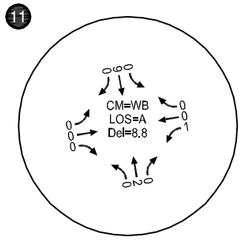
2022 Total Traffic Conditions

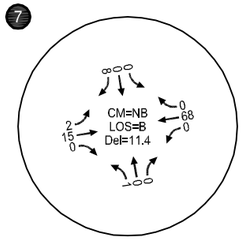
The 2022 total traffic conditions analysis forecasts how the transportation system in the study area will operate after full build out of proposed development. Site-generated trips shown in **Figure 13** and **Figure 14** were added to year 2022 background volumes shown in **Figure 9** to arrive at the 2022 total traffic volumes shown in **Figure 15** and **Figure 16**, respectively. **Figure 17** and **Figure 18** show the lane group LOS for the weekday a.m. and p.m. peak hours, respectively. **Table 11** summarizes the Synchro 9 peak hour levels of service, 95th percentile back of queue, and delay for each lane group by intersection. ***Appendix J*** *contains the year 2022 total traffic conditions (unmitigated) operational worksheets.*

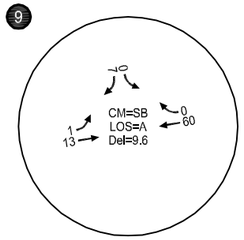


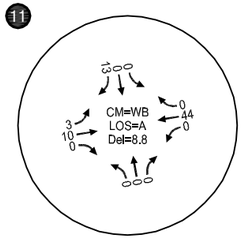


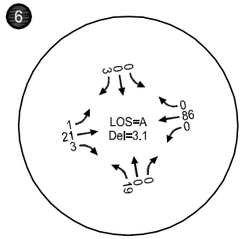


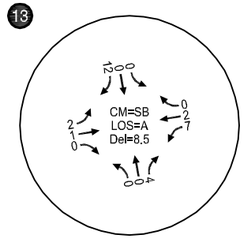


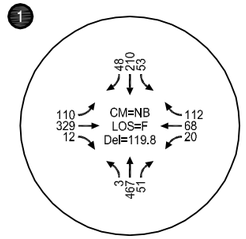


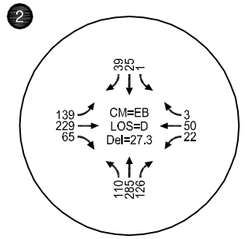


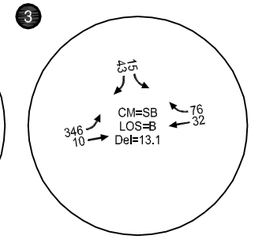


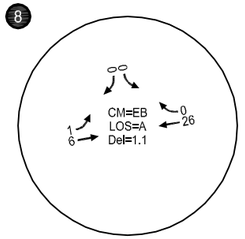


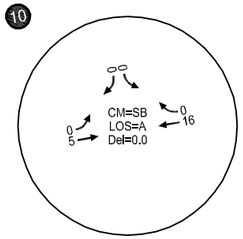








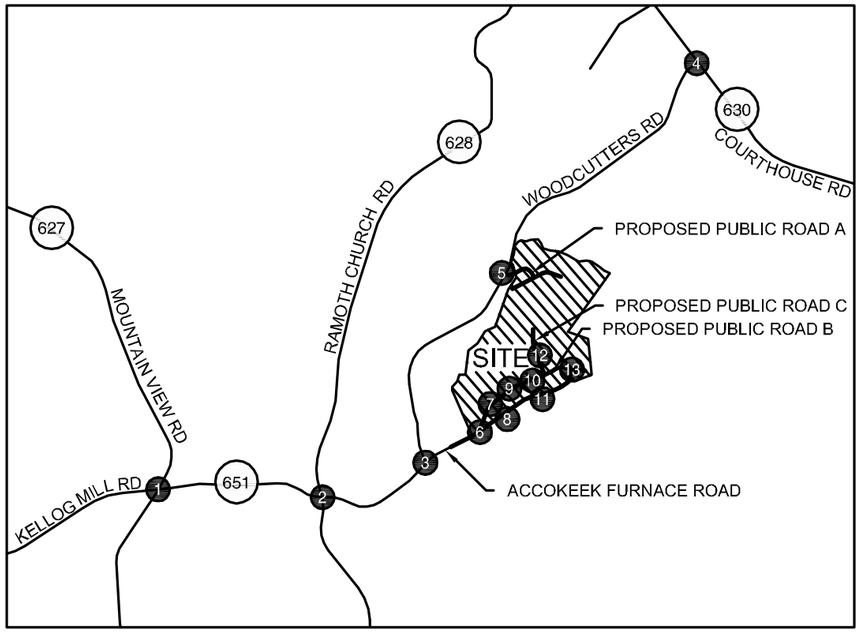


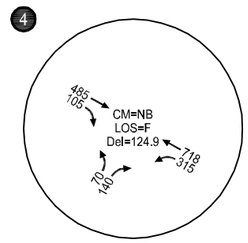


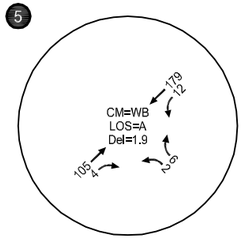
CM = CRITICAL MOVEMENT (TWSC)
LOS = INTERSECTION LEVEL OF SERVICE (AWSC) / CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del = INTERSECTION AVERAGE CONTROL DELAY (AWSC) / CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO
TWC = TWO-WAY STOP CONTROL
AWSC= ALL-WAY STOP CONTROL

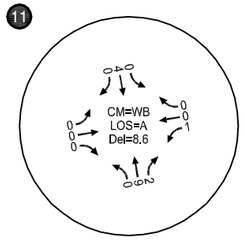
Year 2022 Total Traffic Conditions
Weekday AM Peak Hour
Stafford County, Virginia

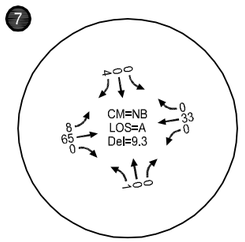
Figure **15**

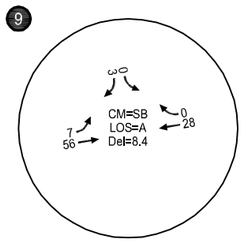


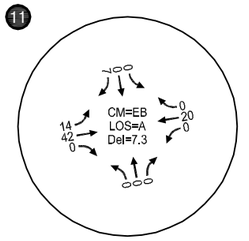


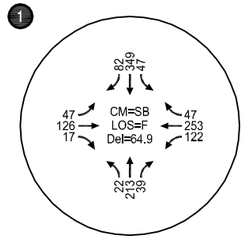


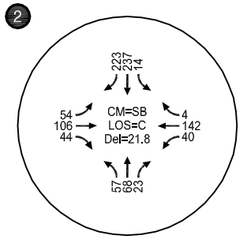


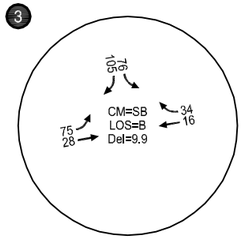


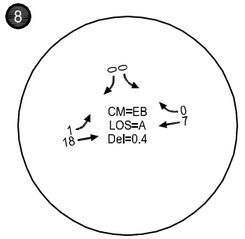


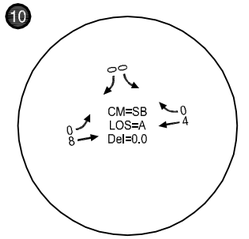












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Year 2022 Total Traffic Conditions
Weekday PM Peak Hour
Stafford County, Virginia

Figure **16**

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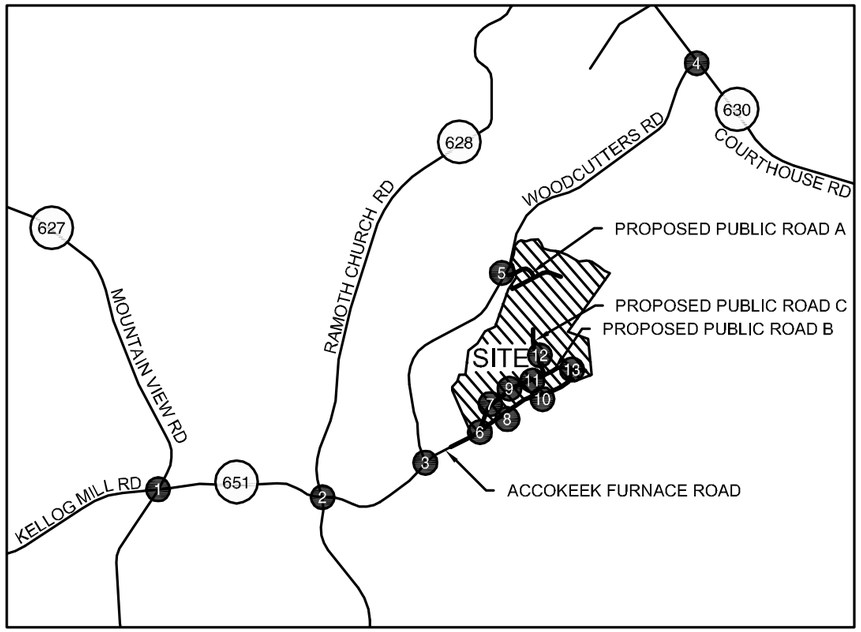

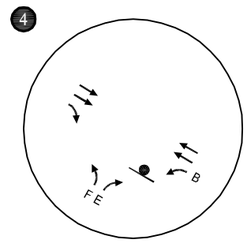

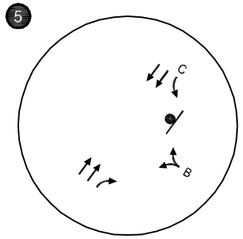

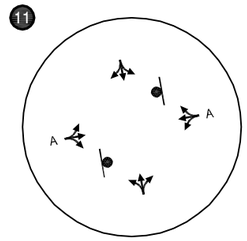

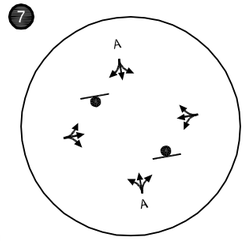

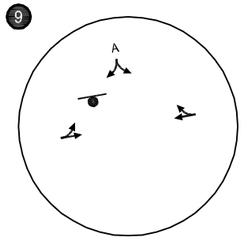

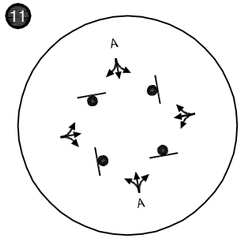

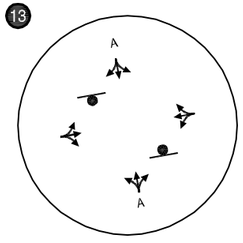

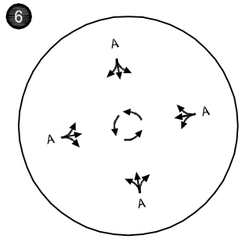

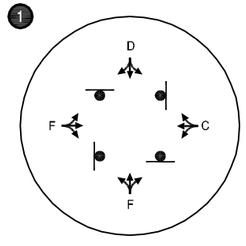

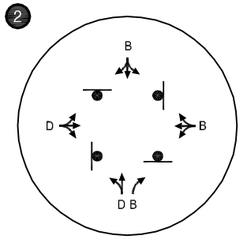

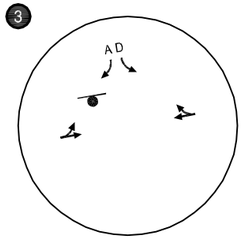

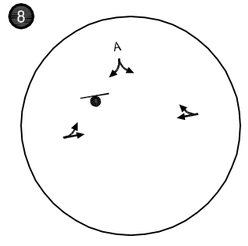

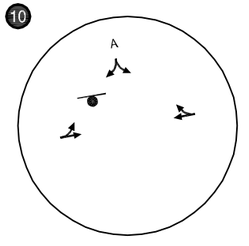

- ROUNDABOUT
X - LANE GROUP LEVEL OF SERVICE
- STOP SIGN
- TRAFFIC SIGNAL

Year 2022 Total Lane Group Level of Service
Weekday AM Peak Hour
Stafford County, Virginia

Figure **17**

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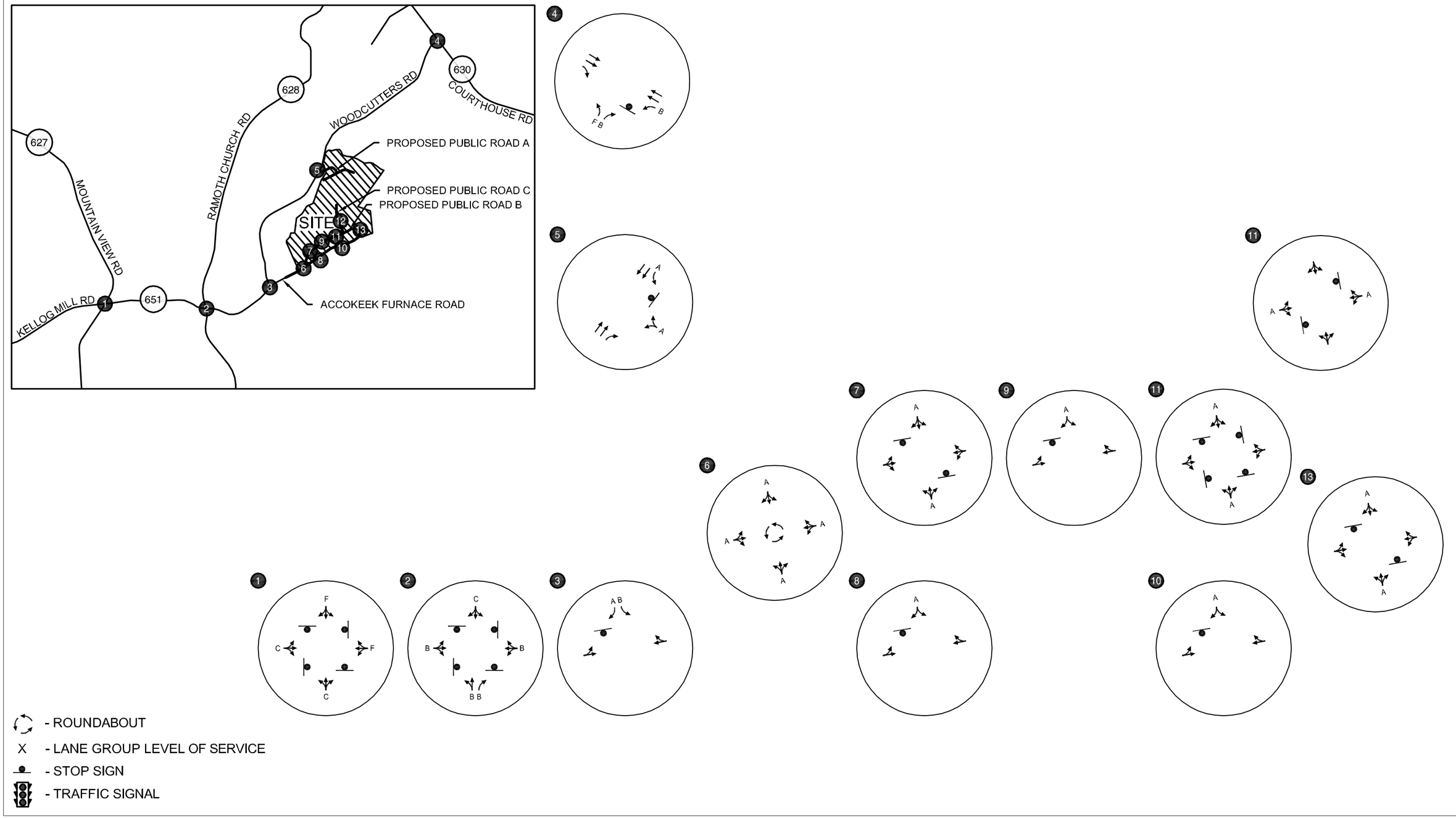

Year 2022 Total Lane Group Level of Service
Weekday PM Peak Hour
Stafford County, Virginia

Figure **18**

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Table 11. 2022 Total Traffic Conditions – Summary of Peak Hour Levels of Service, 95th Percentile Back of Queue, and Delay for Each Lane Group by Intersection

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Mountain View Road/ Kellogg Mill Road (#1)	Unsignalized	EB	EBLTR	F	343	81.4	C	60	19.0
		EB Approach		F		81.4	C		19.0
		WB	WBLTR	C	68	21.5	F	258	50.5
		WB Approach		C		21.5	F		50.5
		NB	NBLTR	F	478	119.8	C	103	23.3
		NB Approach		F		119.8	C		23.3
		SB	SBLTR	D	148	33.2	F	328	64.9
		SB Approach		D		33.2	F		64.9
Ramoth Church Road/Kellogg Mill Road (#2)	Unsignalized	EB	EBLTR	D	185	27.3	B	43	12.7
		EB Approach		D		27.3	B		12.7
		WB	WBLTR	B	13	11.1	B	38	12.6
		WB Approach		B		11.1	B		12.6
		NB	NBLT	D	183	29.7	B	25	11.9
			NBR	B	20	10.1	A	3	8.9
		NB Approach		C		25.0	B		11.4
		SB	SBLTR	B	15	12.9	C	160	21.8
		SB Approach		B		12.9	C		21.8
Woodcutters Road/Kellogg Mill Road/Accokeek Furnace Road (#3)	Unsignalized	EB	EBLT	A	25	8.3	A	5	7.4
		EB Approach				8.3			5.4
		WB	WBTR		0	0.0		0	0.0
		WB Approach				0.0			0.0
		SB	SBL	D	8	25.1	B	10	11.2
			SBR	A	5	8.9	A	10	8.9
		SB Approach		B		13.1	A		9.9
Courthouse Road/ Woodcutters Road (#4)	Unsignalized	EB	EBT		0	0.0		0	0.0
			EBR		0	0.0		0	0.0
		EB Approach				0.0			0.0
		WB	WBL	B	10	10.1	B	35	10.1
			WBT		0	0.0		0	0.0
		WB Approach				1.8			3.1
		NB	NBL	F	103	69.9	F	168	352.3
			NBR	E	310	49.0	B	20	11.2
		NB Approach		F		52.3	F		124.9
Woodcutters Road/Public Road A (#5)	Unsignalized	WB	WBLR	B	3	14.8	A	0	7.4
		WB Approach				3.5			1.9
		NB	NBT		0	0.0		0	0.0
			NBR		0	0.0		0	0.0
		NB Approach							0.0
		SB	SBL	C	3	17.6	A	0	8.9
			SBT		0	0.0		0	0.0
		SB Approach							
Accokeek Furnace Road/ Public Road B/ Site Driveway #1 (#6)	Roundabout	EB	EBLTR	A	3	2.8	A	8	3.3
		EB Approach		A		2.8	A		3.3
		WB	WBLTR	A	8	3.3	A	3	2.9
		WB Approach		A		3.3	A		2.9
		NB	NBLTR	A	3	2.9	A	0	3.0
		NB Approach		A		2.9	A		3.0
		SB	SBLTR	A	0	3.0	A	0	2.8
		SB Approach		A		3.0	A		2.8
		Overall Intersection		A		3.1	A		3.2

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Public Road B/ Site Driveway #2 (#7)	Unsignalized	EB	EBLTR	A	0	7.8	A	0	7.3
		EB Approach				0.9			0.8
		WB	WBLTR	A	0	0.0	A	0	0.0
		WB Approach				0.0			0.0
		NB	NBLTR	B	0	11.4	A	0	9.3
		NB Approach		B		11.4	A		9.3
		SB	SBLTR	A	0	9.9	A	0	8.5
		SB Approach		A		9.9	A		8.5
Accokeek Furnace Road/ Site Driveway #3 (#8)	Unsignalized	EB	EBLTR	A	0	7.4	A	0	7.2
		EB Approach				1.1			0.4
		WB	WBLTR		0	0.0		0	0.0
		WB Approach				0.0			0.0
		SB	SBLTR	A	0	0.0	A	0	0.0
		SB Approach		A		0.0	A		0.0
Public Road B/ Site Driveway #4 (#9)	Unsignalized	EB	EBLTR	A	0	7.7	A	0	7.3
		EB Approach				0.5			0.8
		WB	WBLTR		0	0.0		0	0.0
		WB Approach				0.0			0.0
		SB	SBLTR	A	3	9.6	A	0	8.4
		SB Approach		A		9.6	A		8.4
Accokeek Furnace Road/ Site Driveway #5 (#10)	Unsignalized	EB	EBLTR		0	0.0	A	0	0.0
		EB Approach				0.0			0.0
		WB	WBLTR		0	0.0		0	0.0
		WB Approach				0.0			0.0
		SB	SBLTR	A	0	0.0	A	0	0.0
		SB Approach		A		0.0	A		0.0
Public Road B/ Site Driveway #6 (#11)	Unsignalized	EB	EBLTR	A	5	7.5	A	5	7.3
		EB Approach		A		7.5	A		7.3
		WB	WBLTR	A	18	8.1	A	3	7.1
		WB Approach		A		8.1	A		7.1
		NB	NBLTR	A	0	0.0	A	0	0.0
		NB Approach				0.0			0.0
		SB	SBLTR	A	0	7.0	A	0	6.5
		SB Approach				7.0			6.5
Public Road C/ Site Driveway #7 (#12)	Unsignalized	EB	EBLTR	A	0	0.0	A	0	0.0
		EB Approach		A		0.0	A		0.0
		WB	WBLTR	A	0	8.8	A	0	8.6
		WB Approach		A		8.8	A		8.6
		NB	NBLTR	A	0	0.0	A	0	0.0
		NB Approach				0.0			0.0
		SB	SBLTR	A	0	0.0	A	0	0.0
		SB Approach				0.0			
Accokeek Furnace Road/ Public Road B (#13)	Unsignalized	EB	EBLTR	A	0	4.8	A	0	7.2
		EB Approach				4.8			5.7
		WB	WBLTR	A	0	5.6	A	0	0.0
		WB Approach				5.6			0.0
		NB	NBLTR	A	0	8.4	A	0	0.0
		NB Approach		A		8.4	A		0.0
		SB	SBLTR	A	3	8.5	A	0	8.3
		SB Approach		A		8.5	A		8.3

As shown in the figures and **Table 11**, all study intersections are forecast to continue to operate at LOS C or better during all time periods with the following exceptions discussed below.

Mountain View Road/Kellogg Mill Road

The critical northbound and southbound approaches are anticipated to operate at LOS F during the weekday a.m. and p.m. peak hours, respectively, under year 2022 total traffic conditions.

Forecast Operations of Mini-Roundabout under Year 2022 Total Conditions

The anticipated operations at the Mountain View Road/Kellogg Mill Road intersection were evaluated using the FHWA 75-foot ICD capacity model built into FHWA's *Capacity Analysis for Planning of Junctions* (CAP-X) tool. **Table 12** summarizes the anticipated operations.

Table 12. Operations of a Mini-Roundabout under Year 2022 Total Traffic Volumes – Mountain View Road/Kellogg Mill Road

Scenario	Predicted Approach Capacity (passenger car equivalents per hour)	Critical Approach	Critical V/C Ratio
Weekday A.M. Peak Hour	561	NB	0.93
Weekday P.M. Peak Hour	634	SB	0.75

As shown in **Table 12**, a mini-roundabout with an 75-foot ICD is anticipated to operate under capacity under year 2022 total traffic conditions during the weekday a.m. and p.m. peak hours.

The Accokeek Furnace development is projected to add less than two percent to this intersection, which has been shown to be deficient under existing traffic conditions.

Courthouse Road/Woodcutters Road

The stop-controlled northbound approach operates at LOS F during the weekday a.m. and p.m. peak hours.

Forecast Operations of a Traffic Signal

The anticipated operations of a traffic signal were evaluated using Synchro 9 software and the parameters established in VDOT's TOSAM. **Table** 13 shows the projected operations of the Courthouse Road/Woodcutters Road intersection under year 2022 total traffic conditions.

Table 13. Year 2022 Total Traffic Conditions – Signalized Courthouse Road/Woodcutters Road

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Courthouse Road/ Woodcutters Road (#4)	Signalized	EB	EBT	B	306	16.4	B	155	12.3
			EBR	A	10	2.7	A	22	7.5
		EB Approach		B		16.0	B		11.5
		WB	WBL	D	74	37.8	C	210	20.2
			WBT	A	52	7.7	A	78	3.1
		WB Approach		B		12.8	A		8.3
		NB	NBL	B	108	15.7	C	71	20.4
			NBR	F	360	56.9	B	39	10.5
		NB Approach		D		50.4	B		13.8
		Overall Intersection		C		26.6	A		10.0

Under signalized control, the Courthouse Road/Woodcutters Road intersection is anticipated to operate at LOS C and LOS A during the weekday a.m. and p.m. peak hours, respectively.

The Accokeek Furnace development is projected to account for less than seven percent of the total volume to this intersection, which has been shown to be deficient under existing traffic conditions.

SimTraffic Queuing Analysis

SimTraffic microsimulations were performed at the Courthouse Road/Woodcutters Road intersection in accordance with the procedures outlined in Chapter 7 of VDOT's *Traffic Operations and Safety Analysis Manual* (TOSAM).

Table 14 below provides a queue comparison between background and total traffic conditions for each study time period.

Table 14. Maximum SimTraffic Queue – 2022 Total Traffic Conditions

Intersection	Mvmt	Storage	Weekday AM	Weekday PM
Courthouse Road/ Woodcutters Road (#4)	EBT	Cont.	264	179
	EBR	300	55	98
	WBL	250	110	223
	WBT	Cont.	103	144
	NBL	Cont.	146	105
	NBR	Cont.	259	68

As shown in **Table 14**, the maximum peak hour queues are forecast to be accommodated for all movements.

Ramoth Church Road/Kellogg Mill Road

The critical eastbound approach at the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road operates at LOS D during the weekday a.m. peak hour.

The Accokeek Furnace development is projected to account for approximately 45 percent of the total volume at this intersection, which has been shown to be deficient under existing traffic conditions. However, traffic added to Kellogg Mill Road and Accokeek Furnace Road is projected to be substantial, and was the trigger for this study.

As such, several possible mitigation strategies at this intersection have been explored. The applicant intends to focus their proffers on this intersection where the project's impact is potentially greatest.

Option 1 – Additional Turn Lanes

To address noted LOS deficiencies, the potential for adding additional turn lanes at this intersection were explored. Ultimately, it was determined that even with separate left-turn lanes on all

approaches, the County's LOS standard (LOS C) would not be achievable. Additionally, widening both Kellogg Mill Road and Ramoth Church Road would likely have right-of-way impacts to all four quadrants of the intersection. Therefore, turn lanes alone are not considered a feasible solution.

Option 2 – Single-Lane Roundabout

Traffic operations of a single-lane roundabout were evaluated under year 2022 total traffic conditions. **Table 15** summarize the results, indicating a roundabout would operate at LOS A and LOS A during the weekday a.m. and p.m. peak hours, respectively.

Table 15. Year 2022 Total Traffic Conditions – Roundabout – Ramoth Church Road/Kellogg Mill Road

Intersection Information		AM Peak Hour			PM Peak Hour		
Approach	Lane	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
EB	EBLTR	A	58	6.3	A	28	5.9
EB Approach		A		6.3	A		5.9
WB	WBLTR	A	10	6.1	A	23	4.9
WB Approach		A		6.1	A		4.9
NB	NBLTR	B	135	14.7	A	18	4.7
NB Approach		B		14.7	A		4.7
SB	SBLTR	A	8	4.4	A	80	9.4
SB Approach		A		4.4	A		9.4
Overall Intersection		B		10.2	A		7.2

To accommodate a WB-62 or WB-67 design vehicle, a single-lane roundabout would likely require an inscribed circle diameter (ICD) of approximately 150 feet. The resultant "footprint" of a roundabout would likely have right-of-way impacts to all four quadrants of the intersection.

Option 3 – Realignment of Eastern Portion of Kellogg Mill Road

This option contemplates the realignment of a portion of Kellogg Mill Road on the east side of Ramoth Church Road, creating a separate new "T" intersection to the north. The new intersection would be constructed as a roundabout, and designed to incorporate a future fourth leg (Kellogg Mill Road west of Ramoth Church Road) to the west. This intersection is assumed to be offset a minimum of 440 feet in accordance with VDOT spacing standards, and would effectively implement one half of the County Transportation Plan to realign Kellogg Mill Road from its current location to the north (see Table 4-1 and Figure 4-2 of the Comprehensive Plan). The existing eastern portion of Kellogg Mill Road would be retained to provide local access via Ramoth Church Road, but would be terminated via a cul de sac at the eastern end. **Figure 19** illustrates this concept.

Roundabout control at the new intersection would operate acceptably, but demand for east-west travel on Kellogg Mill Road would still produce heavy turning movement volumes at the existing Ramoth Church Road/Kellogg Mill Road intersection.

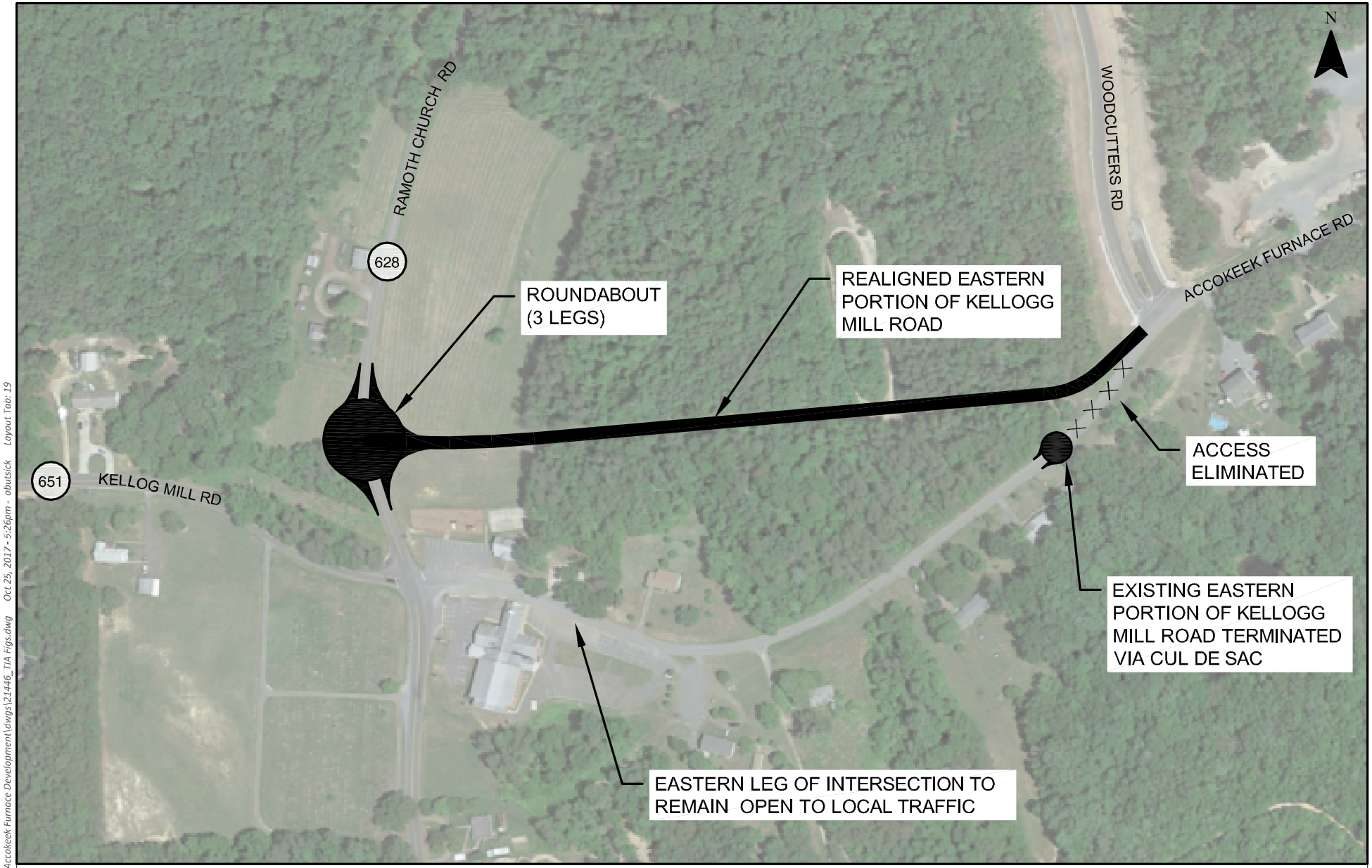
Option 4 – Complete Realignment of Kellogg Mill Road

This option would fully implement the County Comprehensive Plan realignment of Kellogg Mill Road (from 0.15 miles west of Ramoth Church Road to 0.35 miles east) and creation of a new intersection north of the existing Ramoth Church Road/Kellogg Mill Road intersection. Roundabout control at the new intersection would operate acceptably, and it is assumed that the exiting Kellogg Mill Road would be retained to provide local access to the church, local residences, and cemetery in the southwest quadrant of the intersection. **Figure 20** illustrates this concept.

Option 5 – Disconnect Kellogg Mill Road between Ramoth Church Road and Woodcutters Road

This option would sever Kellogg Mill Road at a point just west of Woodcutters Road. Regional through traffic that today uses Woodcutters Road and Kellogg Mill Road to connect between Courthouse Road and Mountain View Road would be diverted to use Ramoth Church Road. This concept eliminate all non-local traffic on the segment of Kellogg Mill Road to the east of Ramoth Church Road (serving only the church and local residences in the area), but would still require improvements to the Kellogg Mill Road/Ramoth Church Road intersection to address existing operational deficiencies. This option is considered less desirable in that it is inconsistent with the County's transportation plan and could have other unintended consequences/impacts at other intersections beyond the scope of this study. **Figure 21** illustrates this concept.

Appendix K *contains the mitigated traffic operations and SimTraffic queuing worksheets for 2022 total traffic conditions.*



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Option 3 - Realignment of Eastern Portion of Kellog Mill Road
Ramoth Church Road/Kellogg Mill Road Intersection Mitigation
Stafford County, Virginia

Figure **19**

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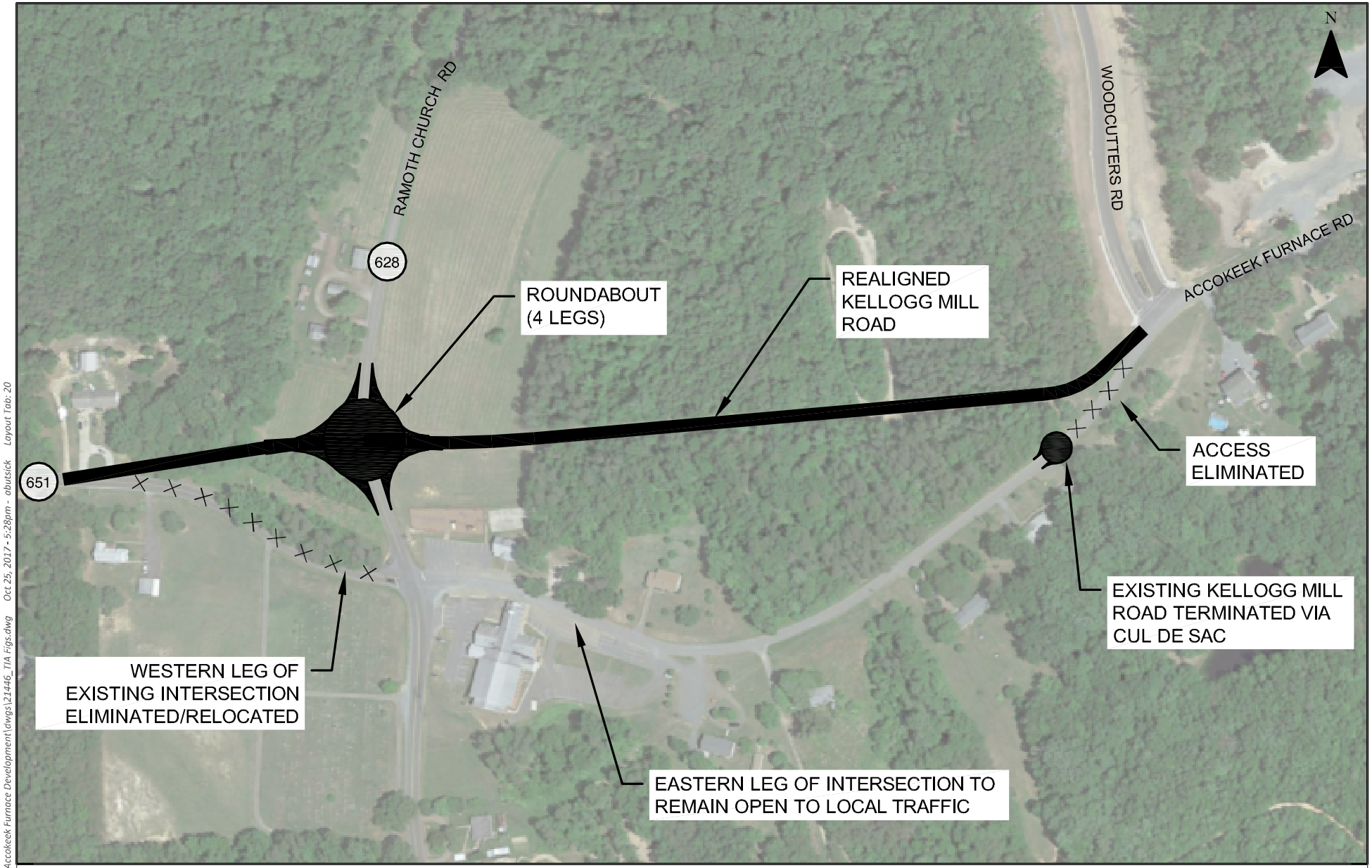

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Option 4 - Complete Realignment of Kellogg Mill Road
Ramoth Church Road/Kellogg Mill Road Intersection Mitigation
Stafford County, Virginia

Figure **20**

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Option 5 - Disconnect Kellogg Mill Road
Ramoth Church Road/Kellogg Mill Road Intersection Mitigation
Stafford County, Virginia

Figure **21**

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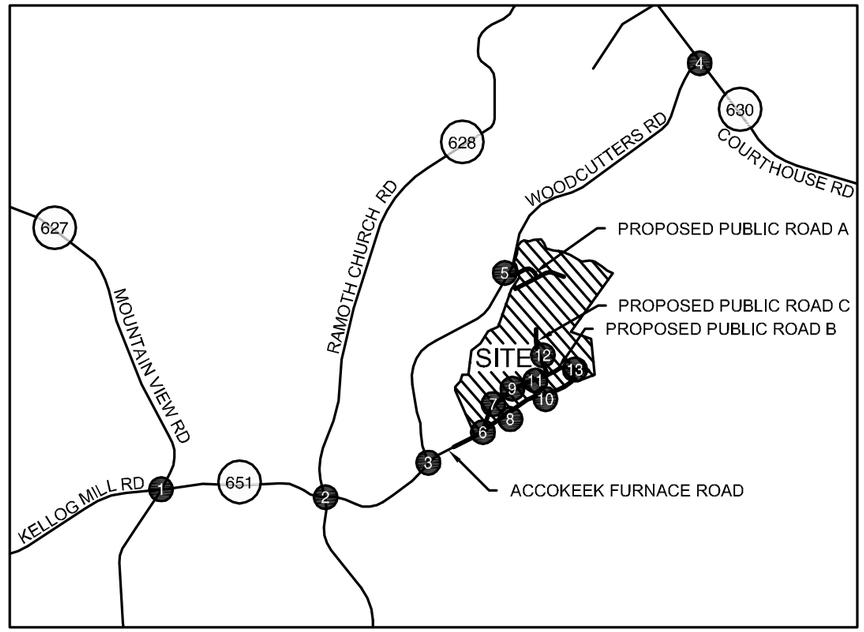
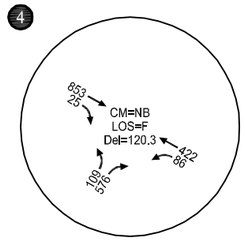
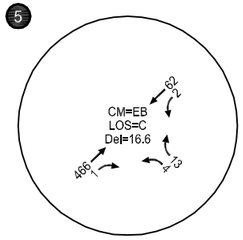
YEAR 2028 TRAFFIC CONDITIONS

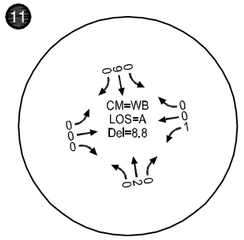
Per the scoping requirements of this project, an analysis of future design year 2028 total traffic conditions was performed for planning purposes. The year 2028 analysis is provided to support long-term planning efforts. Six additional years of background growth were applied to year 2022 total traffic conditions to forecast year 2028 traffic conditions.

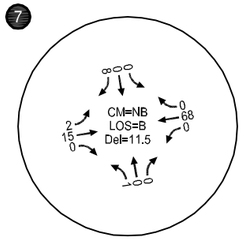
Figure 22 and **Figure 23** show the design year 2028 traffic operational results for the weekday a.m. and weekday p.m. peak hours, respectively. **Figure 24** and **Figure 25** show the lane group levels of service. **Table 16** summarizes the peak hour levels of service, 95th percentile back of queue, and delay for each lane group by intersection. ***Appendix L*** *contains the year 2028 total traffic conditions operational worksheets.*

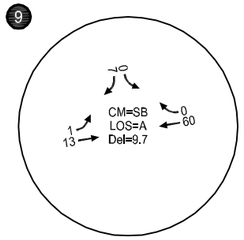


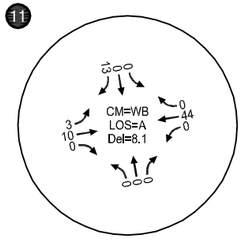


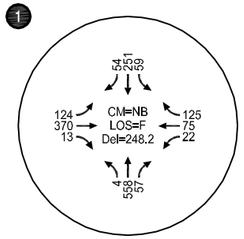


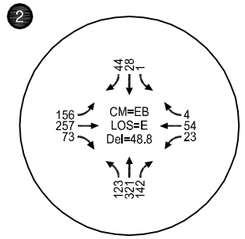


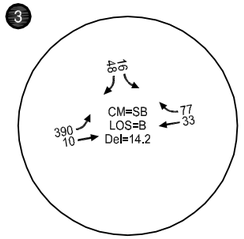


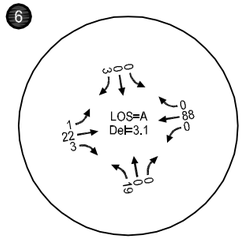


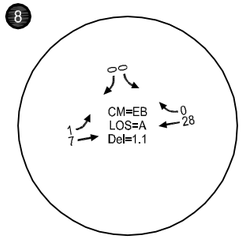


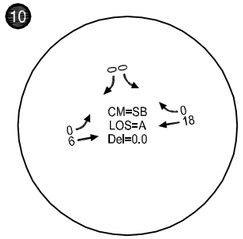












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TWC = TWO-WAY STOP CONTROL
AWSC= ALL-WAY STOP CONTROL

Year 2028 Total Traffic Conditions
Weekday AM Peak Hour
Stafford County, Virginia

Figure **22**

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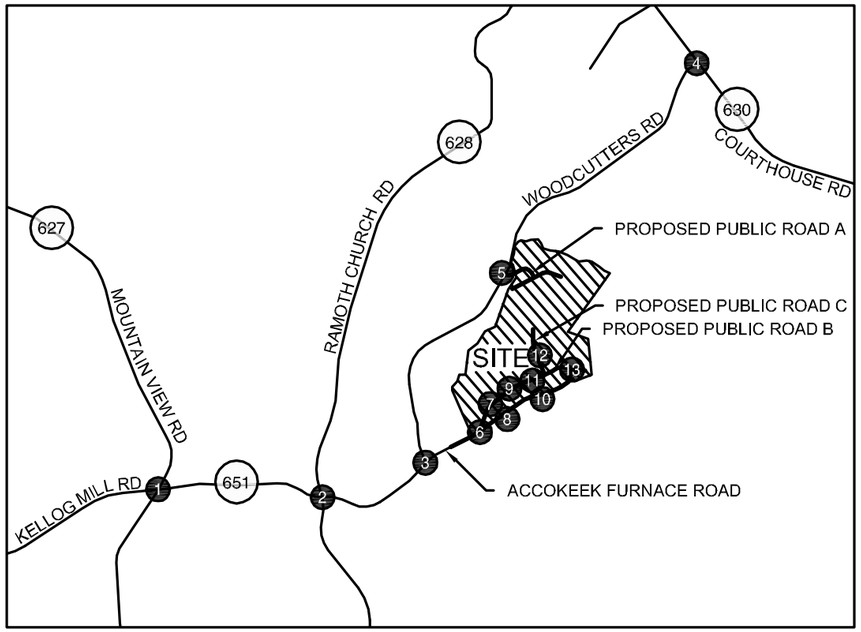

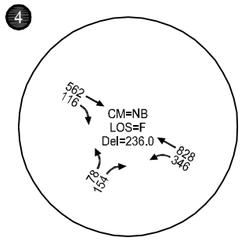

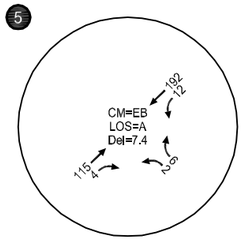

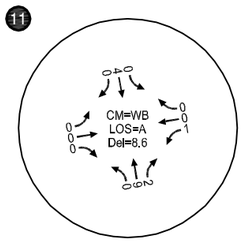

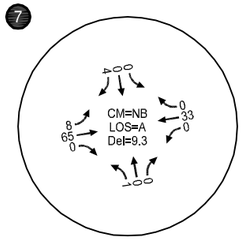

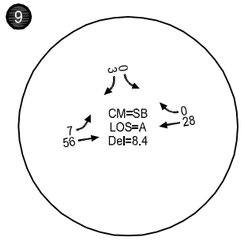

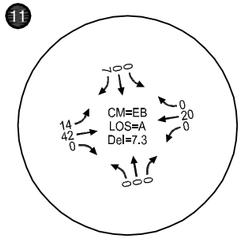

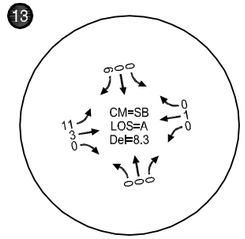

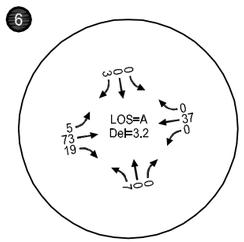

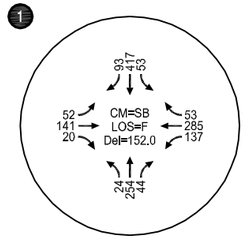

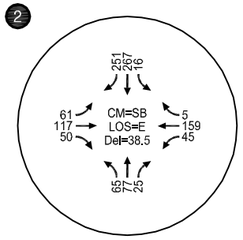

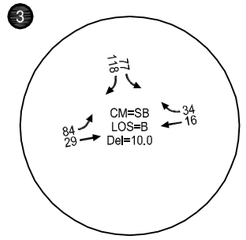

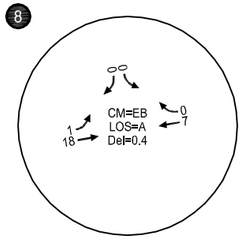

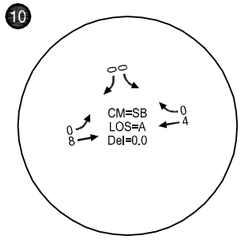

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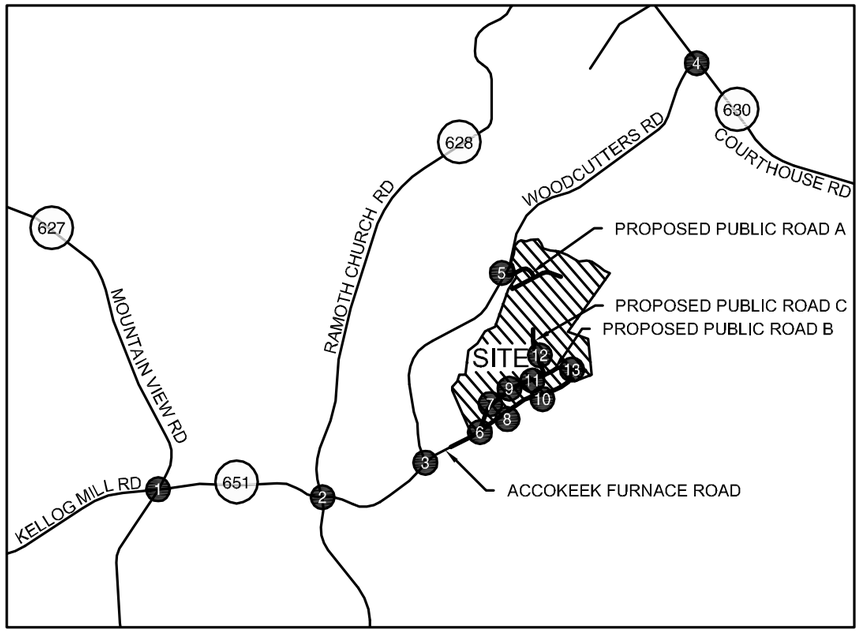
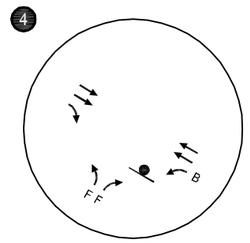
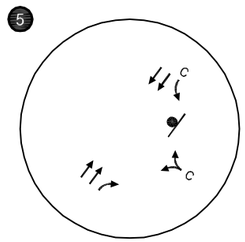
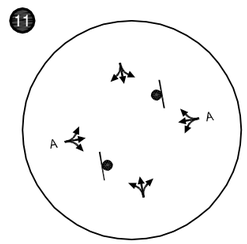
Year 2028 Total Traffic Conditions
Weekday PM Peak Hour
Stafford County, Virginia

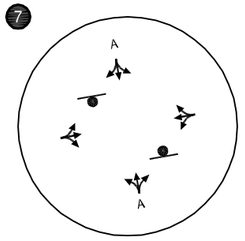
Figure **23**

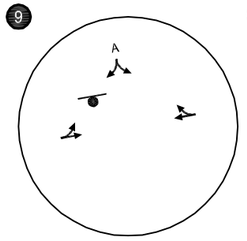


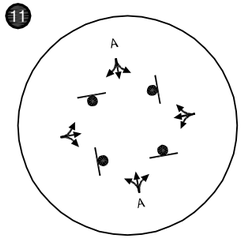


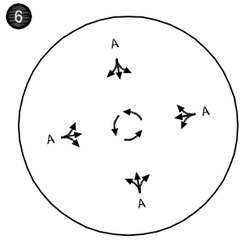


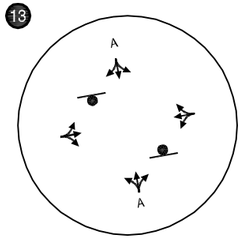


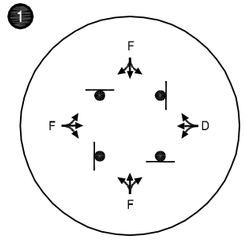


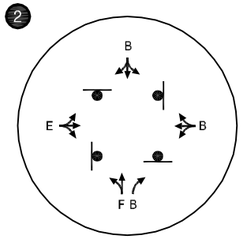


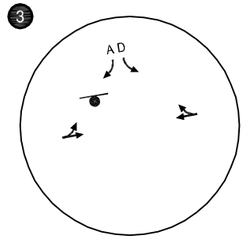


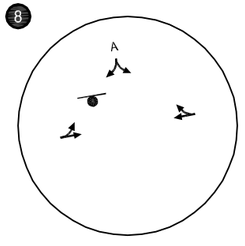


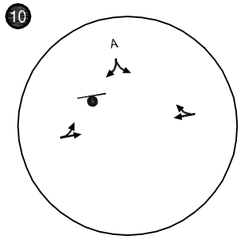












- ROUNDABOUT
X - LANE GROUP LEVEL OF SERVICE
- STOP SIGN
- TRAFFIC SIGNAL

Year 2028 Total Lane Group Level of Service
Weekday AM Peak Hour
Stafford County, Virginia

Figure **24**

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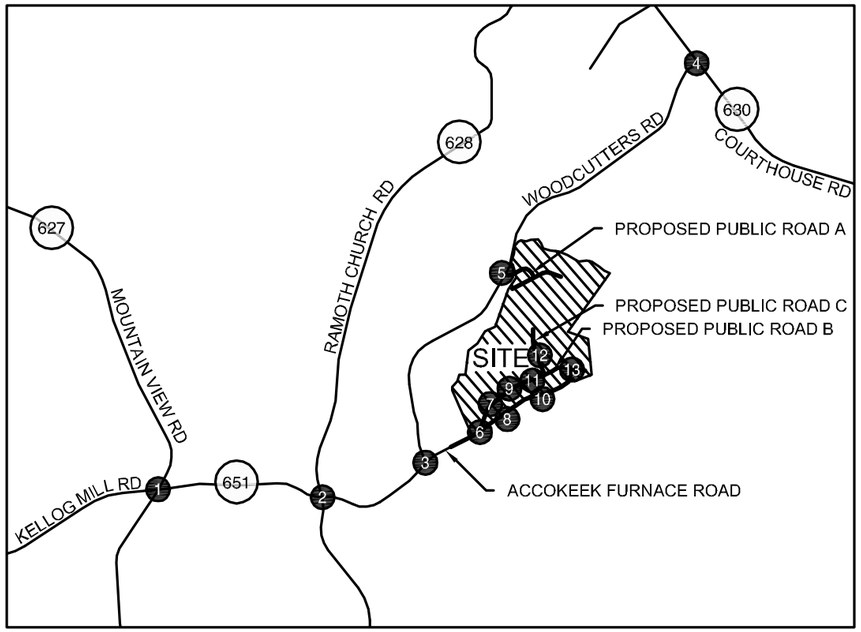
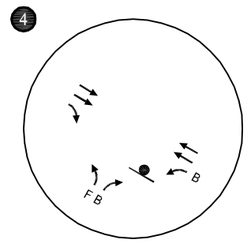
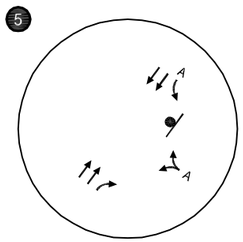
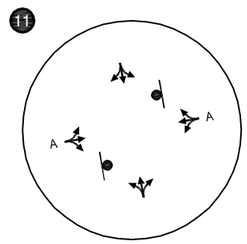
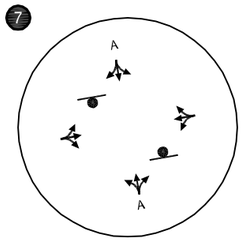
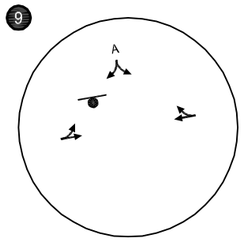


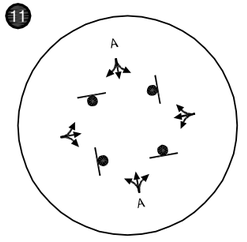


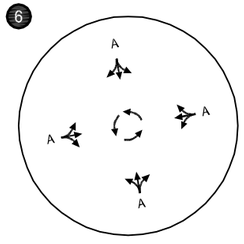


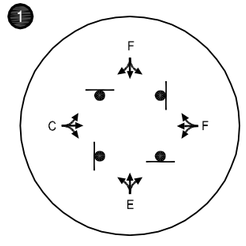


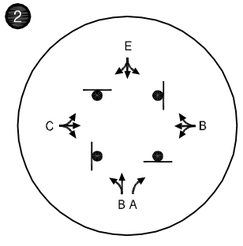


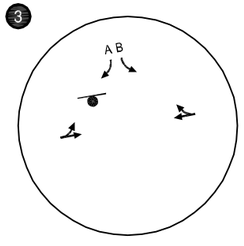


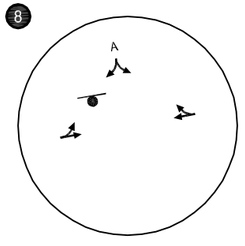


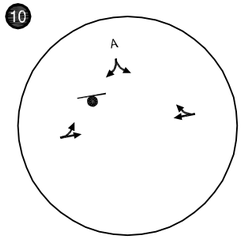












- ROUNDABOUT
X - LANE GROUP LEVEL OF SERVICE
- STOP SIGN
- TRAFFIC SIGNAL

Year 2028 Total Lane Group Level of Service
Weekday PM Peak Hour
Stafford County, Virginia

Figure **25**

KITTELSON & ASSOCIATES

Table 16. 2028 Total Traffic Conditions – Summary of Peak Hour Levels of Service, 95th Percentile Back of Queue, and Delay for Each Lane Group by Intersection

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Mountain View Road/ Kellogg Mill Road (#1)	Unsignalized	EB	EBLTR	F	495	156.1	C	78	24.5
		EB Approach		F		156.1	C		24.5
		WB	WBLTR	D	88	29.0	F	370	93.3
		WB Approach		D		29.0	F		93.3
		NB	NBLTR	F	768	248.2	E	155	35.8
		NB Approach		F		248.2	E		35.8
		SB	SBLTR	F	218	57.9	F	560	152.0
		SB Approach		F		57.9	F		152.0
Ramoth Church Road/Kellogg Mill Road (#2)	Unsignalized	EB	EBLTR	E	300	48.8	C	58	15.1
		EB Approach		E		48.8	C		15.1
		WB	WBLTR	B	18	12.1	B	53	14.8
		WB Approach		B		12.1	B		14.8
		NB	NBLT	F	293	52.8	B	33	13.5
			NBR	B	28	11.1	A	3	9.6
		NB Approach		E		42.7	B		12.9
		SB	SBLTR	B	18	14.0	E	273	38.5
		SB Approach		B		14.0	E		38.5
Woodcutters Road/ Kellogg Mill Road/ Accokeek Furnace Road (#3)	Unsignalized	EB	EBLT	A	30	8.5	A	5	7.4
		EB Approach				8.2			5.5
		WB	WBTR			0.0			0.0
		WB Approach				0.0			0.0
		SB	SBL	D		30.2	B	13	11.5
			SBR	A		8.9	A	10	9.0
		SB Approach		B		14.2	B		10.0
Courthouse Road/ Woodcutters Road (#4)	Unsignalized	EB	EBT		0	0.0		0	0.0
			EBR		0	0.0		0	0.0
		EB Approach				0.0			0.0
		WB	WBL	B	13	10.9	B	43	10.7
			WBT		0	0.0		0	0.0
		WB Approach				1.8			3.2
		NB	NBL	F	175	167.3	F	218	679.0
			NBR	F	530	111.4	B	23	11.6
		NB Approach		F		120.3	F		236.0
Woodcutters Road/ Public Road A (#5)	Unsignalized	WB	WBLR	C	5	16.6	A	0	7.4
		WB Approach				3.9			1.9
		NB	NBT		0	0.0		0	0.0
			NBR		0	0.0		0	0.0
		NB Approach				0.0			0.0
		SB	SBL	C	3	19.6	A	0	8.9
			SBT		0	0.0		0	0.0
		SB Approach							
Accokeek Furnace Road/ Public Road B/ Site Driveway #1 (#6)	Roundabout	EB	EBLTR	A	3	2.8	A	8	3.3
		EB Approach		A		2.8	A		3.3
		WB	WBLTR	A	8	3.3	A	3	2.9
		WB Approach		A		3.3	A		2.9
		NB	NBLTR	A	3	2.9	A	0	3.0
		NB Approach		A		2.9	A		3.0
		SB	SBLTR	A	0	3.0	A	0	2.8
		SB Approach		A		3.0	A		2.8
		Overall Intersection		A		3.1	A		3.2

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Public Road B/ Site Driveway #2 (#7)	Unsignalized	EB	EBLTR	A	0	7.8	A	0	7.3
		EB Approach				0.9			0.8
		WB	WBLTR	A	0	0.0	A	0	0.0
		WB Approach				0.0			0.0
		NB	NBLTR	B	0	11.5	A	0	9.3
		NB Approach		B		11.5	A		9.3
		SB	SBLTR	A	3	9.9	A	0	8.5
		SB Approach		A		9.9	A		8.5
Accokeek Furnace Road/ Site Driveway #3 (#8)	Unsignalized	EB	EBLTR	A	0	7.4	A	0	7.2
		EB Approach				1.1			0.4
		WB	WBLTR		0	0.0		0	0.0
		WB Approach				0.0			0.0
		SB	SBLTR	A	0	0.0	A	0	0.0
		SB Approach		A		0.0	A		0.0
Public Road B/ Site Driveway #4 (#9)	Unsignalized	EB	EBLTR	A	0	7.7	A	0	7.3
		EB Approach				0.6			0.8
		WB	WBLTR		0	0.0		0	0.0
		WB Approach				0.0			0.0
		SB	SBLTR	A	3	9.7	A	0	8.4
		SB Approach		A		9.7	A		8.4
Accokeek Furnace Road/ Site Driveway #5 (#10)	Unsignalized	EB	EBLTR	A	0	0.0	A	0	0.0
		EB Approach				0.0			0.0
		WB	WBLTR		0	0.0		0	0.0
		WB Approach				0.0			0.0
		SB	SBLTR	A	0	0.0	A	0	0.0
		SB Approach		A		0.0	A		0.0
Public Road B/ Site Driveway #6 (#11)	Unsignalized	EB	EBLTR	A	5	7.5	A	5	7.3
		EB Approach		A		7.5	A		7.3
		WB	WBLTR	A	20	8.1	A	3	7.1
		WB Approach		A		8.1	A		7.1
		NB	NBLTR	A	0	7.5	A	0	7.1
		NB Approach		A		7.5	A		7.1
		SB	SBLTR	A	5	7.0	A	0	6.5
		SB Approach		A		7.0	A		6.5
Public Road C/ Site Driveway #7 (#12)	Unsignalized	EB	EBLTR	A	0	0.0	A	0	0.0
		EB Approach		A		0.0	A		0.0
		WB	WBLTR	A	0	8.8	A	0	8.6
		WB Approach		A		8.8	A		8.6
		NB	NBLTR	A	0	0.0	A	0	0.0
		NB Approach				0.0			0.0
		SB	SBLTR	A	0	0.0	A	0	0.0
		SB Approach				0.0			0.0
Accokeek Furnace Road/ Public Road B (#13)	Unsignalized	EB	EBLTR	A	0	7.2	A	0	7.2
		EB Approach				4.8			5.7
		WB	WBLTR	A	3	7.3	A	0	0.0
		WB Approach				5.9			0.0
		NB	NBLTR	A	0	8.4	A	0	0.0
		NB Approach		A		8.4	A		0.0
		SB	SBLTR	A	5	8.5	A	0	8.3
		SB Approach		A		8.5	A		8.3

As shown in the figures and Table 16, all study intersections are forecast to continue to operate at LOS C or better during all time periods with the following exception discussed below.

Mountain View Road/Kellogg Mill Road

The critical northbound and southbound approaches are anticipated to operate at LOS F during the weekday a.m. and p.m. peak hours, respectively, under year 2028 total traffic conditions.

Forecast Operations of Mini-Roundabout under Year 2028 Total Conditions

The anticipated operations at the Mountain View Road/Kellogg Mill Road intersection were evaluated using the FHWA 75-foot ICD capacity model built into FHWA's *Capacity Analysis for Planning of Junctions* (CAP-X) tool. **Table 17** summarizes the anticipated operations.

Table 17. Operations of a Mini-Roundabout under Year 2028 Total Traffic Volumes – Mountain View Road/Kellogg Mill Road

Scenario	Predicted Approach Capacity (passenger car equivalents per hour)	Critical Approach	Critical V/C Ratio
Weekday A.M. Peak Hour	503	NB	1.23
Weekday P.M. Peak Hour	588	SB	0.96

As shown in Table 17, a mini-roundabout with an 75-foot ICD is anticipated to operate over capacity under year 2028 total traffic conditions during the weekday a.m. peak hour. During the weekday p.m. peak hour, a mini-roundabout is anticipated to operate near capacity. A typical single-lane roundabout (e.g., an ICD of approximately 140 to 150 feet) would provide greater capacity on each approach.

Courthouse Road/Woodcutters Road

The stop-controlled northbound approach operates at LOS F during the weekday a.m. and p.m. peak hours.

Forecast Operations of a Traffic Signal

The anticipated operations of a traffic signal were evaluated using Synchro 9 software and the parameters established in VDOT's TOSAM. **Table** 13 shows the projected operations of the Courthouse Road/Woodcutters Road intersection under year 2028 total traffic conditions. ***Appendix N*** *contains the 2028 total traffic operational analysis worksheets for the signalized Courthouse Road/Woodcutters Road intersection.*

Table 18. Year 2028 Total Traffic Conditions – Signalized Courthouse Road/Woodcutters Road

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Courthouse Road/	Signalized	EB	EBT	B	233	14.6	B	196	13.7
			EBR	A	9	2.6	A	25	8.1

Intersection Information				AM Peak Hour			PM Peak Hour		
Intersection	Traffic Control	Approach	Lane Group	LOS	Back of Queue (feet)	Delay (sec)	LOS	Back of Queue (feet)	Delay (sec)
Woodcutters Road (#4)		EB Approach		B		14.3	B		12.7
		WB	WBL	C	59	34.2	C	242	22.2
			WBT	A	39	7.4	A	99	3.2
		WB Approach		B		11.6	A		8.8
		NB	NBL	B	86	13.7	C	82	23.0
			NBR	C	241	21.2	B	49	11.2
		NB Approach		C		20.1	B		15.2
		Overall Intersection		B		15.4	B		10.8

Under signalized control, the Courthouse Road/Woodcutters Road intersection is anticipated to operate at LOS B during both the weekday a.m. and p.m. peak hours.

SimTraffic Queuing Analysis

SimTraffic microsimulations were performed at the Courthouse Road/Woodcutters Road intersection in accordance with the procedures outlined in Chapter 7 of VDOT's *Traffic Operations and Safety Analysis Manual* (TOSAM).

Table 19 below provides a queue comparison between background and total traffic conditions for each study time period.

Table 19. Maximum SimTraffic Queue – 2022 Total Traffic Conditions

Intersection	Mvmt	Storage	Weekday AM	Weekday PM
Courthouse Road/ Woodcutters Road (#4)	EBT	Cont.	226	189
	EBR	300	55	103
	WBL	250	93	233
	WBT	Cont.	97	189
	NBL	Cont.	116	112
	NBR	Cont.	188	78

As shown in **Table 19**, the maximum peak hour queues are forecast to be accommodated for all movements.

Ramoth Church Road/Kellogg Mill Road

The critical northbound and southbound approaches at the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road operates at LOS E during the weekday a.m. and p.m. peak hour, respectively.

One or more of the improvement options identified under 2022 total traffic conditions will serve to mitigate the development's projected impact at this intersection under design year 2028 conditions.

Appendix M *contains the mitigated traffic operations and SimTraffic queuing worksheets for design year 2028 total traffic conditions.*

Section 5
Conclusions and Recommendations

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the transportation impact analysis, the transportation system can accommodate full build-out of the proposed development and assuming provision of the recommended mitigations. The findings of this analysis and our recommendations are discussed below.

Existing Conditions

- All study intersections currently operate at LOS C or better with the following exceptions:
    - Mountain View Road/Kellogg Mill Road (#1): The critical northbound and southbound approaches at the all-way stop-controlled Mountain View Road/Kellogg Mill Road intersection operate at LOS F and LOS D during the weekday a.m. and p.m. peak hours, respectively.
        - A mini-roundabout with a 75-foot ICD is anticipated to operate under capacity under existing traffic volumes during the weekday a.m. and p.m. peak hours. As such, a mini-roundabout will be presented as a mitigation strategy at the Mountain View Road/Kellogg Mill Road intersection in all future year traffic analyses.
    - Ramoth Church Road/Kellogg Mill Road (#2): The critical northbound approach of the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road intersection currently operates at LOS D during the weekday a.m. peak hour.
    - Courthouse Road/Woodcutters Road (#4): The stop-controlled northbound approach operates at LOS F and LOS E during the weekday a.m. and p.m. peak hours, respectively.
        - MUTCD signal warrants are met under existing conditions at this intersection. If signalized, the intersection is anticipated to operate at LOS C or better during the study time periods in its current configuration.

2022 Background Traffic Conditions

- Growth rates of three percent (Courthouse Road and Mountain View Road) and two percent (all other roads) were compounded annually and applied to account for near-term regional traffic growth.
- Forecast traffic from the Augustine Woods (95 single-family homes) was also added to the study network to develop year 2022 background traffic volumes.
- Two transportation improvements were identified for inclusion in the background 2022 analysis.
    - Widening of Courthouse Road to a 4-lane cross-section through the study area

- Widening of Woodcutters Road to a 4-lane cross-section throughout the study area

- All study intersections are forecast to operate at LOS C or better with the following exceptions:
  - Mountain View Road/Kellogg Mill Road (#1): A mini-roundabout with a 75-foot ICD is anticipated to operate under capacity under 2022 background traffic volumes during the weekday a.m. and p.m. peak hours.
  - Ramoth Church Road/Kellogg Mill Road (#2): The critical northbound approach of the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road intersection is forecast to continue to operate at LOS D during the weekday a.m. peak hour.
  - Courthouse Road/Woodcutters Road (#4): The stop-controlled northbound approach is forecast to operate at LOS F and LOS E during the weekday a.m. and p.m. peak hours, respectively.
    - MUTCD signal warrants are met assuming a four-lane Courthouse Road at this intersection. If signalized, the intersection is anticipated to operate at LOS B or better during the study time periods.

Proposed Development

- Brookfield Homes is applying for a rezoning of approximately 72 acres of Agricultural (A1) land to Suburban Residential (R1) land to allow for the Accokeek Furnace development of 350 townhomes.
- The site proposes extend the existing Accokeek Furnace Road from its current terminus and develop a series of new public and private roadways. Access to the individual condominium/townhome lots are proposed to be provided via the new public and private roads.
- The development is estimated to generate approximately 1,913 net new weekday daily trips, 141 weekday a.m. (24 in, 117 out), and 168 weekday p.m. (113 in, 55 out) peak hour trips when fully built out in year 2022.

2022 Total Traffic Conditions

- All study intersections are forecast to operate at LOS C or better with the following exceptions:
  - Mountain View Road/Kellogg Mill Road (#1): A mini-roundabout with a 75-foot ICD is anticipated to operate under capacity under 2022 total traffic volumes during the weekday a.m. and p.m. peak hours.
  - Ramoth Church Road/Kellogg Mill Road (#2): The critical northbound approach of the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road intersection is forecast to continue to operate at LOS D during the weekday a.m. peak hour.

- The development is projected to account for approximately 45 percent of the total volume at this intersection, which has been shown to be deficient under existing traffic conditions. Several possible mitigation strategies at this intersection were explored and are described briefly below.

  - Option 1 – Additional Turn Lanes: This option would add turn lanes at this intersection. Ultimately, it was determined that even with separate left-turn lanes on all approaches, the County's LOS standard (LOS C) would not be achievable. Widening both Kellogg Mill Road and Ramoth Church Road would also have right-of-way impacts to all four quadrants of the intersection. This option is not considered a feasible solution.

  - Option 2 – Single-Lane Roundabout: This option would construct a single-lane roundabout (Inscribed Circle Diameter of 150 feet) designed to accommodate a WB-62 or WB-67 design vehicle. While this option would satisfy the County's LOS standard, the resultant "footprint" of the roundabout would likely have right-of-way impacts to all four quadrants of the intersection.

  - Option 3 – Realignment of Eastern Portion of Kellogg Mill Road: This option contemplates the realignment of a portion of Kellogg Mill Road on the east side of Ramoth Church Road, creating a separate new "T" intersection to the north. The new intersection would be constructed as a roundabout, and designed to incorporate a future fourth leg (Kellogg Mill Road west of Ramoth Church Road) to the west. This option would effectively implement one half of the County Transportation Plan to realign Kellogg Mill Road from its current location to the north. The existing eastern portion of Kellogg Mill Road would be retained to provide local access via Ramoth Church Road, but would be terminated via a cul de sac at the eastern end.

    Roundabout control at the new intersection would operate acceptably, but demand for east-west travel on Kellogg Mill Road would still produce heavy turning movement volumes at the existing Ramoth Church Road/Kellogg Mill Road intersection.

  - Option 4 – Complete Realignment of Kellogg Mill Road: This option would fully implement the County Comprehensive Plan realignment of Kellogg Mill Road (from 0.15 miles west of Ramoth Church Road to 0.35 miles east) and creation of a new intersection north of the existing Ramoth Church Road/Kellogg Mill Road intersection. Roundabout control at the new intersection would

operate acceptably, and it is assumed that the exiting Kellogg Mill Road would be retained to provide local access to the church, local residences, and cemetery in the southwest quadrant of the intersection.

- Option 5 – Disconnect Kellogg Mill Road Between Ramoth Church Road and Woodcutters Road: This option would sever Kellogg Mill Road at a point just west of Woodcutters Road. Regional through traffic that today uses Woodcutters Road and Kellogg Mill Road to connect between Courthouse Road and Mountain View Road would be diverted to use Ramoth Church Road. This concept eliminate all non-local traffic on the segment of Kellogg Mill Road to the east of Ramoth Church Road (serving only the church and local residences in the area), but would still require improvements to the Kellogg Mill Road/Ramoth Church Road intersection to address existing operational deficiencies. This option is considered less desirable in that it is inconsistent with the County's transportation plan and could have other unintended consequences/impacts at other intersections beyond the scope of this study.

- Courthouse Road/Woodcutters Road (#4): The stop-controlled northbound approach is forecast to operate at LOS F and LOS E during the weekday a.m. and p.m. peak hours, respectively.
  - MUTCD signal warrants are met assuming a four-lane Courthouse Road at this intersection. If signalized, the intersection is anticipated to operate at LOS C or better during the study time periods.

2028 Total Traffic Conditions

- All study intersections are forecast to operate at LOS C or better with the following exceptions:
  - Mountain View Road/Kellogg Mill Road (#1): A mini-roundabout with a 75-foot ICD is anticipated to operate near or above capacity under 2028 total traffic volumes during the weekday a.m. and p.m. peak hours.
  - Ramoth Church Road/Kellogg Mill Road (#2): The critical approaches of the all-way stop-controlled Ramoth Church Road/Kellogg Mill Road intersection is forecast to continue to operate at LOS E during the weekday a.m. and p.m. peak hours.
  - Courthouse Road/Woodcutters Road (#4): The stop-controlled northbound approach is forecast to operate at LOS F during both the weekday a.m. and p.m. peak hours.

- MUTCD signal warrants are met assuming a four-lane Courthouse Road at this intersection. If signalized, the intersection is anticipated to operate at LOS C or better during the study time periods.

RECOMMENDATIONS

The following improvements are recommended to mitigate the impacts of the proposed Accokeek Furnace development.

- Contribute proffer dollars to an improvement for the Kellogg Mill Road/Ramoth Church Road to be determined prior to rezoning approval. In general, improvements that implement Stafford County's current Comprehensive Plan are considered more desirable than those that do not.

Section 6
References

REFERENCES

1. Stafford County GIS Office. *Stafford County Zoning.* Accessed October 1, 2017. https://staffordcountyva.gov/DocumentCenter/View/604

2. Transportation Research Board. Highway Capacity Manual. 2010.

3. Institute of Transportation Engineers Journal. Mini roundabouts for the United States and Traffic Capacity Models. November 2012.

4. Virginia Department of Transportation. *Traffic Operations and Safety Analysis Manual*. November 2015.

5. Institute of Transportation Engineers. *Trip Generation, 9th Edition.* 2012.

Appendix A
Scoping Letter

VDOT Virginia Department of Transportation

PRE-SCOPE OF WORK MEETING FORM

Information on the Project
Traffic Impact Analysis Base Assumptions

The applicant is responsible for entering the relevant information and submitting the form to VDOT and the locality no less than three (3) business days prior to the meeting. If a form is not received by this deadline, the scope of work meeting may be postponed.

Contact Information			
Consultant Name: Tele: E-mail:	Chris Tiesler, PE & John Callow - Kittelson & Associates, Inc. (703) 885-8970 ctiesler@kittelson.com		
Developer/Owner Name: Tele: E-mail:	Scott Gookin - Brookfield Homes (703) 270-1400 Scott.Gookin@brookfieldhomes.com		
Project Information			
Project Name:	Accokeek Furnace Road Development	Locality/County:	Stafford County
Project Location: (Attach regional and site specific location map)	See Figure 1 - attached		
Submission Type	Comp Plan ☐	Rezoning ☒	Site Plan ☐ Subd Plat ☐
Project Description: (Including details on the land use, acreage, phasing, access location, etc. Attach additional sheet if necessary)	Brookfield Homes is applying for a rezoning to allow the development of 356 condominiums/townhomes along Woodcutters Road and Accokeek Furnace Road. The site is located to the northeast of the Woodcutters Road/Accokeek Furnace Road intersection in Stafford County, Virginia. The proposed site will extend the existing Accokeek Furnace Road from it current terminus and develop a series of new public and private roadways. Access to the individual condominum/townhome lots are proposed to be provided via the new public and private roads.		
Proposed Use(s): (Check all that apply; attach additional pages as necessary)	Residential ☒	Commercial ☐	Mixed Use ☐ Other ☐
	Residential Uses(s) Number of Units: 356 ITE LU Code(s): (see attached Trip Gen Table) **Commercial Use(s)** ITE LU Code(s): 230 Square Ft or Other Variable:		**Other Use(s)** ITE LU Code(s): Independent Variable(s):

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

Total Peak Hour Trip Projection:	Less than 100 ☐	100 – 499 ☒	500 – 999 ☐	1,000 or more ☐

Traffic Impact Analysis Assumptions

Study Period	Existing Year: 2018	Build-out Year: 2022	Design Year: 2028
Study Area Boundaries (Attach map)	North: Route 630 (Courthouse Road)	South: Blaque Trax Lane	
	East: Accokeek Furnace Road	West: Route 627 (Mountain View Road)	
External Factors That Could Affect Project (Planned road improvements, other nearby developments)	The Woods at Augustine - approved development of 95 single-family homes along the north side of Courthouse Road between Monument Drive and Shelton Shop Road Per discussion with VDOT staff, all other proposed developments will be captured through annual growth rates on Courthouse Road and Mountain View Road Widening of Courthouse Road to a 4-lane cross-section through the study area		
Consistency With Comprehensive Plan (Land use, transportation plan)	No		
Available Traffic Data (Historical, forecasts)	2015 AADT Volumes from VDOT Route 630 (Courthouse Road) - 10,000 (from Shelton Shop Rd to Ramp from I-95) Route 628 (Ramoth Church Road) - 4,000 (from Courthouse Rd to Accokeek Furnace Rd) Route 628 (Ramoth Church Road) - 2,400 (from Accokeek Furnace Rd to US 1) Route 627 (Mountain View Road) - 6,400 (from Centreport Pkwy to Kellog Mill Rd) Route 627 (Mountain View Road) - 6,800 (from Kellog Mill Rd to Shelton Shop Rd)		
Trip Distribution (Attach sketch)	Road Name: NORTH: 75% north on Woodcutters Road (10% to west on Courthouse Road/65% to east on Courthouse Road) [See Figure 2]	Road Name: NORTHWEST: 5% northwest on Mountain View Road	
	Road Name: SOUTH: 10% south on Ramoth Church Road/5% south on Mountain View Road	Road Name: WEST: 5% west on Kellog Mill Road	
Annual Vehicle Trip Growth Rate:	3.0% on Courthouse Rd & Mountain View Rd through design year. 2.0% on all other roads	Peak Period for Study (check all that apply)	☒ AM ☒ PM ☐ SAT
		Peak Hour of the Generator	6-9 am 4-7 pm
Study Intersections	1.Woodcutters Road/Accokeek Furnace Road	6.Accokeek Furnace Road/Proposed Public Road A/Site Driveway #1 (future)	

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

and/or Road Segments (Attach additional sheets as necessary)	2.Ramoth Church Road/Accokeek Furnace Road/Kellog Mill Road	7.Proposed Public Road A/Site Driveway #2/Site Driveway #3 (future)
	3.Kellog Mill Road/Mountain View Road	8.Proposed Public Road A/Site Driveway #4 (future)
	4.Courthouse Road/Woodcutters Road	9.Proposed Public Road A/Site Driveway #5/Site Driveway #6 (future)
	5.Woodcutters Road/Proposed Public Road A (future)	10. Proposed Public Road B/Site Driveway #7/Site Driveway #8 (future) 11.Accokeek Furnace Road/Proposed Public Road A/Site Driveway #9 (future) 12. Accokeek Furnace Road/Site Driveway #10 (future) 13. Accokeek Furnace Road/Site Driveway #11 (future)
Trip Adjustment Factors	Internal allowance: ☐ Yes ☒ No Reduction: _____% trips	Pass-by allowance: ☐ Yes ☒ No Reduction: _____% trips
Software Methodology	☒ Synchro ☐ HCS (v.2000/+) ☐ aaSIDRA ☐ CORSIM ☒ Other SimTraffic	
Traffic Signal Proposed or Affected (Analysis software to be used, progression speed, cycle length)	Analysis Software: Synchro v9	Results: HCM Methodology
Improvement(s) Assumed or to be Considered	Widening of Courthouse Road to a 4-lane cross-section through the study area	
Background Traffic Studies Considered	The Woods at Augustine	
Plan Submission	☐ Master Development Plan (MDP) ☒ Generalized Development Plan (GDP) ☐ Preliminary/Sketch Plan ☐ Other Plan type (Final Site, Subd. Plan)	
Additional Issues to be Addressed	☒ Queuing analysis ☐ Actuation/Coordination ☐ Weaving analysis ☐ Merge analysis ☒ Bike/Ped Accommodations ☒ Intersection(s) ☐ TDM Measures ☒ Other Preliminary MUTCD signal warrant analysis at Courthoouse Road/Woodcutters Road; If conditions at Kellog Mill Road/Mountain View Road deteriorate to unacceptable levels, the forecast operations of a mini-roundabout will be evaluated, per VDOT's request.	

NOTES on ASSUMPTIONS: _____

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

SCOPE OF WORK MEETING

ADDITIONS TO THE REQUIRED ELEMENTS, CHANGES TO THE METHODOLOGY OR STANDARD ASSUMPTIONS, AND SIGNATURE PAGE

Any additions to the Required Elements or changes to the Methodology or Standard Assumptions due to special circumstances that are approved by VDOT:

AGREED: Andrew Butsick — DATE: 9/14/17
Applicant or Consultant

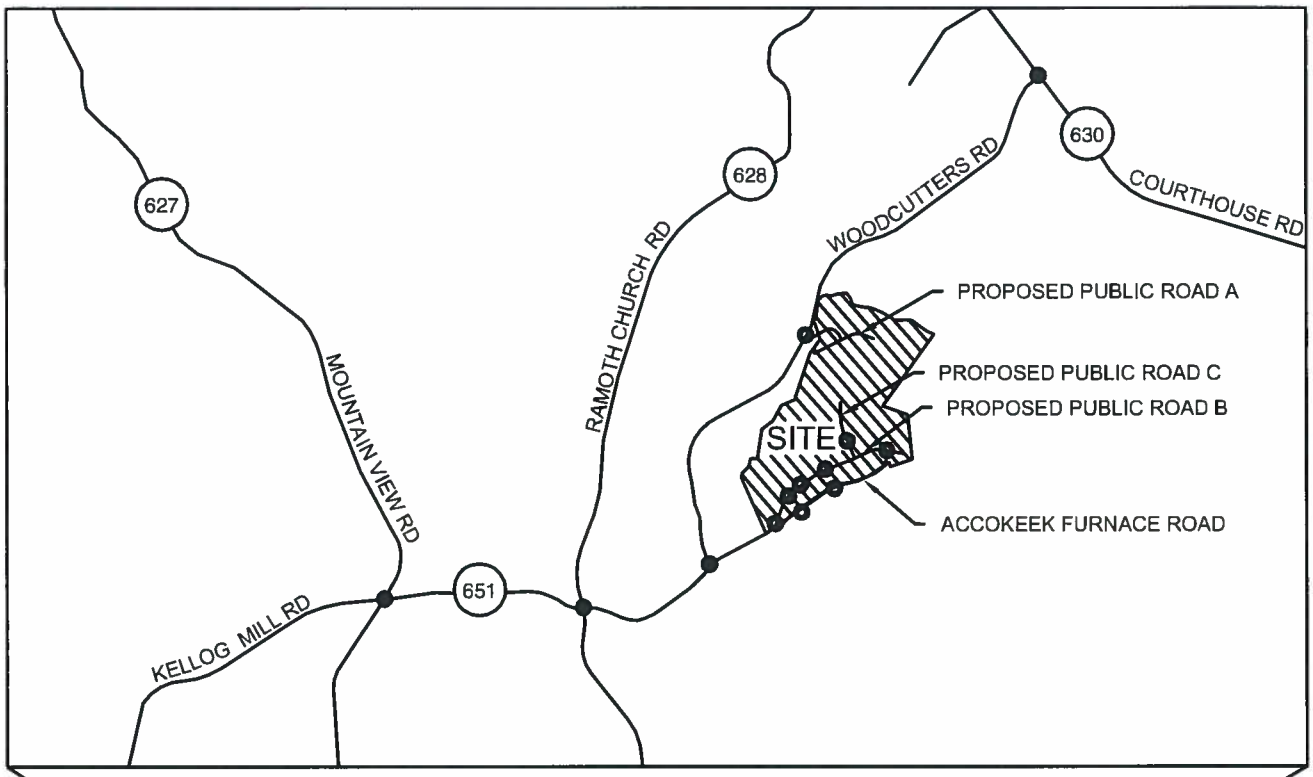
PRINT NAME: Andrew Butsick
Applicant or Consultant

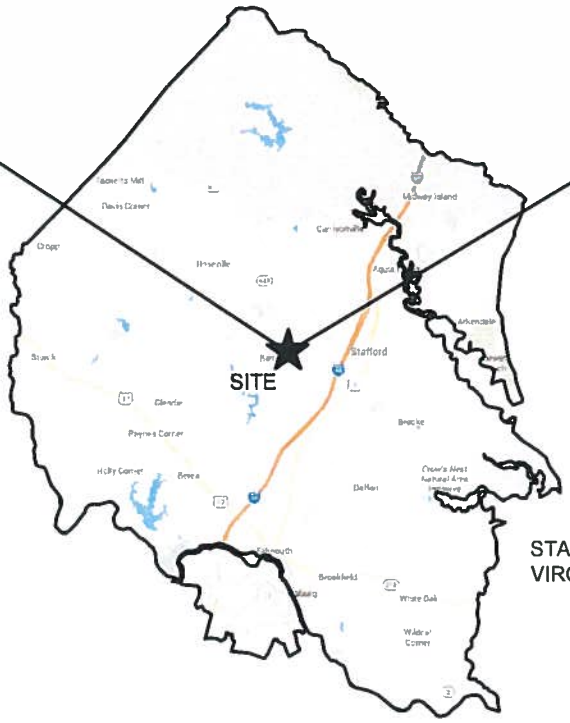
SIGNED: [signature] — DATE: 9/18/17
VDOT Representative

PRINT NAME: DAVID L. BEALE
VDOT Representative

SIGNED: Charles J. Hess — DATE: 9/18/17
Local Government Representative

PRINT NAME: Charles J. Hess
Local Government Representative



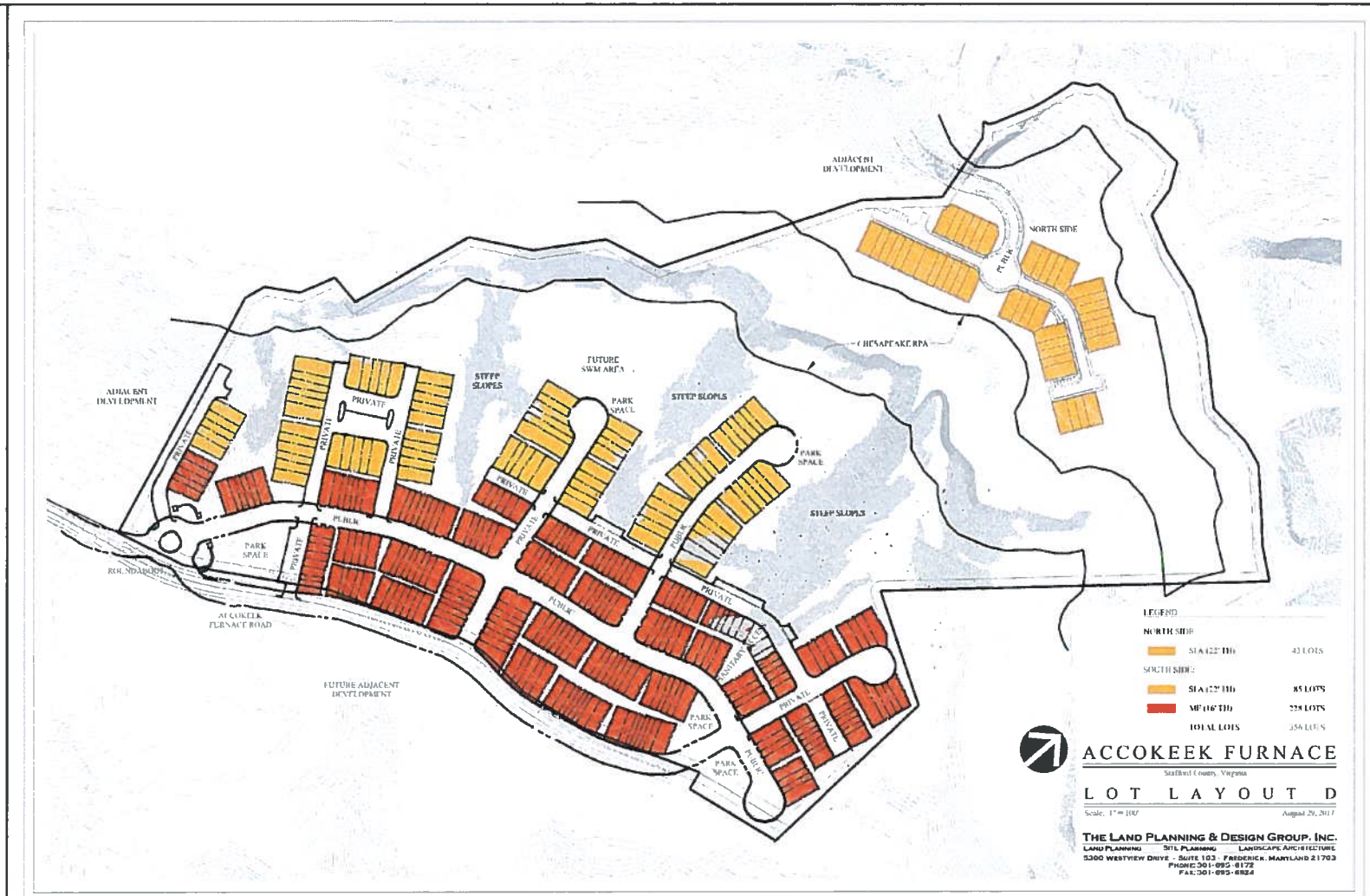


● - Study Intersections

⊙ - Future Study Intersections

Site Vicinity Map
Stafford County, Virginia

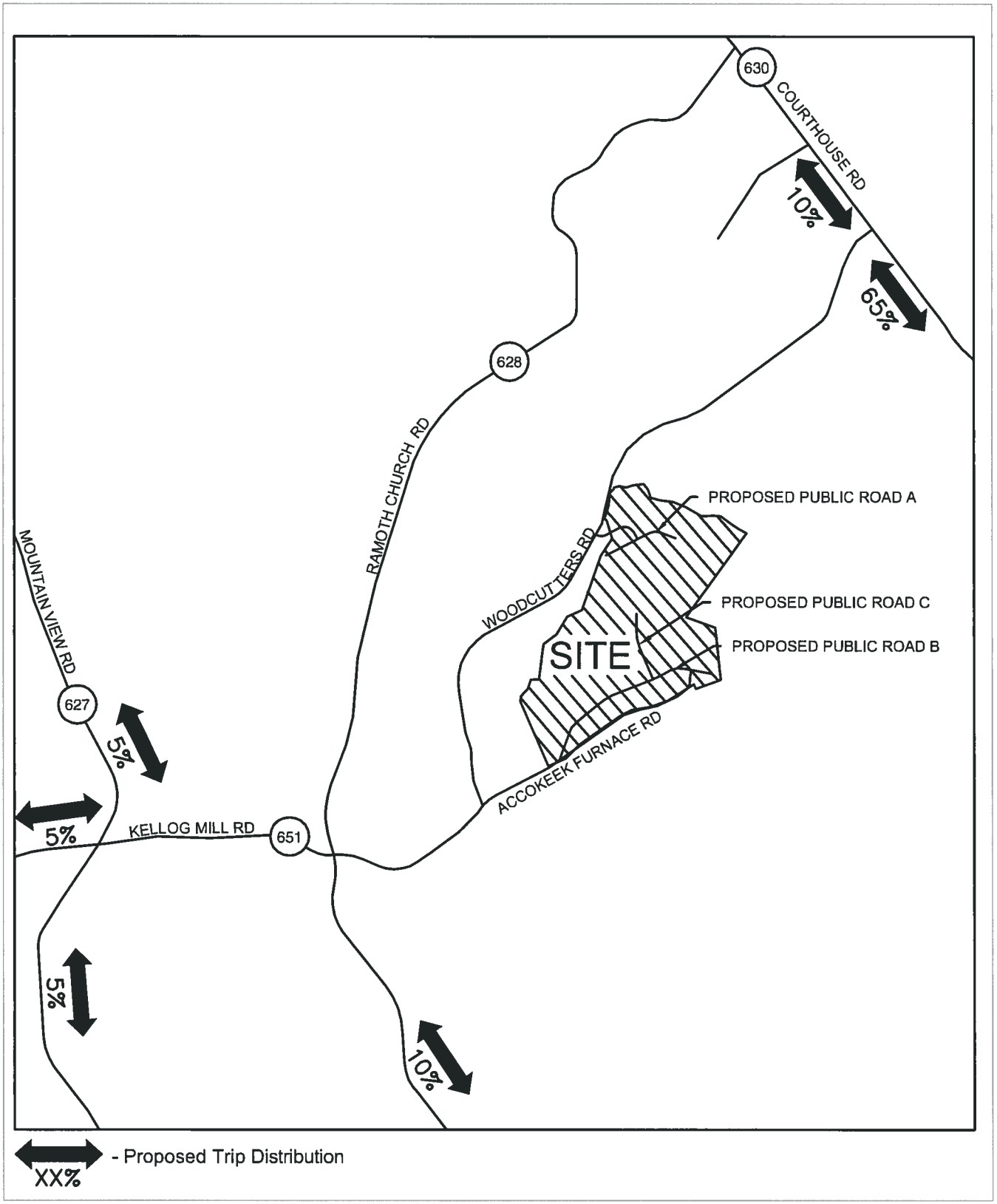
Figure
1



Proposed Site Plan
Developed by the Land Planning & Design Groupe, Inc. (8/30/17)
Stafford County, Virginia

Figure **2**

KITTELSON & ASSOCIATES



Proposed Trip Distribution
Accokeek Furnace Road Development
Stafford County, Virginia

Figure
3

Accokeek Furnace Road Development - Trip Generation

ITE Trip Gen 9th Ed

Land Use	ITE Code	Units		Weekday Daily	Saturday Daily	Peak Hour Generator									Peak Hour Adjacent Street								
						Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour			Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour*		
						Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out
Residential Condominum/Townhouse	230	356.000	Dwelling units	1,941	1,717	144	27	117	157	100	57	146	79	67	143	24	119	170	114	56	146	79	67
Net New Trips				**1,941**	**1,717**	**144**	**27**	**117**	**157**	**100**	**57**	**146**	**79**	**67**	**143**	**24**	**119**	**170**	**114**	**56**	**146**	**79**	**67**

**ITE Land Use Code 230 does not contain trip generation estimates for Saturday Peak Hour of Adjancent Street. Trip generation rates for Saturday Peak Hour of Generator estimates used.*

Appendix B
Traffic Counts

Type of peak hour being reported: User-Defined

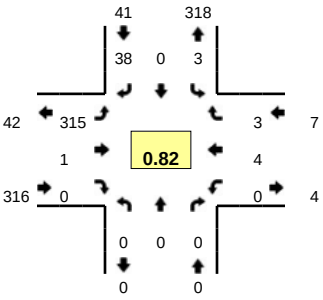
Method for determining peak hour: Total Entering Volume

LOCATION: Woodcutters Rd -- Kellog Mill Rd/Accokeek Furnace Rd

QC JOB #: 14407201

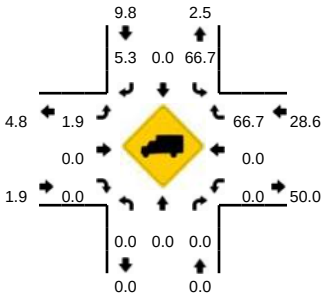
CITY/STATE: Fredericksburg, VA

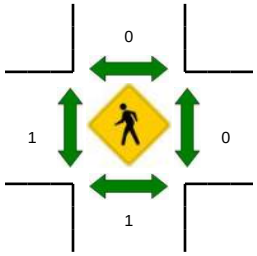
DATE: Wed, May 10 2017

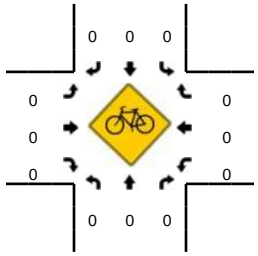


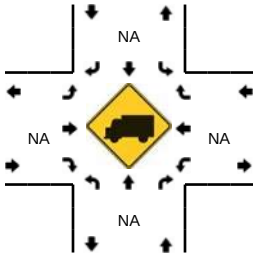
Peak-Hour: 6:45 AM -- 7:45 AM

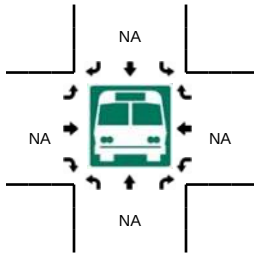
Peak 15-Min: 7:00 AM -- 7:15 AM











15-Min Count Period Beginning At	Woodcutters Rd (Northbound)				Woodcutters Rd (Southbound)				Kellog Mill Rd/Accokeek Furnace Rd (Eastbound)				Kellog Mill Rd/Accokeek Furnace Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	0	0	0	0	0	0	0	14	0	0	0	0	0	1	0	15	
6:15 AM	0	0	0	0	0	0	2	0	17	1	0	0	0	0	6	0	26	
6:30 AM	0	0	0	0	0	0	2	0	26	0	0	0	0	0	2	0	30	
6:45 AM	0	0	0	0	0	0	3	0	61	0	0	0	0	3	0	0	67	138
7:00 AM	0	0	0	0	2	0	11	0	96	0	0	0	0	0	2	0	111	234
7:15 AM	0	0	0	0	1	0	10	0	89	0	0	0	0	1	1	0	102	310
7:30 AM	0	0	0	0	0	0	14	0	69	1	0	0	0	0	0	0	84	364
7:45 AM	0	0	0	0	0	0	4	0	32	0	0	0	0	0	0	0	36	333
8:00 AM	0	0	0	0	0	0	5	0	20	1	0	0	0	0	1	0	27	249
8:15 AM	0	0	0	0	1	0	5	1	14	0	0	1	0	0	1	0	23	170
8:30 AM	0	0	0	0	1	0	0	0	9	2	0	0	0	4	2	0	18	104
8:45 AM	0	0	0	0	0	0	7	0	7	0	0	0	0	0	1	0	15	83

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	8	0	44	0	384	0	0	0	0	0	8	0	444
Heavy Trucks	0	0	0		4	0	0		8	0	0		0	0	4		16
Pedestrians		4				0				0				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/28/2017 10:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

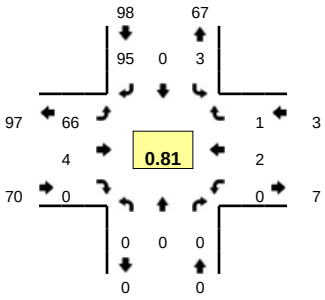
Method for determining peak hour: Total Entering Volume

LOCATION: Woodcutters Rd -- Kellog Mill Rd/Accokeek Furnace Rd

QC JOB #: 14407202

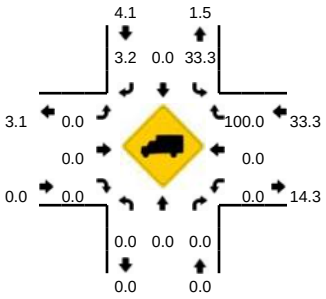
CITY/STATE: Fredericksburg, VA

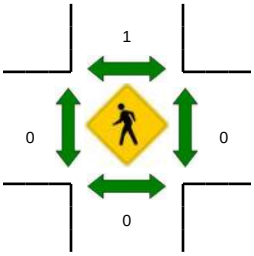
DATE: Tue, May 09 2017

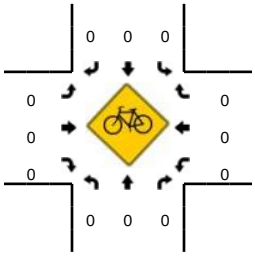


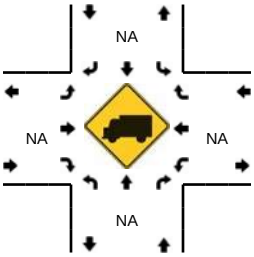
Peak-Hour: 4:45 PM -- 5:45 PM

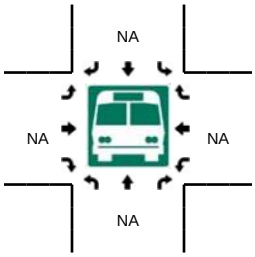
Peak 15-Min: 5:15 PM -- 5:30 PM











15-Min Count Period Beginning At	Woodcutters Rd (Northbound)				Woodcutters Rd (Southbound)				Kellog Mill Rd/Accokeek Furnace Rd (Eastbound)				Kellog Mill Rd/Accokeek Furnace Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	0	0	25	0	14	4	0	0	0	1	1	0	45	
4:15 PM	0	0	0	0	1	0	27	0	11	1	0	0	0	2	2	0	44	
4:30 PM	0	0	0	0	1	0	40	0	18	0	0	0	0	0	0	0	59	
4:45 PM	0	0	0	0	1	0	14	0	9	2	0	0	0	0	0	0	26	174
5:00 PM	0	0	0	0	1	0	32	0	16	1	0	0	0	1	0	0	51	180
5:15 PM	0	0	0	0	1	0	24	0	25	1	0	0	0	1	1	0	53	189
5:30 PM	0	0	0	0	0	0	25	0	16	0	0	0	0	0	0	0	41	171
5:45 PM	0	0	0	0	0	0	27	0	14	2	0	0	0	0	2	0	45	190
6:00 PM	0	0	0	0	1	0	21	0	10	1	0	0	0	1	0	0	34	173
6:15 PM	0	0	0	0	0	0	11	0	10	1	0	0	0	0	0	0	22	142
6:30 PM	0	0	0	0	0	0	6	0	10	0	0	0	0	1	0	0	17	118
6:45 PM	0	0	0	0	0	0	16	0	8	1	0	0	0	2	0	0	27	100

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	4	0	96	0	100	4	0	0	0	4	4	0	212
Heavy Trucks	0	0	0		4	0	8		0	0	0		0	0	4		16
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/28/2017 10:39 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

Method for determining peak hour: Total Entering Volume

LOCATION: Ramoth Church Rd -- Kellogg Mill Rd

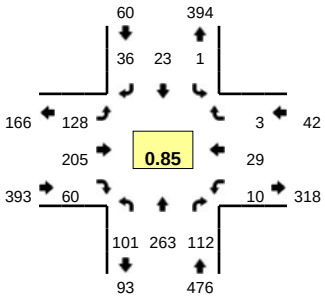
CITY/STATE: Fredericksburg, VA

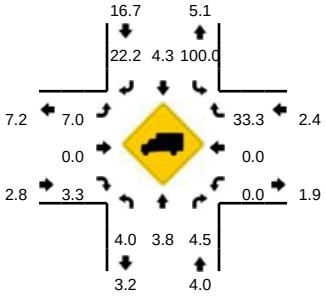
QC JOB #: 14407203

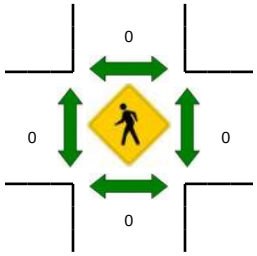
DATE: Wed, May 10 2017

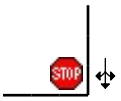
Peak-Hour: 6:45 AM -- 7:45 AM

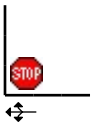
Peak 15-Min: 7:15 AM -- 7:30 AM

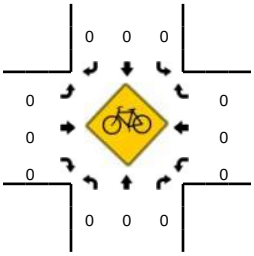


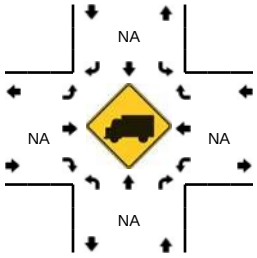


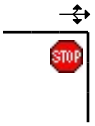


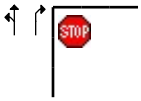


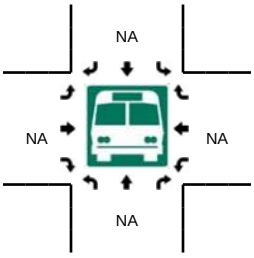












15-Min Count Period Beginning At	Ramoth Church Rd (Northbound)				Ramoth Church Rd (Southbound)				Kellogg Mill Rd (Eastbound)				Kellogg Mill Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	2	2	3	0	0	5	4	0	11	11	12	0	0	1	0	0	51	
6:15 AM	3	12	3	0	0	7	4	0	16	14	8	0	0	2	0	0	69	
6:30 AM	5	39	8	0	0	5	7	0	27	19	11	0	1	1	0	0	123	
6:45 AM	16	52	15	0	0	4	5	0	30	44	11	0	0	5	0	0	182	425
7:00 AM	32	79	33	0	0	5	6	0	40	63	12	0	1	8	1	0	280	654
7:15 AM	29	79	37	0	0	6	18	0	31	53	20	0	5	5	1	0	284	869
7:30 AM	24	53	27	0	1	8	7	0	27	45	17	0	4	11	1	0	225	971
7:45 AM	22	75	14	0	0	11	9	0	29	18	8	0	2	3	1	0	192	981
8:00 AM	11	37	6	0	2	13	5	0	30	15	13	0	1	4	0	0	137	838
8:15 AM	6	32	5	0	0	8	7	0	33	10	9	0	1	4	2	0	117	671
8:30 AM	10	23	4	0	1	4	5	0	28	10	4	0	0	4	1	0	94	540
8:45 AM	5	17	1	0	0	6	10	0	19	8	10	0	1	6	0	0	83	431

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	116	316	148	0	0	24	72	0	124	212	80	0	20	20	4	0	1136
Heavy Trucks	0	0	0		0	4	32		4	0	4		0	0	0		44
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/28/2017 10:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

Method for determining peak hour: Total Entering Volume

LOCATION: Ramoth Church Rd -- Kellogg Mill Rd

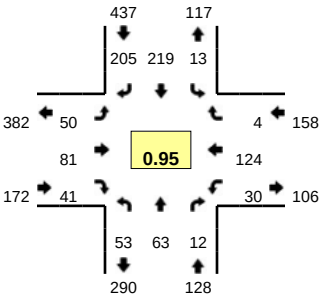
QC JOB #: 14407204

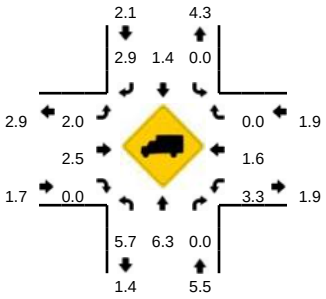
CITY/STATE: Fredericksburg, VA

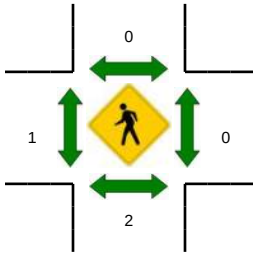
DATE: Wed, May 10 2017

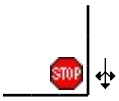
Peak-Hour: 4:45 PM -- 5:45 PM

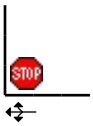
Peak 15-Min: 4:45 PM -- 5:00 PM

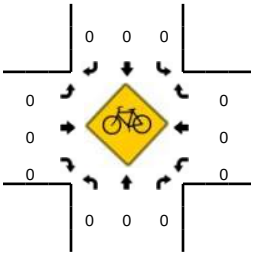


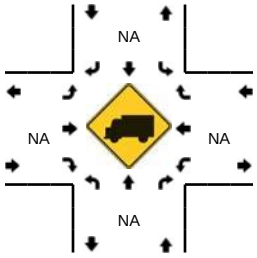


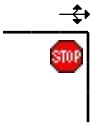


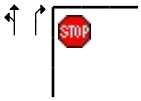


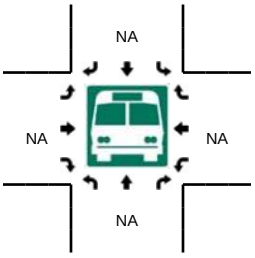












15-Min Count Period Beginning At	Ramoth Church Rd (Northbound)				Ramoth Church Rd (Southbound)				Kellogg Mill Rd (Eastbound)				Kellogg Mill Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	17	10	1	0	4	29	46	0	13	4	8	0	9	21	0	0	162	
4:15 PM	15	11	2	0	0	47	41	0	7	15	12	0	8	18	0	0	176	
4:30 PM	15	22	5	0	1	51	50	0	6	16	10	0	5	16	0	0	197	
4:45 PM	13	19	4	0	2	59	57	0	13	11	4	0	7	45	1	0	235	770
5:00 PM	19	12	4	0	2	48	51	0	12	21	12	0	8	24	1	0	214	822
5:15 PM	9	15	0	0	6	63	47	0	10	30	13	0	7	29	2	0	231	877
5:30 PM	12	17	4	0	3	49	50	0	15	19	12	0	8	26	0	0	215	895
5:45 PM	10	22	4	0	2	34	36	0	9	17	8	0	5	41	2	0	190	850
6:00 PM	8	7	1	0	1	26	30	0	13	15	9	0	4	21	3	0	138	774
6:15 PM	12	10	4	0	0	21	25	0	20	8	7	0	0	26	1	0	134	677
6:30 PM	4	8	0	0	1	13	20	0	10	9	1	0	5	10	1	0	82	544
6:45 PM	8	8	4	0	2	9	11	0	10	13	11	0	2	10	2	0	90	444

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	52	76	16	0	8	236	228	0	52	44	16	0	28	180	4	0	940
Heavy Trucks	0	8	0		0	8	12		4	0	0		4	8	0		44
Pedestrians		8				0				0				0			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/28/2017 10:39 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

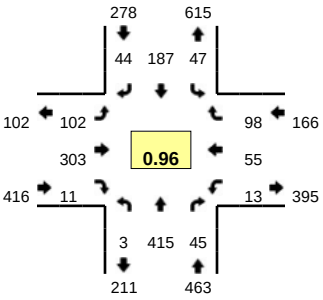
Method for determining peak hour: Total Entering Volume

LOCATION: Mountain View Rd -- Kellogg Mill Rd

CITY/STATE: Fredericksburg, VA

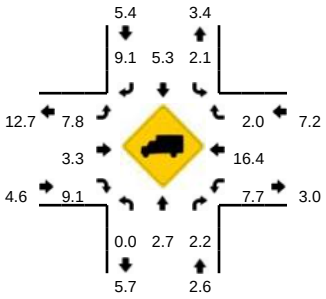
QC JOB #: 14407205

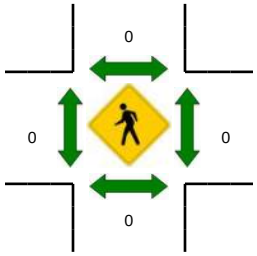
DATE: Wed, May 10 2017

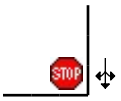


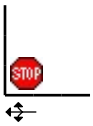
Peak-Hour: 6:45 AM -- 7:45 AM

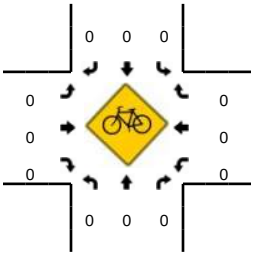
Peak 15-Min: 7:30 AM -- 7:45 AM

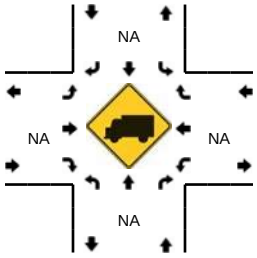


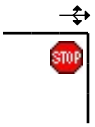


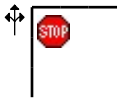


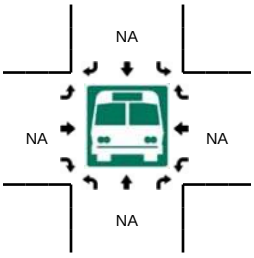












15-Min Count Period Beginning At	Mountain View Rd (Northbound)				Mountain View Rd (Southbound)				Kellogg Mill Rd (Eastbound)				Kellogg Mill Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	48	4	0	8	23	1	0	24	23	0	0	4	2	2	0	139	
6:15 AM	3	64	6	0	7	23	6	0	18	31	2	0	3	6	2	0	171	
6:30 AM	0	118	13	0	5	25	5	0	24	35	3	0	4	6	5	0	243	
6:45 AM	1	119	13	0	9	27	3	0	31	70	2	0	4	8	14	0	301	854
7:00 AM	0	106	9	0	12	48	8	0	15	91	1	0	3	10	32	0	335	1050
7:15 AM	1	94	10	0	14	54	16	0	14	81	3	0	4	20	30	0	341	1220
7:30 AM	1	96	13	0	12	58	17	0	42	61	5	0	2	17	22	0	346	1323
7:45 AM	1	121	11	0	7	53	19	0	33	32	3	0	8	5	22	0	315	1337
8:00 AM	3	100	17	0	6	40	6	0	23	37	2	0	4	6	11	0	255	1257
8:15 AM	4	90	17	0	3	46	18	0	20	31	3	0	2	9	6	0	249	1165
8:30 AM	0	73	3	0	4	31	14	0	23	29	6	0	5	7	6	0	201	1020
8:45 AM	1	39	9	0	9	48	15	0	20	27	4	0	7	9	3	0	191	896

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	384	52	0	48	232	68	0	168	244	20	0	8	68	88	0	1384
Heavy Trucks	0	12	0		4	4	0		8	4	4		0	0	4		40
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/28/2017 10:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

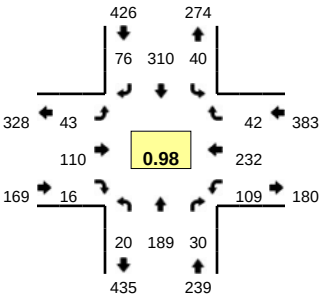
Method for determining peak hour: Total Entering Volume

LOCATION: Mountain View Rd -- Kellogg Mill Rd

CITY/STATE: Fredericksburg, VA

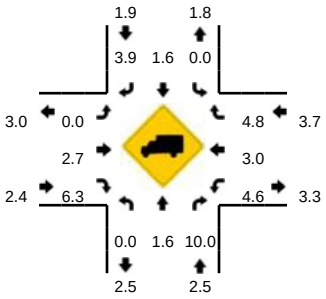
QC JOB #: 14407206

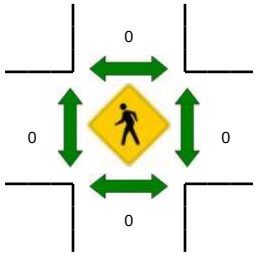
DATE: Wed, May 10 2017

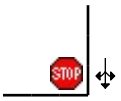


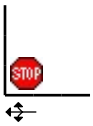
Peak-Hour: 4:45 PM -- 5:45 PM

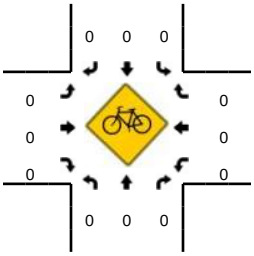
Peak 15-Min: 5:15 PM -- 5:30 PM

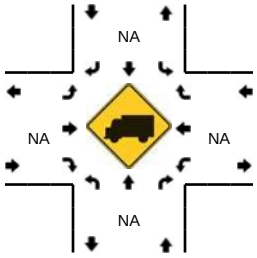


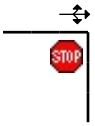


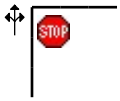


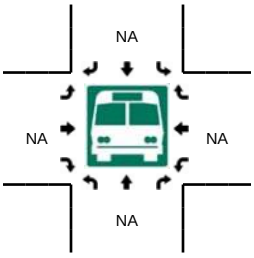












15-Min Count Period Beginning At	Mountain View Rd (Northbound)				Mountain View Rd (Southbound)				Kellogg Mill Rd (Eastbound)				Kellogg Mill Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	3	28	13	0	6	72	23	0	11	10	2	0	27	50	9	0	254	
4:15 PM	2	41	7	0	4	100	17	0	11	21	5	0	26	46	6	0	286	
4:30 PM	4	45	2	0	6	93	23	0	8	24	2	0	24	48	10	0	289	
4:45 PM	7	32	6	0	6	76	22	0	16	18	4	0	31	69	9	0	296	1125
5:00 PM	5	61	7	0	10	80	14	0	3	31	2	0	22	63	10	0	308	1179
5:15 PM	4	51	9	0	8	78	18	0	14	35	4	0	32	49	8	0	310	1203
5:30 PM	4	45	8	0	16	76	22	0	10	26	6	0	24	51	15	0	303	1217
5:45 PM	3	31	4	0	7	68	27	0	8	28	5	0	24	64	8	0	277	1198
6:00 PM	2	46	5	0	6	54	19	0	18	18	5	0	14	41	9	0	237	1127
6:15 PM	3	34	3	0	6	58	15	0	11	30	2	0	14	37	13	0	226	1043
6:30 PM	1	36	9	0	3	48	13	0	12	11	6	0	9	21	5	0	174	914
6:45 PM	0	18	5	0	3	20	6	0	7	15	3	0	3	16	7	0	103	740

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	16	204	36	0	32	312	72	0	56	140	16	0	128	196	32	0	1240
Heavy Trucks	0	0	4		0	8	8		0	4	0		0	4	0		28
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/28/2017 10:39 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

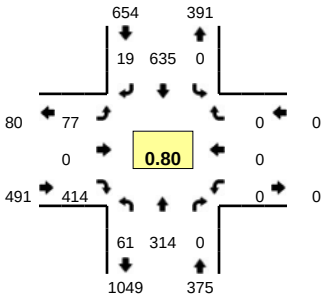
Method for determining peak hour: Total Entering Volume

LOCATION: Courthouse Rd -- Woodcutters Rd

CITY/STATE: Stafford, VA

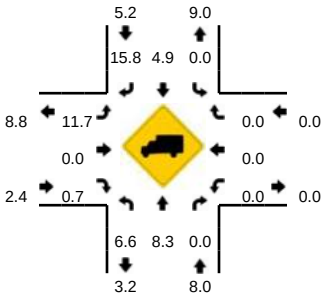
QC JOB #: 14407207

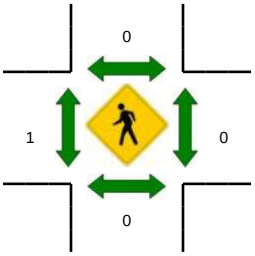
DATE: Wed, May 10 2017

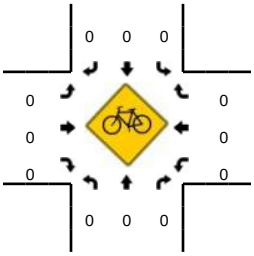


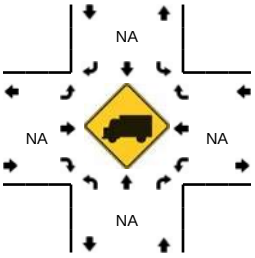
Peak-Hour: 6:45 AM -- 7:45 AM

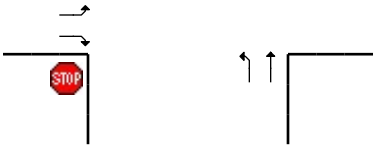
Peak 15-Min: 7:15 AM -- 7:30 AM

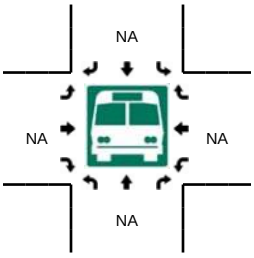












15-Min Count Period Beginning At	Courthouse Rd (Northbound)				Courthouse Rd (Southbound)				Woodcutters Rd (Eastbound)				Woodcutters Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	6	20	0	0	0	48	0	0	8	0	40	0	0	0	0	0	122	
6:15 AM	1	39	0	0	0	73	1	0	15	0	35	0	0	0	0	0	164	
6:30 AM	2	25	0	0	0	66	2	0	11	0	44	1	0	0	0	0	151	
6:45 AM	4	36	0	0	0	103	4	0	15	0	81	0	0	0	0	0	243	680
7:00 AM	18	70	0	0	0	178	8	0	12	0	115	0	0	0	0	0	401	959
7:15 AM	16	100	0	0	0	213	4	0	19	0	122	0	0	0	0	0	474	1269
7:30 AM	23	108	0	0	0	141	3	0	31	0	96	0	0	0	0	0	402	1520
7:45 AM	5	114	0	0	0	101	8	0	25	0	36	0	0	0	0	0	289	1566
8:00 AM	8	63	0	0	0	104	20	0	33	0	30	0	0	0	0	0	258	1423
8:15 AM	10	81	0	0	0	104	7	0	21	0	34	0	0	0	0	0	257	1206
8:30 AM	17	74	0	0	0	111	14	0	44	0	16	0	0	0	0	0	276	1080
8:45 AM	7	97	0	0	0	116	11	0	30	0	31	0	0	0	0	0	292	1083
9:00 AM	10	68	0	0	0	116	18	0	11	0	26	0	0	0	0	0	249	1074
9:15 AM	15	49	0	0	0	74	17	0	9	0	20	0	0	0	0	0	184	1001
9:30 AM	10	51	0	0	0	69	7	0	5	0	14	0	0	0	0	0	156	881
9:45 AM	16	57	0	0	0	76	6	0	9	0	19	0	0	0	0	0	183	772

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	64	400	0	0	0	852	16	0	76	0	488	0	0	0	0	0	1896
Heavy Trucks	4	60	0		0	20	0		20	0	0		0	0	0		104
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/28/2017 10:35 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

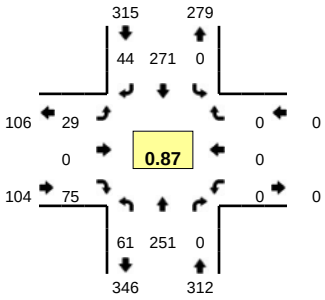
Method for determining peak hour: Total Entering Volume

LOCATION: Courthouse Rd -- Woodcutters Rd

QC JOB #: 14407208

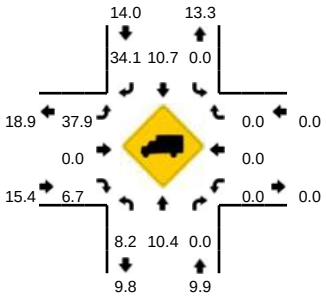
CITY/STATE: Stafford, VA

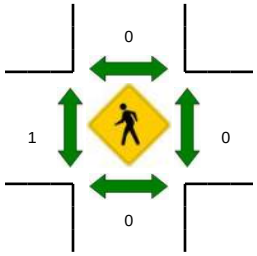
DATE: Wed, May 10 2017

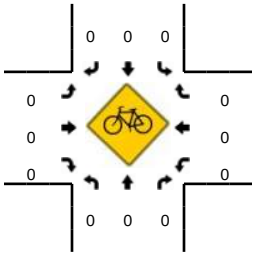


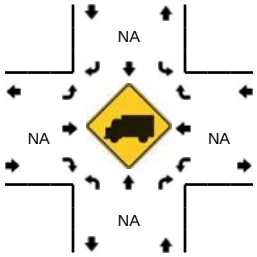
Peak-Hour: 12:00 PM -- 1:00 PM

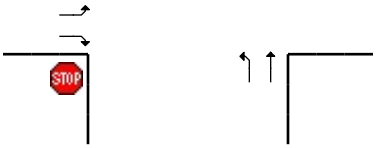
Peak 15-Min: 12:45 PM -- 1:00 PM

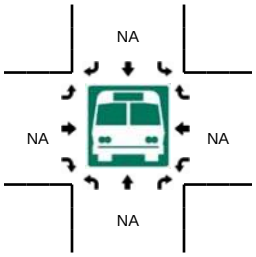












15-Min Count Period Beginning At	Courthouse Rd (Northbound)				Courthouse Rd (Southbound)				Woodcutters Rd (Eastbound)				Woodcutters Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
10:00 AM	7	59	0	0	0	57	5	0	5	0	17	0	0	0	0	0	150	
10:15 AM	13	56	0	0	0	63	7	0	7	0	21	0	0	0	0	0	167	
10:30 AM	10	57	0	0	0	64	7	0	16	0	19	0	0	0	0	0	173	
10:45 AM	18	71	0	0	0	68	8	0	7	0	20	0	0	0	0	0	192	682
11:00 AM	15	65	0	0	0	62	7	0	10	0	13	0	0	0	0	0	172	704
11:15 AM	19	62	0	0	0	52	9	0	7	0	12	0	0	0	0	0	161	698
11:30 AM	15	54	0	0	0	58	12	0	6	0	19	0	0	0	0	0	164	689
11:45 AM	11	80	0	0	0	70	7	0	8	0	13	0	0	0	0	0	189	686
12:00 PM	18	69	0	0	0	67	12	0	6	0	20	0	0	0	0	0	192	706
12:15 PM	15	54	0	0	0	58	9	0	8	0	21	0	0	0	0	0	165	710
12:30 PM	11	64	0	0	0	59	9	0	8	0	12	0	0	0	0	0	163	709
12:45 PM	17	64	0	0	0	87	14	0	6	0	22	1	0	0	0	0	211	731
1:00 PM	16	63	0	0	0	59	12	0	11	0	12	0	0	0	0	0	173	712
1:15 PM	12	66	0	0	0	53	7	0	8	0	15	0	0	0	0	0	161	708
1:30 PM	8	71	0	0	0	65	12	0	9	0	12	0	0	0	0	0	177	722
1:45 PM	13	79	0	0	0	78	6	0	7	0	10	0	0	0	0	0	193	704

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	68	256	0	0	0	348	56	0	24	0	88	4	0	0	0	0	844
Heavy Trucks	8	16	0		0	40	12		8	0	4		0	0	0		88
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/18/2017 12:07 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

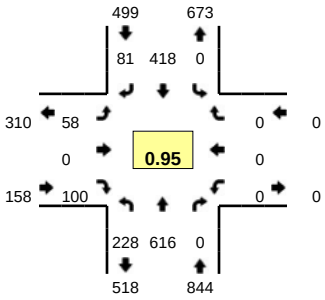
Method for determining peak hour: Total Entering Volume

LOCATION: Courthouse Rd -- Woodcutters Rd

QC JOB #: 14407209

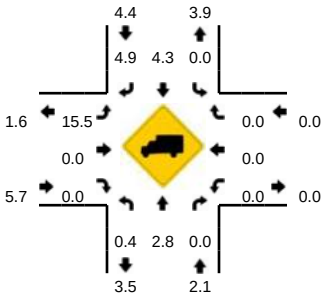
CITY/STATE: Stafford, VA

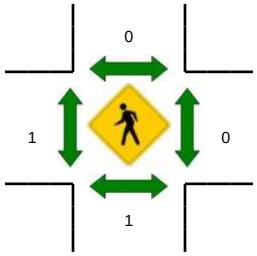
DATE: Wed, May 10 2017

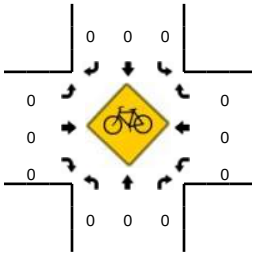


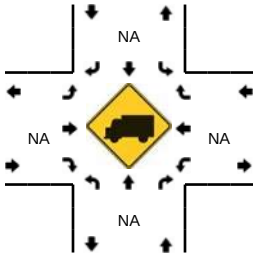
Peak-Hour: 4:45 PM -- 5:45 PM

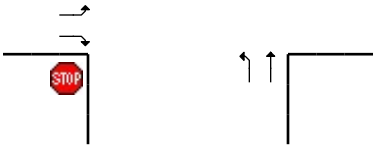
Peak 15-Min: 5:15 PM -- 5:30 PM

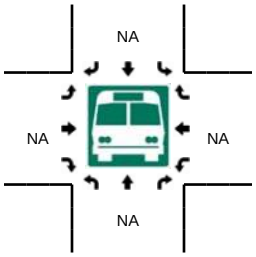












15-Min Count Period Beginning At	Courthouse Rd (Northbound)				Courthouse Rd (Southbound)				Woodcutters Rd (Eastbound)				Woodcutters Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
2:00 PM	19	82	0	0	0	75	7	0	5	0	23	0	0	0	0	0	211	
2:15 PM	60	181	0	0	0	85	9	0	6	0	17	0	0	0	0	0	358	
2:30 PM	35	108	0	0	0	78	24	0	14	0	29	0	0	0	0	0	288	
2:45 PM	24	100	0	0	0	83	12	0	13	0	17	0	0	0	0	0	249	1106
3:00 PM	28	104	0	0	0	135	15	1	13	0	22	0	0	0	0	0	318	1213
3:15 PM	31	126	0	1	0	93	15	1	12	0	20	0	0	0	0	0	299	1154
3:30 PM	33	102	0	0	0	94	16	0	9	0	20	0	0	0	0	0	274	1140
3:45 PM	24	121	0	0	0	120	26	0	10	0	22	0	0	0	0	0	323	1214
4:00 PM	40	103	0	0	0	110	22	0	16	0	18	0	0	0	0	0	309	1205
4:15 PM	43	123	0	0	0	86	19	0	10	0	17	0	0	0	0	0	298	1204
4:30 PM	49	145	0	0	0	90	14	0	11	0	31	1	0	0	0	0	341	1271
4:45 PM	63	157	0	0	0	105	19	0	15	0	21	0	0	0	0	0	380	1328
5:00 PM	51	161	0	0	0	102	24	0	21	0	19	1	0	0	0	0	379	1398
5:15 PM	66	162	0	0	0	95	22	0	12	0	39	0	0	0	0	0	396	1496
5:30 PM	48	136	0	0	0	116	16	0	9	0	21	0	0	0	0	0	346	1501
5:45 PM	59	140	0	0	0	97	16	0	9	0	32	0	0	0	0	0	353	1474
6:00 PM	46	135	0	0	0	85	15	0	17	0	26	0	0	0	0	0	324	1419
6:15 PM	31	115	0	0	0	73	18	0	15	0	17	1	0	0	0	0	270	1293
6:30 PM	33	105	0	0	0	89	8	0	7	0	17	0	0	0	0	0	259	1206
6:45 PM	31	82	0	0	0	123	17	0	4	0	22	0	0	0	0	0	279	1132

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	264	648	0	0	0	380	88	0	48	0	156	0	0	0	0	0	1584
Heavy Trucks	0	8	0		0	20	0		4	0	0		0	0	0		32
Pedestrians		0				0				4				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/28/2017 10:39 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Appendix C
Level of Service Description

APPENDIX C LEVEL-OF-SERVICE CONCEPT

Level of service (LOS) is a concept developed to quantify the degree of comfort (including such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles) afforded to drivers as they travel through an intersection or roadway segment. Six grades are used to denote the various level of service from "A" to "F".[1]

Signalized Intersections

The six level-of-service grades are described qualitatively for signalized intersections in Table C1. Additionally, Table C2 identifies the relationship between level of service and average control delay per vehicle. Control delay is defined to include initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Using this definition, Level of Service "D" is generally considered to represent the minimum acceptable design standard.

Table C1 Level-of-Service Definitions (Signalized Intersections)

Level of Service	Average Delay per Vehicle
A	Very low average control delay, less than 10 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
B	Average control delay is greater than 10 seconds per vehicle and less than or equal to 20 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for a level of service A, causing higher levels of average delay.
C	Average control delay is greater than 20 seconds per vehicle and less than or equal to 35 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
D	Average control delay is greater than 35 seconds per vehicle and less than or equal to 55 seconds per vehicle. The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle length, or high volume/capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	Average control delay is greater than 55 seconds per vehicle and less than or equal to 80 seconds per vehicle. This is usually considered to be the limit of acceptable delay. These high delay values generally (but not always) indicate poor progression, long cycle lengths, and high volume/capacity ratios. Individual cycle failures are frequent occurrences.
F	Average control delay is in excess of 80 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation. It may also occur at high volume/capacity ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also contribute to such high delay values.

Most of the material in this Appendix is adapted from the Transportation Research Board, Highway Capacity Manual, (2000).

[1] Most of the material in this Appendix is adapted from the Transportation Research Board, Highway Capacity Manual, (2010).

Table C2 Level-of-Service Criteria for Signalized Intersections

Level of Service	Average Control Delay per Vehicle (Seconds)
A	<10.0
B	>10 and (20
C	>20 and (35
D	>35 and (55
E	>55 and (80
F	>80

Unsignalized Intersections

Unsignalized intersections include two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections. The 2010 Highway Capacity Manual (HCM) provides models for estimating control delay at both TWSC and AWSC intersections. A qualitative description of the various service levels associated with an unsignalized intersection is presented in Table C3. A quantitative definition of level of service for unsignalized intersections is presented in Table C4. Using this definition, Level of Service "E" is generally considered to represent the minimum acceptable design standard.

Table C3 Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Delay per Vehicle to Minor Street
A	• Nearly all drivers find freedom of operation. • Very seldom is there more than one vehicle in queue.
B	• Some drivers begin to consider the delay an inconvenience. • Occasionally there is more than one vehicle in queue.
C	• Many times there is more than one vehicle in queue. • Most drivers feel restricted, but not objectionably so.
D	• Often there is more than one vehicle in queue. • Drivers feel quite restricted.
E	• Represents a condition in which the demand is near or equal to the probable maximum number of vehicles that can be accommodated by the movement. • There is almost always more than one vehicle in queue. • Drivers find the delays approaching intolerable levels.
F	• Forced flow. • Represents an intersection failure condition that is caused by geometric and/or operational constraints external to the intersection.

Table C4 Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay per Vehicle (Seconds)
A	<10.0
B	>10.0 and (15.0
C	>15.0 and (25.0
D	>25.0 and (35.0
E	>35.0 and (50.0
F	>50.0

It should be noted that the level-of-service criteria for unsignalized intersections are somewhat different than the criteria used for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, there are a number of driver behavior considerations that combine to make delays at signalized intersections less galling than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, while drivers on the minor street approaches to TWSC intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized intersections than signalized intersections. For these reasons, it is considered that the control delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection. While overall intersection level of service is calculated for AWSC intersections, level of service is only calculated for the minor approaches and the major street left turn movements at TWSC intersections. No delay is assumed to the major street through movements. For TWSC intersections, the overall intersection level of service remains undefined: level of service is only calculated for each minor street lane.

In the performance evaluation of TWSC intersections, it is important to consider other measures of effectiveness (MOEs) in addition to delay, such as v/c ratios for individual movements, average queue lengths, and 95^{th}-percentile queue lengths. By focusing on a single MOE for the worst movement only, such as delay for the minor-street left turn, users may make inappropriate traffic control decisions. The potential for making such inappropriate decisions is likely to be particularly pronounced when the HCM level-of-service thresholds are adopted as legal standards, as is the case in many public agencies.

Appendix D
Existing Conditions Level of Service Worksheets

Intersection	
Intersection Delay, s/veh	43.6
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations			↕				↕				↕	
Traffic Vol, veh/h	0	102	303	11	0	13	55	98	0	3	415	45
Future Vol, veh/h	0	102	303	11	0	13	55	98	0	3	415	45
Peak Hour Factor	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	8	3	9	2	8	16	2	2	0	3	2
Mvmt Flow	0	106	316	11	0	14	57	102	0	3	432	47
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	50.3	16.6	59.5
HCM LOS	F	C	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	25%	8%	17%
Vol Thru, %	90%	73%	33%	67%
Vol Right, %	10%	3%	59%	16%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	463	416	166	278
LT Vol	3	102	13	47
Through Vol	415	303	55	187
RT Vol	45	11	98	44
Lane Flow Rate	482	433	173	290
Geometry Grp	1	1	1	1
Degree of Util (X)	0.967	0.913	0.395	0.627
Departure Headway (Hd)	7.22	7.582	8.227	7.797
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	502	481	436	460
Service Time	5.253	5.613	6.32	5.878
HCM Lane V/C Ratio	0.96	0.9	0.397	0.63
HCM Control Delay	59.5	50.3	16.6	23.2
HCM Lane LOS	F	F	C	C
HCM 95th-tile Q	12.4	10.4	1.9	4.2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	47	187	44
Future Vol, veh/h	0	47	187	44
Peak Hour Factor	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	2	5	9
Mvmt Flow	0	49	195	46
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	23.2
HCM LOS	C

Intersection	
Intersection Delay, s/veh	22.8
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations																
Traffic Vol, veh/h	0	128	207	60	0	10	29	3	0	101	263	112	0	1	23	36
Future Vol, veh/h	0	128	207	60	0	10	29	3	0	101	263	112	0	1	23	36
Peak Hour Factor	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85
Heavy Vehicles, %	2	7	0	3	2	0	0	33	2	4	4	4	2	100	4	22
Mvmt Flow	0	151	244	71	0	12	34	4	0	119	309	132	0	1	27	42
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	25	10.4	23.4	12.5
HCM LOS	C	B	C	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	28%	0%	32%	24%	2%
Vol Thru, %	72%	0%	52%	69%	38%
Vol Right, %	0%	100%	15%	7%	60%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	364	112	395	42	60
LT Vol	101	0	128	10	1
Through Vol	263	0	207	29	23
RT Vol	0	112	60	3	36
Lane Flow Rate	428	132	465	49	71
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.768	0.205	0.757	0.091	0.156
Departure Headway (Hd)	6.459	5.606	5.862	6.664	7.954
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	557	638	613	533	448
Service Time	4.217	3.364	3.919	4.76	6.045
HCM Lane V/C Ratio	0.768	0.207	0.759	0.092	0.158
HCM Control Delay	27.6	9.8	25	10.4	12.5
HCM Lane LOS	D	A	C	B	B
HCM 95th-tile Q	6.9	0.8	6.8	0.3	0.5

Intersection	
Int Delay, s/veh	8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	319	1	4	3	3	38
Future Vol, veh/h	319	1	4	3	3	38
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	2	0	0	67	67	5
Mvmt Flow	389	1	5	4	4	46

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	9	0	-	0	786	8
Stage 1	-	-	-	-	7	-
Stage 2	-	-	-	-	779	-
Critical Hdwy	4.12	-	-	-	7.77	6.25
Critical Hdwy Stg 1	-	-	-	-	6.77	-
Critical Hdwy Stg 2	-	-	-	-	6.77	-
Follow-up Hdwy	2.218	-	-	-	4.103	3.345
Pot Cap-1 Maneuver	1611	-	-	-	244	1065
Stage 1	-	-	-	-	869	-
Stage 2	-	-	-	-	306	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1609	-	-	-	198	1064
Mov Cap-2 Maneuver	-	-	-	-	198	-
Stage 1	-	-	-	-	659	-
Stage 2	-	-	-	-	232	-

Approach	EB	WB	SB
HCM Control Delay, s	7.9	0	9.8
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1609	-	-	-	806
HCM Lane V/C Ratio	0.242	-	-	-	0.062
HCM Control Delay (s)	7.9	0	-	-	9.8
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	1	-	-	-	0.2

Intersection	
Int Delay, s/veh	56.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Traffic Vol, veh/h	635	19	61	314	77	414
Future Vol, veh/h	635	19	61	314	77	414
Conflicting Peds, #/hr	0	0	0	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	300	250	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	5	16	7	8	12	1
Mvmt Flow	794	24	76	393	96	518

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	794	0	1340	794
Stage 1	-	-	-	-	794	-
Stage 2	-	-	-	-	546	-
Critical Hdwy	-	-	4.17	-	6.52	6.21
Critical Hdwy Stg 1	-	-	-	-	5.52	-
Critical Hdwy Stg 2	-	-	-	-	5.52	-
Follow-up Hdwy	-	-	2.263	-	3.608	3.309
Pot Cap-1 Maneuver	-	-	806	-	160	~ 390
Stage 1	-	-	-	-	428	-
Stage 2	-	-	-	-	561	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	806	-	145	~ 390
Mov Cap-2 Maneuver	-	-	-	-	145	-
Stage 1	-	-	-	-	428	-
Stage 2	-	-	-	-	508	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	172.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	145	390	-	-	806	-
HCM Lane V/C Ratio	0.664	1.327	-	-	0.095	-
HCM Control Delay (s)	68.8	192.3	-	-	9.9	-
HCM Lane LOS	F	F	-	-	A	-
HCM 95th %tile Q(veh)	3.7	24	-	-	0.3	-

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

Intersection	
Intersection Delay, s/veh	23.4
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	43	110	16	0	109	232	42	0	20	189	30
Future Vol, veh/h	0	43	110	16	0	109	232	42	0	20	189	30
Peak Hour Factor	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	0	3	6	2	5	3	5	2	0	2	10
Mvmt Flow	0	44	112	16	0	111	237	43	0	20	193	31
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	14.3	26.2	16
HCM LOS	B	D	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	8%	25%	28%	9%
Vol Thru, %	79%	65%	61%	73%
Vol Right, %	13%	9%	11%	18%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	239	169	383	426
LT Vol	20	43	109	40
Through Vol	189	110	232	310
RT Vol	30	16	42	76
Lane Flow Rate	244	172	391	435
Geometry Grp	1	1	1	1
Degree of Util (X)	0.47	0.349	0.733	0.78
Departure Headway (Hd)	6.933	7.292	6.753	6.457
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	519	491	535	561
Service Time	4.993	5.358	4.779	4.482
HCM Lane V/C Ratio	0.47	0.35	0.731	0.775
HCM Control Delay	16	14.3	26.2	28.7
HCM Lane LOS	C	B	D	D
HCM 95th-tile Q	2.5	1.5	6.1	7.2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations			↕	
Traffic Vol, veh/h	0	40	310	76
Future Vol, veh/h	0	40	310	76
Peak Hour Factor	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	0	2	4
Mvmt Flow	0	41	316	78
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	28.7
HCM LOS	D

Intersection	
Intersection Delay, s/veh	13.8
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations																
Traffic Vol, veh/h	0	50	81	41	0	30	124	4	0	53	63	12	0	13	219	206
Future Vol, veh/h	0	50	81	41	0	30	124	4	0	53	63	12	0	13	219	206
Peak Hour Factor	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	0	2	3	2	0	2	6	6	0	2	0	1	3
Mvmt Flow	0	53	85	43	0	32	131	4	0	56	66	13	0	14	231	217
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	11.2	11.2	10.8	16.6
HCM LOS	B	B	B	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	46%	0%	29%	19%	3%
Vol Thru, %	54%	0%	47%	78%	50%
Vol Right, %	0%	100%	24%	3%	47%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	116	12	172	158	438
LT Vol	53	0	50	30	13
Through Vol	63	0	81	124	219
RT Vol	0	12	41	4	206
Lane Flow Rate	122	13	181	166	461
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.219	0.019	0.29	0.273	0.641
Departure Headway (Hd)	6.455	5.511	5.765	5.913	5.006
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	554	647	621	605	719
Service Time	4.21	3.266	3.82	3.97	3.046
HCM Lane V/C Ratio	0.22	0.02	0.291	0.274	0.641
HCM Control Delay	11	8.4	11.2	11.2	16.6
HCM Lane LOS	B	A	B	B	C
HCM 95th-tile Q	0.8	0.1	1.2	1.1	4.7

Intersection	
Int Delay, s/veh	7.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	66	4	2	1	3	95
Future Vol, veh/h	66	4	2	1	3	95
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	0	0	0	100	33	3
Mvmt Flow	73	4	2	1	3	104

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	3	0	-	0	152	4
Stage 1	-	-	-	-	3	-
Stage 2	-	-	-	-	149	-
Critical Hdwy	4.1	-	-	-	6.73	6.23
Critical Hdwy Stg 1	-	-	-	-	5.73	-
Critical Hdwy Stg 2	-	-	-	-	5.73	-
Follow-up Hdwy	2.2	-	-	-	3.797	3.327
Pot Cap-1 Maneuver	1632	-	-	-	772	1077
Stage 1	-	-	-	-	945	-
Stage 2	-	-	-	-	808	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1630	-	-	-	737	1076
Mov Cap-2 Maneuver	-	-	-	-	737	-
Stage 1	-	-	-	-	945	-
Stage 2	-	-	-	-	772	-

Approach	EB	WB	SB
HCM Control Delay, s	6.9	0	8.8
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1630	-	-	-	1061
HCM Lane V/C Ratio	0.044	-	-	-	0.102
HCM Control Delay (s)	7.3	0	-	-	8.8
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3

Intersection	
Int Delay, s/veh	6.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Traffic Vol, veh/h	418	81	228	616	58	100
Future Vol, veh/h	418	81	228	616	58	100
Conflicting Peds, #/hr	0	1	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	300	250	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	4	5	0	3	16	0
Mvmt Flow	440	85	240	648	61	105

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	441	0	1569	442
Stage 1	-	-	-	-	441	-
Stage 2	-	-	-	-	1128	-
Critical Hdwy	-	-	4.1	-	6.56	6.2
Critical Hdwy Stg 1	-	-	-	-	5.56	-
Critical Hdwy Stg 2	-	-	-	-	5.56	-
Follow-up Hdwy	-	-	2.2	-	3.644	3.3
Pot Cap-1 Maneuver	-	-	1130	-	113	620
Stage 1	-	-	-	-	620	-
Stage 2	-	-	-	-	290	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1129	-	89	619
Mov Cap-2 Maneuver	-	-	-	-	89	-
Stage 1	-	-	-	-	619	-
Stage 2	-	-	-	-	228	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.4	46.9
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	89	619	-	-	1129	-
HCM Lane V/C Ratio	0.686	0.17	-	-	0.213	-
HCM Control Delay (s)	107	12	-	-	9	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	3.3	0.6	-	-	0.8	-

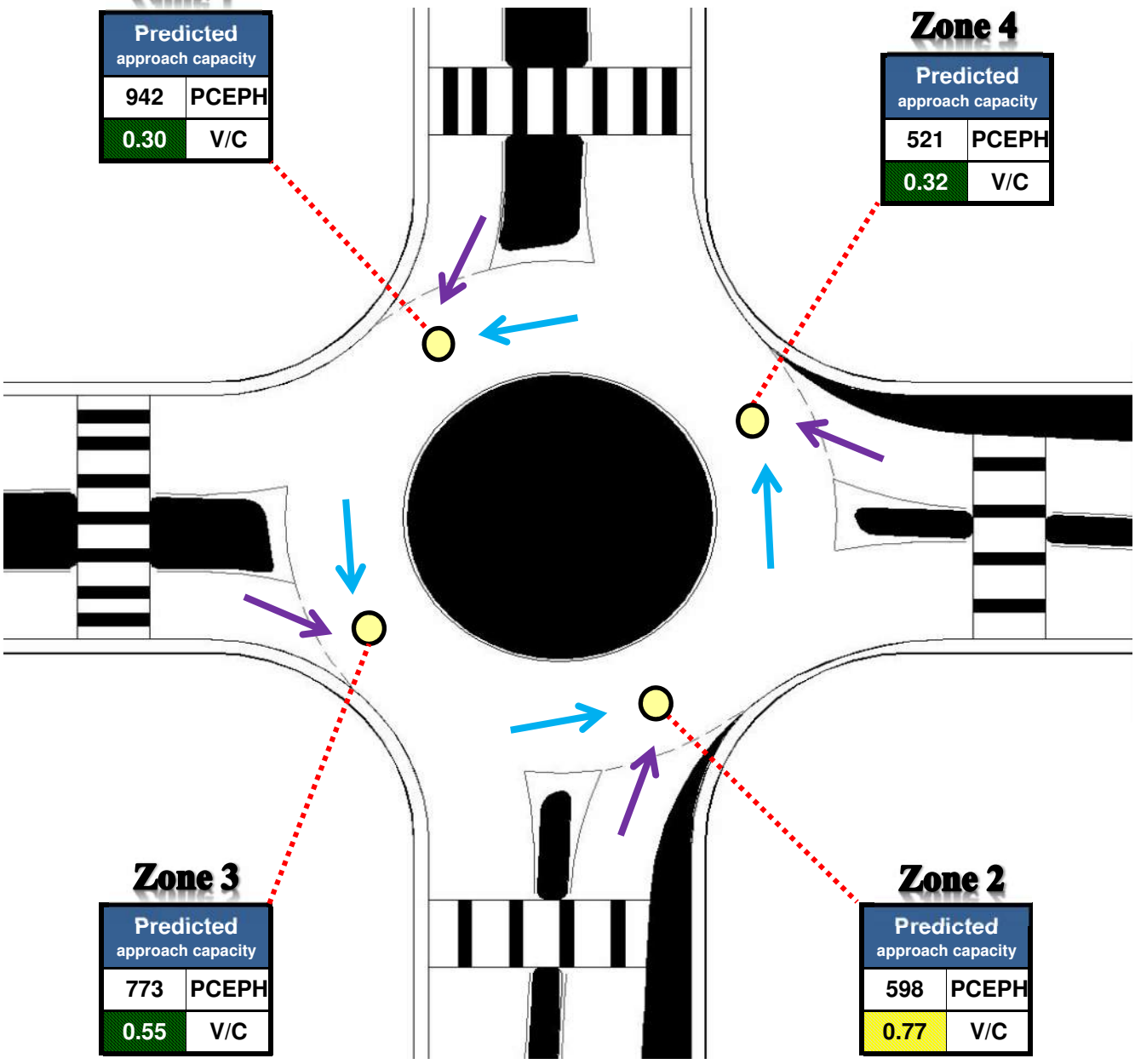
75' ICD Mini-Roundabout

Design and Results

Project Name:	*Accokeek Furnace Road Development*
Project Number:	*21446*
Location	*Stafford, VA*
Date	October 17, 2017

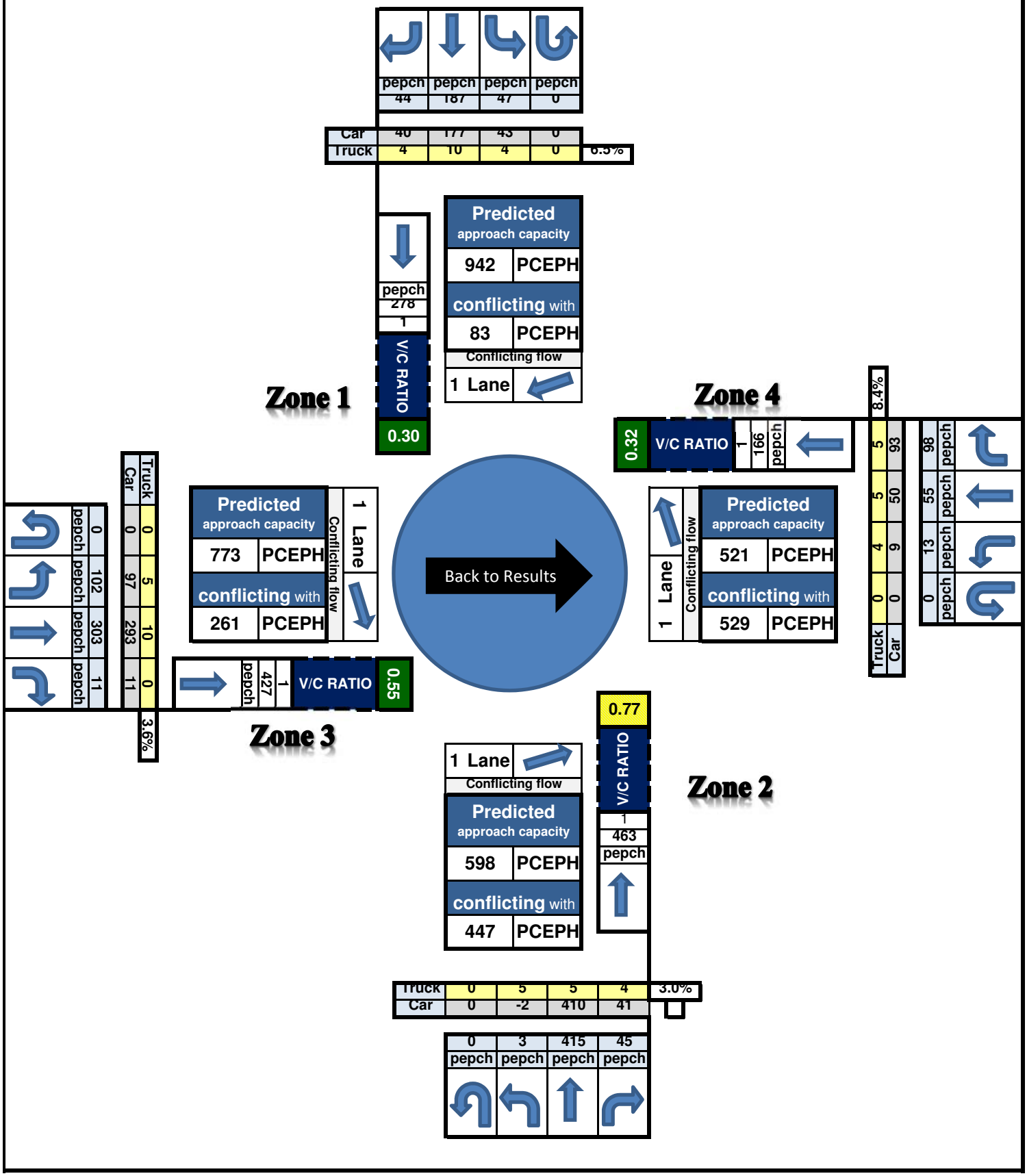
Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600

VOLUME / CAPACITY RATIO:				
Zone 1	0.30	Zone 4	0.32	
Zone 3	0.55	Zone 2	0.77	



75' ICD Mini-Roundabout

Data Input and Configuration



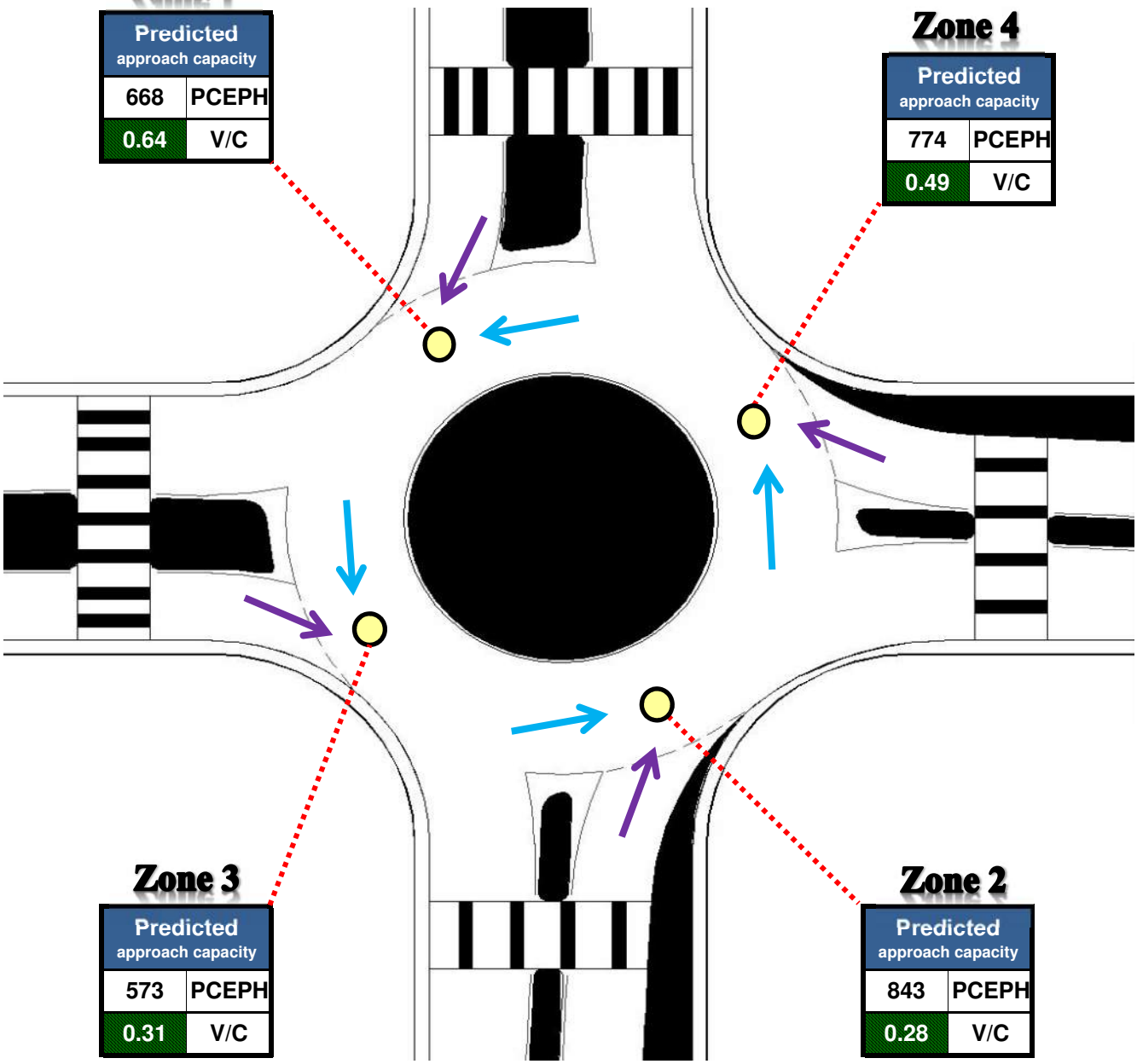
75' ICD Mini-Roundabout

Design and Results

Project Name:	*Accokeek Furnace Road Development*
Project Number:	*21446*
Location	*Stafford, VA*
Date	October 17, 2017

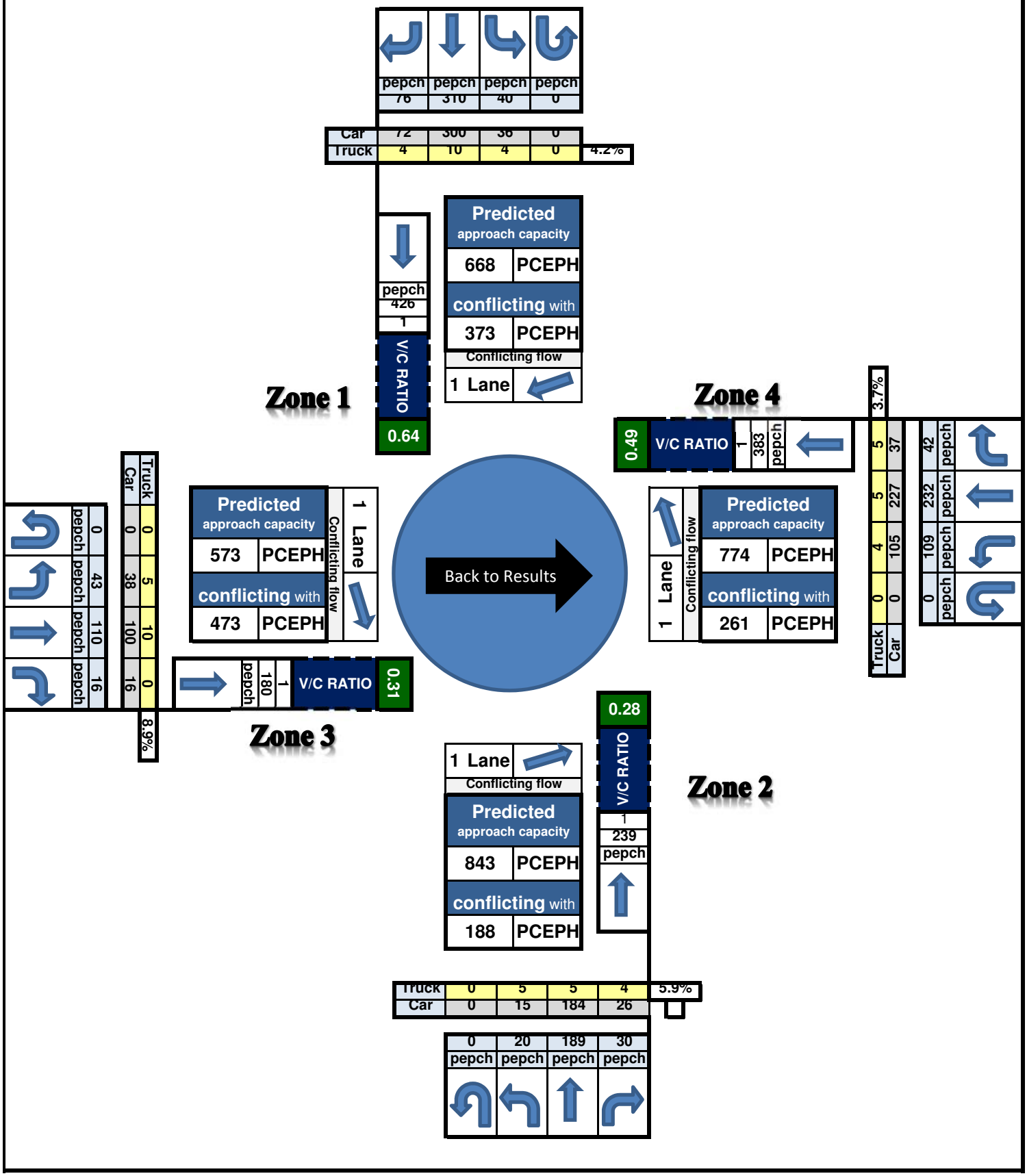
Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600

VOLUME / CAPACITY RATIO:				
Zone 1	0.64	Zone 4	0.49	
Zone 3	0.31	Zone 2	0.28	



75' ICD Mini-Roundabout

Data Input and Configuration



Appendix E
MUTCD Signal Warrant
Analysis Worksheets
(2-Lane Courthouse Road)

KITTELSON & ASSOCIATES, INC.
610 SW Alder, Suite 700
Portland, Oregon 97205
(503) 228-5230

Project #: 21446
Project Name: Accokeek Furnace
Analyst: CBT
Date: 11/2/2017
File: K:\H_Projects\21\21446 - Accokeek Furnace Development\signal warrant\[21446_Signal Warrant Analysis_EX.xls]Warrant Summary(100%)
Intersection: Courthouse Rd/Woodcutters Rd
Scenario: 2017 Existing Conditions

Analysis Traffic Volumes

Hour		Major Street		Minor Street	
Begin	End	EB	WB	NB	SB
7:00 AM	8:00 AM	656	454	456	0
2nd Highest Hour		617	427	429	0
3rd Highest Hour		558	386	388	0
4th Highest Hour		512	354	356	0
5th Highest Hour		472	327	283	0
6th Highest Hour		466	322	324	0
7th Highest Hour		453	313	315	0
8th Highest Hour		321	222	223	0
9th Highest Hour		0	0	0	0
10th Highest Hour		0	0	0	0
11th Highest Hour		0	0	0	0
12th Highest Hour		0	0	0	0
13th Highest Hour		0	0	0	0
14th Highest Hour		0	0	0	0
15th Highest Hour		0	0	0	0
16th Highest Hour		0	0	0	0
17th Highest Hour		0	0	0	0
18th Highest Hour		0	0	0	0
19th Highest Hour		0	0	0	0
20th Highest Hour		0	0	0	0
21st Highest Hour		0	0	0	0
22nd Highest Hour		0	0	0	0
23rd Highest Hour		0	0	0	0
24th Highest Hour		0	0	0	0

Warrant Summary

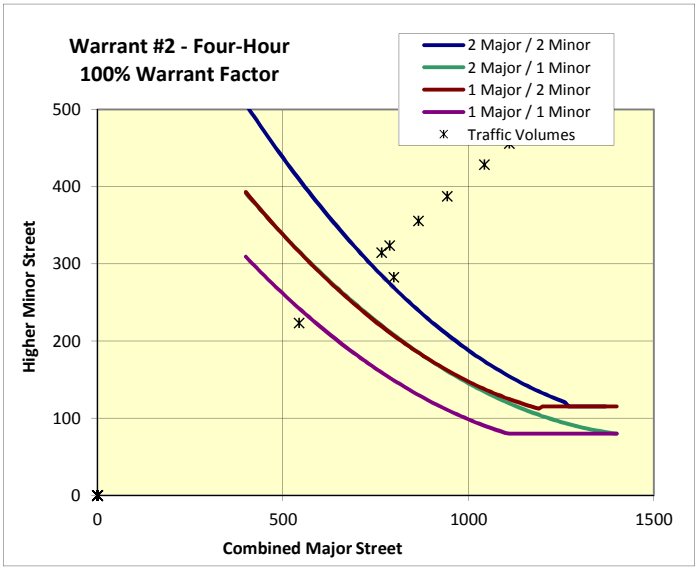
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

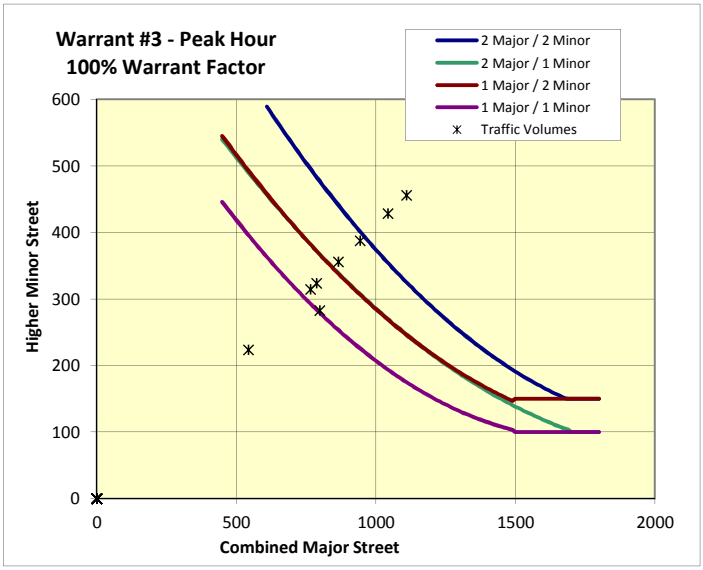
Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Minor
East-West Approach =	Major
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	2
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	78%
Major Street: 8th-Highest Hour / Peak Hour	49%
Minor Street: 4th-Highest Hour / Peak Hour	78%
Minor Street: 8th-Highest Hour / Peak Hour	49%

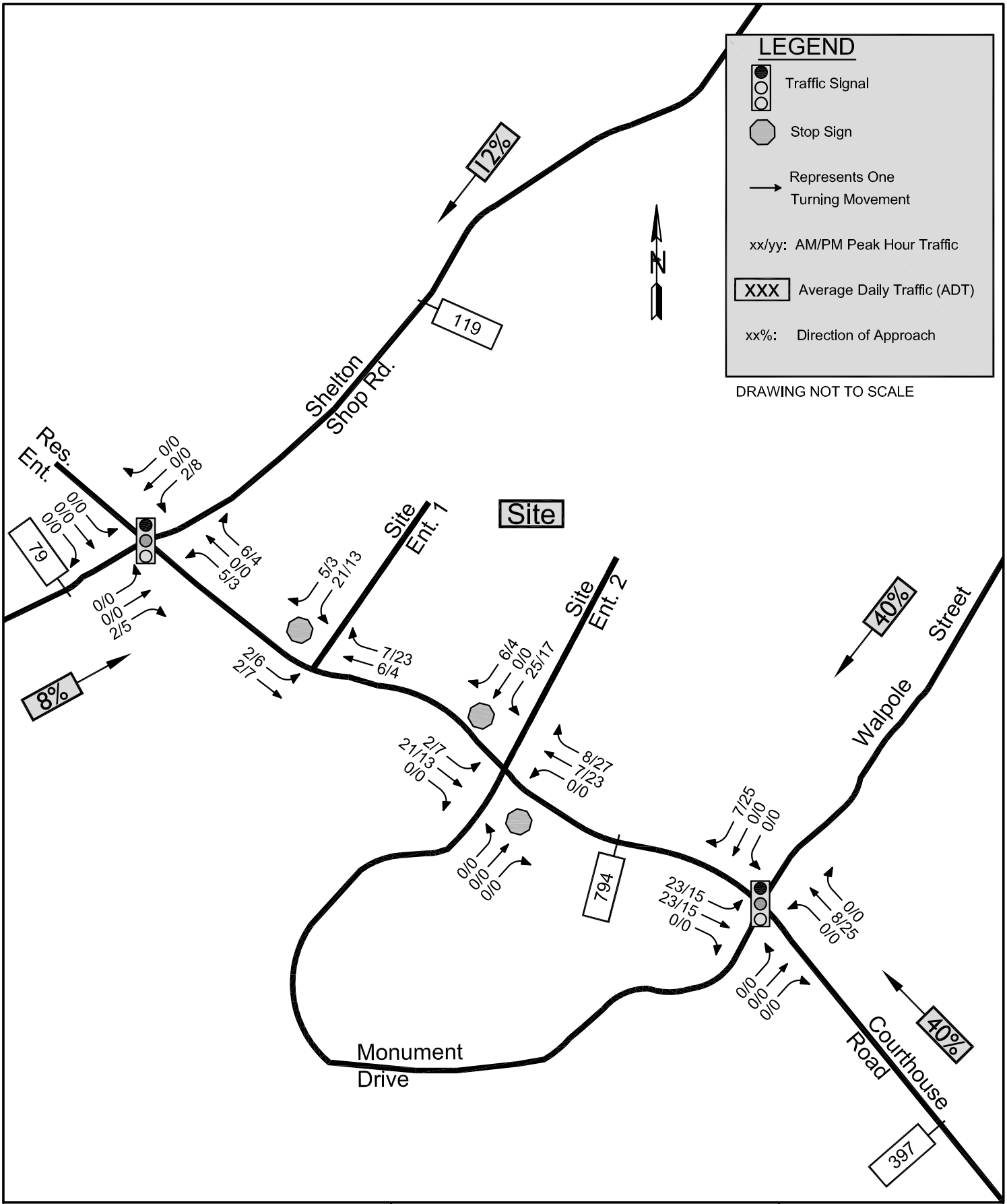
Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	200	8	Yes	**Yes**
	B	750	100	7	No	
80%	A	400	160	8	Yes	**Yes**
	B	600	80	7	No	
70%	A	350	140	8	Yes	**Yes**
	B	525	70	8	Yes	
56%	A	280	112	8	Yes	**Yes**
	B	420	56	8	Yes	





Appendix F
In-Process Development
Trip Assignment



Bowman CONSULTING	**Site Generated Traffic Assignments** The Woods at Augustine Stafford County, Virginia	**Figure 15** Job # 6828-01-001 30

Appendix G
2022 Background Traffic Conditions Level of Service Worksheets

Intersection	
Intersection Delay, s/veh	72.5
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	110	328	12	0	14	60	106	0	3	467	49
Future Vol, veh/h	0	110	328	12	0	14	60	106	0	3	467	49
Peak Hour Factor	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	8	3	9	2	8	16	2	2	0	3	2
Mvmt Flow	0	115	342	13	0	15	63	110	0	3	486	51
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	74.3	19.5	114.2
HCM LOS	F	C	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	24%	8%	17%
Vol Thru, %	90%	73%	33%	68%
Vol Right, %	9%	3%	59%	16%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	519	450	180	309
LT Vol	3	110	14	51
Through Vol	467	328	60	210
RT Vol	49	12	106	48
Lane Flow Rate	541	469	188	322
Geometry Grp	1	1	1	1
Degree of Util (X)	1.144	1.008	0.447	0.722
Departure Headway (Hd)	7.754	8.252	9.233	8.586
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	470	445	392	425
Service Time	5.754	6.252	7.233	6.586
HCM Lane V/C Ratio	1.151	1.054	0.48	0.758
HCM Control Delay	114.2	74.3	19.5	30.9
HCM Lane LOS	F	F	C	D
HCM 95th-tile Q	18.9	13.1	2.2	5.6

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	51	210	48
Future Vol, veh/h	0	51	210	48
Peak Hour Factor	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	2	5	9
Mvmt Flow	0	53	219	50
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	30.9
HCM LOS	D

Intersection	
Intersection Delay, s/veh	23
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations																
Traffic Vol, veh/h	0	139	224	65	0	11	31	3	0	110	285	121	0	1	25	39
Future Vol, veh/h	0	139	224	65	0	11	31	3	0	110	285	121	0	1	25	39
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	7	0	3	2	0	0	33	2	4	4	4	2	100	4	22
Mvmt Flow	0	151	243	71	0	12	34	3	0	120	310	132	0	1	27	42
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	25.1	10.4	23.6	12.5
HCM LOS	D	B	C	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	28%	0%	32%	24%	2%
Vol Thru, %	72%	0%	52%	69%	38%
Vol Right, %	0%	100%	15%	7%	60%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	395	121	428	45	65
LT Vol	110	0	139	11	1
Through Vol	285	0	224	31	25
RT Vol	0	121	65	3	39
Lane Flow Rate	429	132	465	49	71
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.771	0.205	0.758	0.091	0.156
Departure Headway (Hd)	6.461	5.608	5.865	6.673	7.958
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	558	638	614	532	448
Service Time	4.219	3.366	3.924	4.771	6.05
HCM Lane V/C Ratio	0.769	0.207	0.757	0.092	0.158
HCM Control Delay	27.8	9.8	25.1	10.4	12.5
HCM Lane LOS	D	A	D	B	B
HCM 95th-tile Q	7	0.8	6.8	0.3	0.5

Intersection	
Int Delay, s/veh	7.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	345	1	4	3	3	41
Future Vol, veh/h	345	1	4	3	3	41
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	0	0	67	67	5
Mvmt Flow	375	1	4	3	3	45

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	8	0	-	0	757	7
Stage 1	-	-	-	-	6	-
Stage 2	-	-	-	-	751	-
Critical Hdwy	4.12	-	-	-	7.07	6.25
Critical Hdwy Stg 1	-	-	-	-	6.07	-
Critical Hdwy Stg 2	-	-	-	-	6.07	-
Follow-up Hdwy	2.218	-	-	-	4.103	3.345
Pot Cap-1 Maneuver	1612	-	-	-	296	1067
Stage 1	-	-	-	-	872	-
Stage 2	-	-	-	-	368	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1610	-	-	-	227	1066
Mov Cap-2 Maneuver	-	-	-	-	227	-
Stage 1	-	-	-	-	872	-
Stage 2	-	-	-	-	282	-

Approach	EB	WB	SB
HCM Control Delay, s	7.9	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1610	-	-	-	227	1066
HCM Lane V/C Ratio	0.233	-	-	-	0.014	0.042
HCM Control Delay (s)	7.9	0	-	-	21.1	8.5
HCM Lane LOS	A	A	-	-	C	A
HCM 95th %tile Q(veh)	0.9	-	-	-	0	0.1

Intersection	
Int Delay, s/veh	11.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Traffic Vol, veh/h	738	21	66	361	83	448
Future Vol, veh/h	738	21	66	361	83	448
Conflicting Peds, #/hr	0	0	0	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	300	250	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	5	16	7	8	12	1
Mvmt Flow	802	23	72	392	90	487

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	802	0	1143	401
Stage 1	-	-	-	-	802	-
Stage 2	-	-	-	-	341	-
Critical Hdwy	-	-	4.24	-	7.04	6.92
Critical Hdwy Stg 1	-	-	-	-	6.04	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	-	-	2.27	-	3.62	3.31
Pot Cap-1 Maneuver	-	-	786	-	179	602
Stage 1	-	-	-	-	377	-
Stage 2	-	-	-	-	663	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	786	-	162	602
Mov Cap-2 Maneuver	-	-	-	-	162	-
Stage 1	-	-	-	-	377	-
Stage 2	-	-	-	-	602	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	34.6
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	162	602	-	-	786	-
HCM Lane V/C Ratio	0.557	0.809	-	-	0.091	-
HCM Control Delay (s)	52.1	31.4	-	-	10	-
HCM Lane LOS	F	D	-	-	B	-
HCM 95th %tile Q(veh)	2.9	8.1	-	-	0.3	-

Intersection	
Intersection Delay, s/veh	39.9
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	47	119	17	0	118	251	45	0	22	213	32
Future Vol, veh/h	0	47	119	17	0	118	251	45	0	22	213	32
Peak Hour Factor	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	0	3	6	2	5	3	5	2	0	2	10
Mvmt Flow	0	48	121	17	0	120	256	46	0	22	217	33
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	17.4	43.3	21.2
HCM LOS	C	E	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	8%	26%	29%	9%
Vol Thru, %	80%	65%	61%	74%
Vol Right, %	12%	9%	11%	17%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	267	183	414	474
LT Vol	22	47	118	43
Through Vol	213	119	251	349
RT Vol	32	17	45	82
Lane Flow Rate	272	187	422	484
Geometry Grp	1	1	1	1
Degree of Util (X)	0.585	0.427	0.874	0.954
Departure Headway (Hd)	7.736	8.226	7.451	7.104
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	466	437	486	513
Service Time	5.812	6.308	5.481	5.132
HCM Lane V/C Ratio	0.584	0.428	0.868	0.943
HCM Control Delay	21.2	17.4	43.3	56.1
HCM Lane LOS	C	C	E	F
HCM 95th-tile Q	3.7	2.1	9.3	12.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations			↕	
Traffic Vol, veh/h	0	43	349	82
Future Vol, veh/h	0	43	349	82
Peak Hour Factor	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	0	2	4
Mvmt Flow	0	44	356	84
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	56.1
HCM LOS	F

Intersection	
Intersection Delay, s/veh	15.8
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations																
Traffic Vol, veh/h	0	54	88	44	0	32	134	4	0	57	68	13	0	14	237	223
Future Vol, veh/h	0	54	88	44	0	32	134	4	0	57	68	13	0	14	237	223
Peak Hour Factor	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	0	2	3	2	0	2	6	6	0	2	0	1	3
Mvmt Flow	0	57	93	46	0	34	141	4	0	60	72	14	0	15	249	235
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	11.9	11.9	11.3	20.1
HCM LOS	B	B	B	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	46%	0%	29%	19%	3%
Vol Thru, %	54%	0%	47%	79%	50%
Vol Right, %	0%	100%	24%	2%	47%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	125	13	186	170	474
LT Vol	57	0	54	32	14
Through Vol	68	0	88	134	237
RT Vol	0	13	44	4	223
Lane Flow Rate	132	14	196	179	499
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.243	0.022	0.325	0.305	0.714
Departure Headway (Hd)	6.659	5.714	5.98	6.136	5.149
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	537	622	597	582	699
Service Time	4.437	3.491	4.057	4.213	3.206
HCM Lane V/C Ratio	0.246	0.023	0.328	0.308	0.714
HCM Control Delay	11.6	8.6	11.9	11.9	20.1
HCM Lane LOS	B	A	B	B	C
HCM 95th-tile Q	0.9	0.1	1.4	1.3	6

Intersection	
Int Delay, s/veh	7.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	71	4	2	1	3	103
Future Vol, veh/h	71	4	2	1	3	103
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	33	33	3
Mvmt Flow	77	4	2	1	3	112

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	3	0	-	0	162	4
Stage 1	-	-	-	-	3	-
Stage 2	-	-	-	-	159	-
Critical Hdwy	4.1	-	-	-	6.73	6.23
Critical Hdwy Stg 1	-	-	-	-	5.73	-
Critical Hdwy Stg 2	-	-	-	-	5.73	-
Follow-up Hdwy	2.2	-	-	-	3.797	3.327
Pot Cap-1 Maneuver	1632	-	-	-	762	1077
Stage 1	-	-	-	-	945	-
Stage 2	-	-	-	-	800	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1630	-	-	-	726	1076
Mov Cap-2 Maneuver	-	-	-	-	726	-
Stage 1	-	-	-	-	945	-
Stage 2	-	-	-	-	762	-

Approach	EB	WB	SB
HCM Control Delay, s	6.9	0	8.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1630	-	-	-	726	1076
HCM Lane V/C Ratio	0.047	-	-	-	0.004	0.104
HCM Control Delay (s)	7.3	0	-	-	10	8.7
HCM Lane LOS	A	A	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0	0.3

Intersection	
Int Delay, s/veh	6.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Traffic Vol, veh/h	485	88	247	718	63	108
Future Vol, veh/h	485	88	247	718	63	108
Conflicting Peds, #/hr	0	1	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	300	250	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	4	5	0	3	16	0
Mvmt Flow	511	93	260	756	66	114

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	512	0	1410	257
Stage 1	-	-	-	-	512	-
Stage 2	-	-	-	-	898	-
Critical Hdwy	-	-	4.1	-	7.12	6.9
Critical Hdwy Stg 1	-	-	-	-	6.12	-
Critical Hdwy Stg 2	-	-	-	-	6.12	-
Follow-up Hdwy	-	-	2.2	-	3.66	3.3
Pot Cap-1 Maneuver	-	-	1064	-	114	748
Stage 1	-	-	-	-	528	-
Stage 2	-	-	-	-	326	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1063	-	86	747
Mov Cap-2 Maneuver	-	-	-	-	86	-
Stage 1	-	-	-	-	527	-
Stage 2	-	-	-	-	246	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.4	53.3
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	86	747	-	-	1063	-
HCM Lane V/C Ratio	0.771	0.152	-	-	0.245	-
HCM Control Delay (s)	126.4	10.7	-	-	9.5	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	3.9	0.5	-	-	1	-

Appendix H
MUTCD Signal Warrant
Analysis Worksheets
(4-Lane Courthouse Road)

KITTELSON & ASSOCIATES, INC.
610 SW Alder, Suite 700
Portland, Oregon 97205
(503) 228-5230

Project #: 21446
Project Name: Accokeek Furnace
Analyst: CBT
Date: 11/2/2017
File: K:\H_Projects\21\21446 - Accokeek Furnace Development\signal warrant\[21446_Signal Warrant Analysis_BKGD.xls]Warrant Summary(100%)
Intersection: Courthouse Rd/Woodcutters Rd
Scenario: 2017 Existing Conditions

Analysis Traffic Volumes

Hour		Major Street		Minor Street	
Begin	End	EB	WB	NB	SB
7:00 AM	8:00 AM	738	511	494	0
2nd Highest Hour		694	480	464	0
3rd Highest Hour		627	434	420	0
4th Highest Hour		576	399	385	0
5th Highest Hour		531	368	306	0
6th Highest Hour		524	363	351	0
7th Highest Hour		509	353	341	0
8th Highest Hour		362	250	242	0
9th Highest Hour		0	0	0	0
10th Highest Hour		0	0	0	0
11th Highest Hour		0	0	0	0
12th Highest Hour		0	0	0	0
13th Highest Hour		0	0	0	0
14th Highest Hour		0	0	0	0
15th Highest Hour		0	0	0	0
16th Highest Hour		0	0	0	0
17th Highest Hour		0	0	0	0
18th Highest Hour		0	0	0	0
19th Highest Hour		0	0	0	0
20th Highest Hour		0	0	0	0
21st Highest Hour		0	0	0	0
22nd Highest Hour		0	0	0	0
23rd Highest Hour		0	0	0	0
24th Highest Hour		0	0	0	0

Warrant Summary

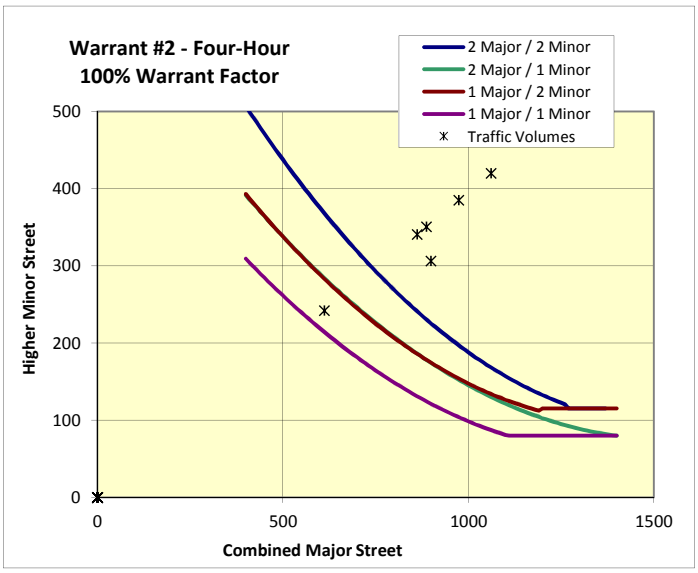
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

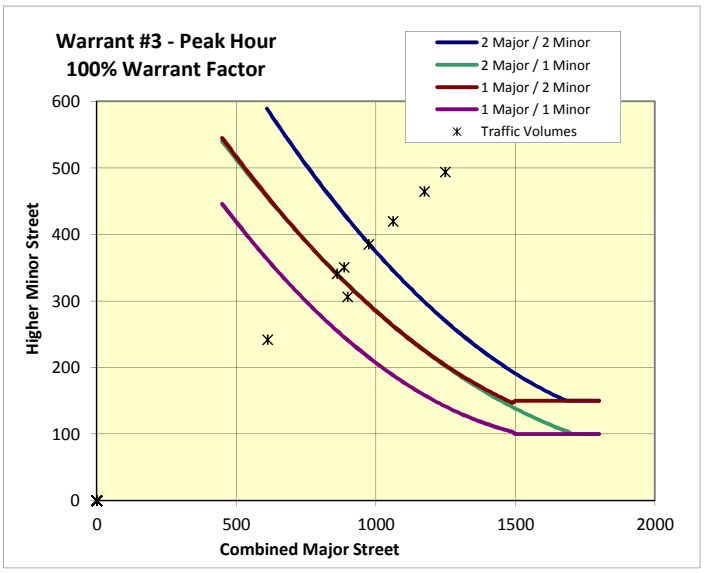
Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Minor
East-West Approach =	Major
Major Street Thru Lanes =	2
Minor Street Thru Lanes =	2
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	78%
Major Street: 8th-Highest Hour / Peak Hour	49%
Minor Street: 4th-Highest Hour / Peak Hour	78%
Minor Street: 8th-Highest Hour / Peak Hour	49%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	600	200	8	Yes	**Yes**
	B	900	100	5	No	
80%	A	480	160	8	Yes	**Yes**
	B	720	80	7	No	
70%	A	420	140	8	Yes	**Yes**
	B	630	70	7	No	
56%	A	336	112	8	Yes	**Yes**
	B	504	56	8	Yes	





Appendix I
2022 Mitigated Background Traffic Conditions Level of Service & Queuing Worksheets

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	802	23	72	392	90	487
v/c Ratio	0.71	0.03	0.18	0.18	0.39	0.62
Control Delay	23.5	3.2	23.0	4.3	34.0	16.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.5	3.2	23.0	4.3	34.0	16.0
Queue Length 50th (ft)	140	0	22	24	32	116
Queue Length 95th (ft)	245	9	64	47	88	258
Internal Link Dist (ft)	1281			1088	465	
Turn Bay Length (ft)		300	250			
Base Capacity (vph)	1743	1033	607	2948	501	980
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.02	0.12	0.13	0.18	0.50

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	738	21	66	361	83	448
Future Volume (veh/h)	738	21	66	361	83	448
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1638	1776	1759	1696	1881
Adj Flow Rate, veh/h	802	23	72	392	90	487
Adj No. of Lanes	2	1	1	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	5	16	7	8	12	1
Cap, veh/h	1212	913	96	1689	490	576
Arrive On Green	0.35	0.35	0.06	0.51	0.30	0.30
Sat Flow, veh/h	3529	1392	1691	3431	1616	1599
Grp Volume(v), veh/h	802	23	72	392	90	487
Grp Sat Flow(s),veh/h/ln	1719	1392	1691	1671	1616	1599
Q Serve(g_s), s	12.3	0.4	2.6	4.1	2.6	17.6
Cycle Q Clear(g_c), s	12.3	0.4	2.6	4.1	2.6	17.6
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1212	913	96	1689	490	576
V/C Ratio(X)	0.66	0.03	0.75	0.23	0.18	0.85
Avail Cap(c_a), veh/h	1701	1111	594	3147	490	576
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.1	3.8	29.1	8.7	16.1	18.4
Incr Delay (d2), s/veh	0.6	0.0	10.9	0.1	0.2	11.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.9	0.3	1.5	1.9	1.2	9.5
LnGrp Delay(d),s/veh	17.8	3.8	40.0	8.8	16.3	29.6
LnGrp LOS	B	A	D	A	B	C
Approach Vol, veh/h	825			464	577	
Approach Delay, s/veh	17.4			13.6	27.5	
Approach LOS	B			B	C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		25.0	9.6	28.1				37.7
Change Period (Y+Rc), s		6.0	6.0	6.0				6.0
Max Green Setting (Gmax), s		19.0	22.0	31.0				59.0
Max Q Clear Time (g_c+I1), s		19.6	4.6	14.3				6.1
Green Ext Time (p_c), s		0.0	0.1	7.8				11.5

Intersection Summary	
HCM 2010 Ctrl Delay	19.6
HCM 2010 LOS	B

Intersection: 4: Woodcutters Rd & Courthouse Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	218	204	52	106	104	83	122	201
Average Queue (ft)	130	102	9	42	45	24	49	91
95th Queue (ft)	194	182	36	85	87	63	99	160
Link Distance (ft)	1318	1318			1138	1138	481	481
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			300	250				
Storage Blk Time (%)								
Queuing Penalty (veh)								

Network Summary

Network wide Queuing Penalty: 0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	511	93	260	756	66	114
v/c Ratio	0.53	0.13	0.54	0.34	0.26	0.15
Control Delay	17.7	2.3	20.9	4.3	23.3	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.7	2.3	20.9	4.3	23.3	2.8
Queue Length 50th (ft)	61	0	61	37	16	2
Queue Length 95th (ft)	126	16	145	71	55	21
Internal Link Dist (ft)	1281			1088	465	
Turn Bay Length (ft)		300	250			
Base Capacity (vph)	1902	1186	1105	3436	752	1250
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.08	0.24	0.22	0.09	0.09

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	485	88	247	718	63	108
Future Volume (veh/h)	485	88	247	718	63	108
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1810	1900	1845	1638	1900
Adj Flow Rate, veh/h	511	93	260	756	66	114
Adj No. of Lanes	2	1	1	2	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	4	5	0	3	16	0
Cap, veh/h	1285	751	345	2340	185	500
Arrive On Green	0.37	0.37	0.19	0.67	0.12	0.12
Sat Flow, veh/h	3563	1536	1810	3597	1560	1615
Grp Volume(v), veh/h	511	93	260	756	66	114
Grp Sat Flow(s),veh/h/ln	1736	1536	1810	1752	1560	1615
Q Serve(g_s), s	4.6	1.4	5.7	3.9	1.6	2.2
Cycle Q Clear(g_c), s	4.6	1.4	5.7	3.9	1.6	2.2
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1285	751	345	2340	185	500
V/C Ratio(X)	0.40	0.12	0.75	0.32	0.36	0.23
Avail Cap(c_a), veh/h	2101	1112	1224	4866	833	1171
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.8	5.9	16.1	3.0	17.1	10.8
Incr Delay (d2), s/veh	0.2	0.1	3.3	0.1	1.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.2	0.7	3.1	1.8	0.8	1.0
LnGrp Delay(d),s/veh	10.0	5.9	19.4	3.0	18.2	11.0
LnGrp LOS	B	A	B	A	B	B
Approach Vol, veh/h	604			1016	180	
Approach Delay, s/veh	9.4			7.2	13.7	
Approach LOS	A			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		9.5	12.5	20.1				32.6
Change Period (Y+Rc), s		4.5	4.5	4.5				4.5
Max Green Setting (Gmax), s		22.5	28.5	25.5				58.5
Max Q Clear Time (g_c+I1), s		4.2	7.7	6.6				5.9
Green Ext Time (p_c), s		0.5	0.7	9.0				12.8

Intersection Summary	
HCM 2010 Ctrl Delay	8.6
HCM 2010 LOS	A

Intersection: 4: Courthouse Rd & Woodcutters Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	152	135	68	172	112	105	93	52
Average Queue (ft)	92	61	28	91	54	47	36	24
95th Queue (ft)	138	115	61	148	94	91	76	46
Link Distance (ft)	1318	1318			1138	1138	481	481
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			300	250				
Storage Blk Time (%)				0				
Queuing Penalty (veh)				0				

Network Summary

Network wide Queuing Penalty: 0

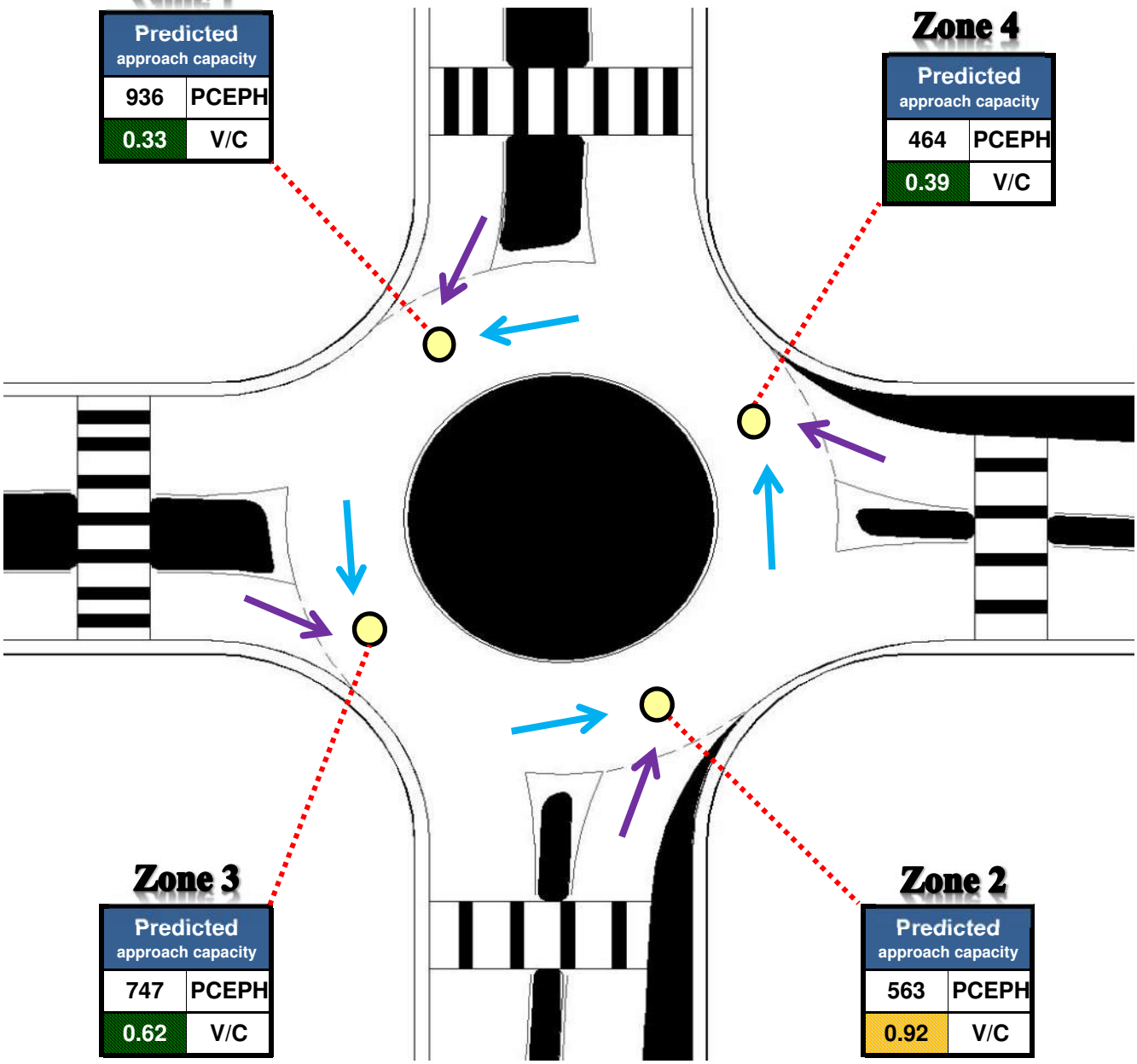
75' ICD Mini-Roundabout

Design and Results

Project Name:	*Accokeek Furnace Road Development*
Project Number:	*21446*
Location	*Stafford, VA*
Date	October 17, 2017

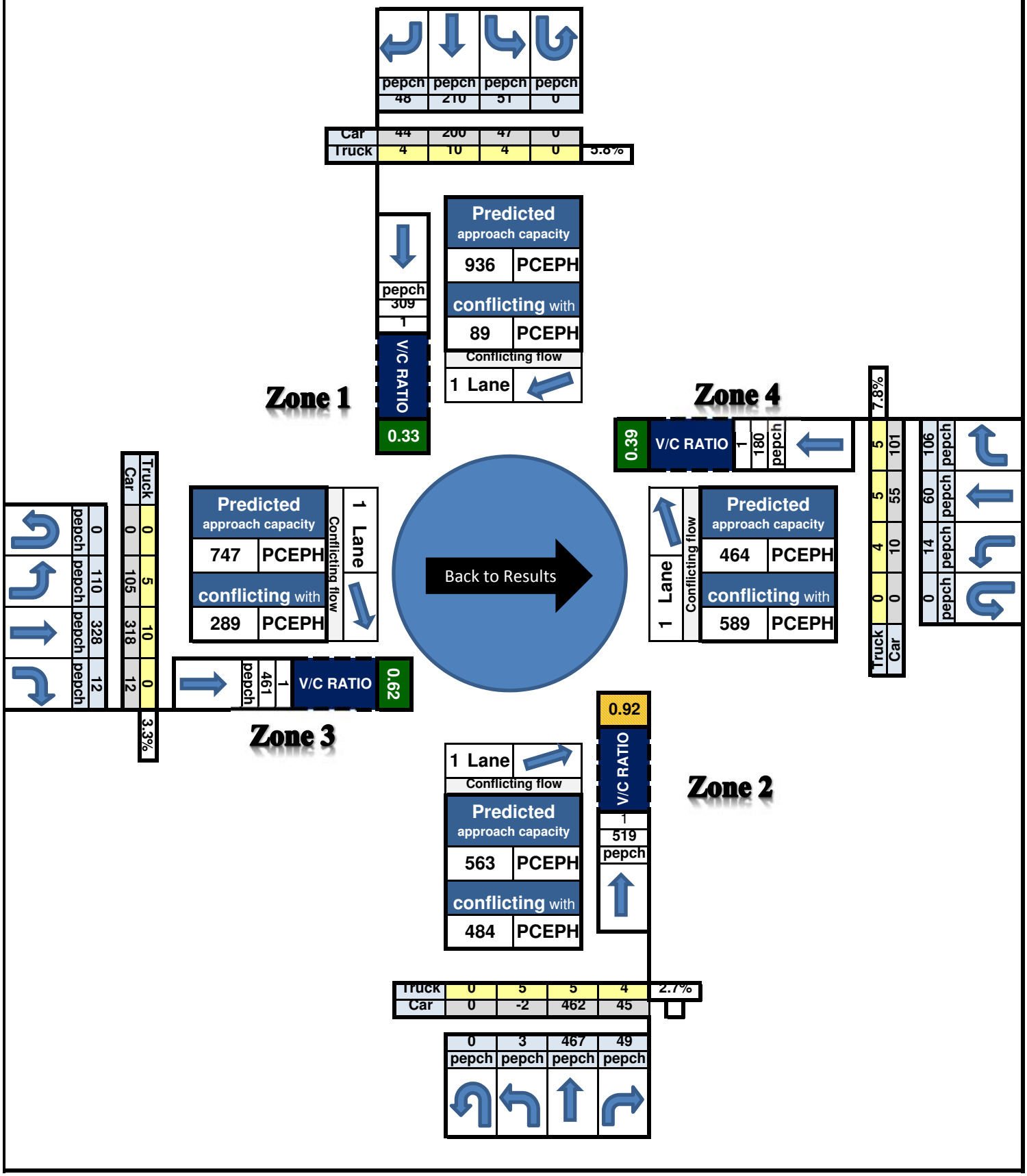
Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600

VOLUME / CAPACITY RATIO:				
Zone 1	0.33	Zone 4	0.39	
Zone 3	0.62	Zone 2	0.92	



75' ICD Mini-Roundabout

Data Input and Configuration



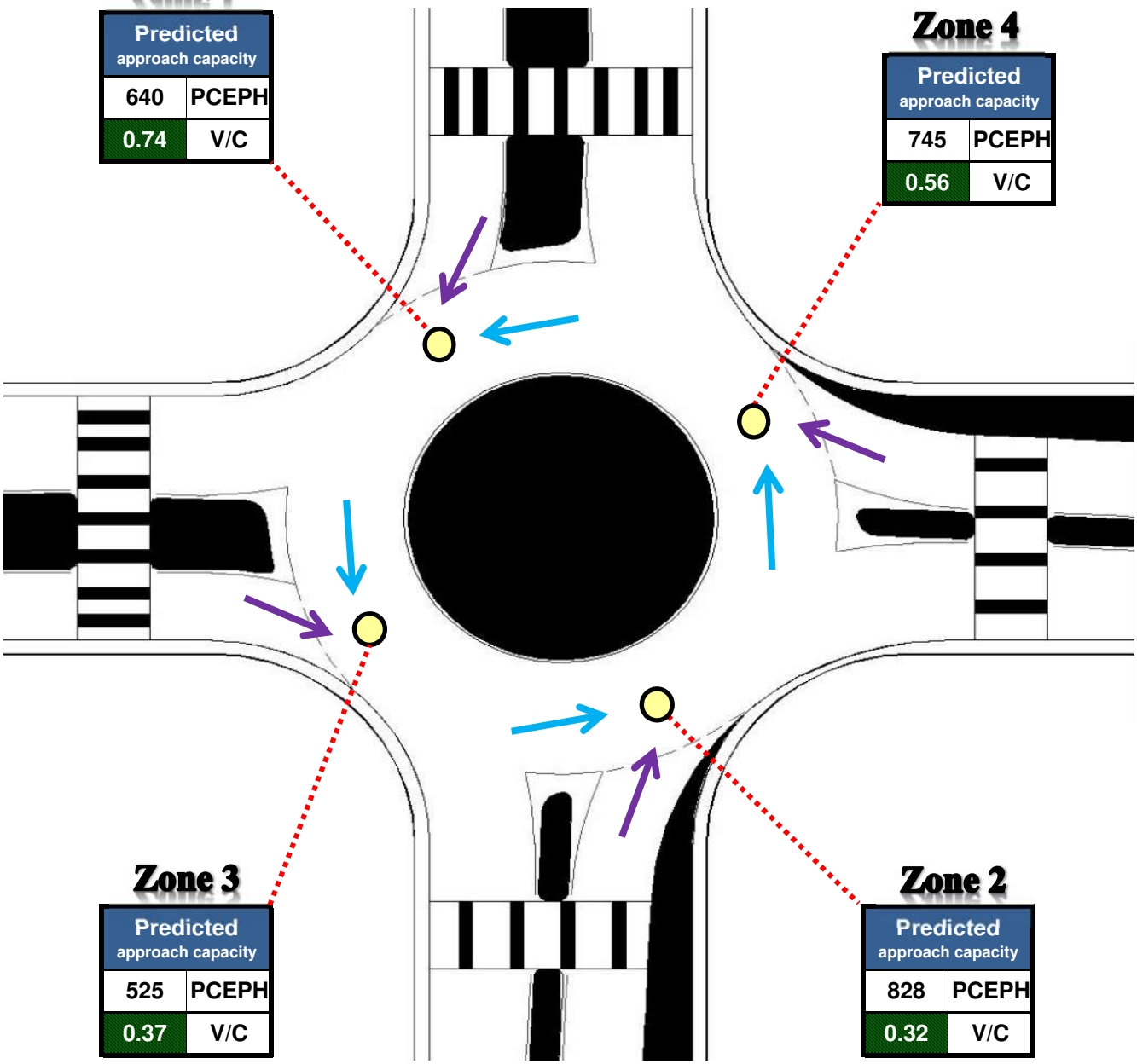
75' ICD Mini-Roundabout

Design and Results

Project Name:	*Accokeek Furnace Road Development*
Project Number:	*21446*
Location	*Stafford, VA*
Date	October 17, 2017

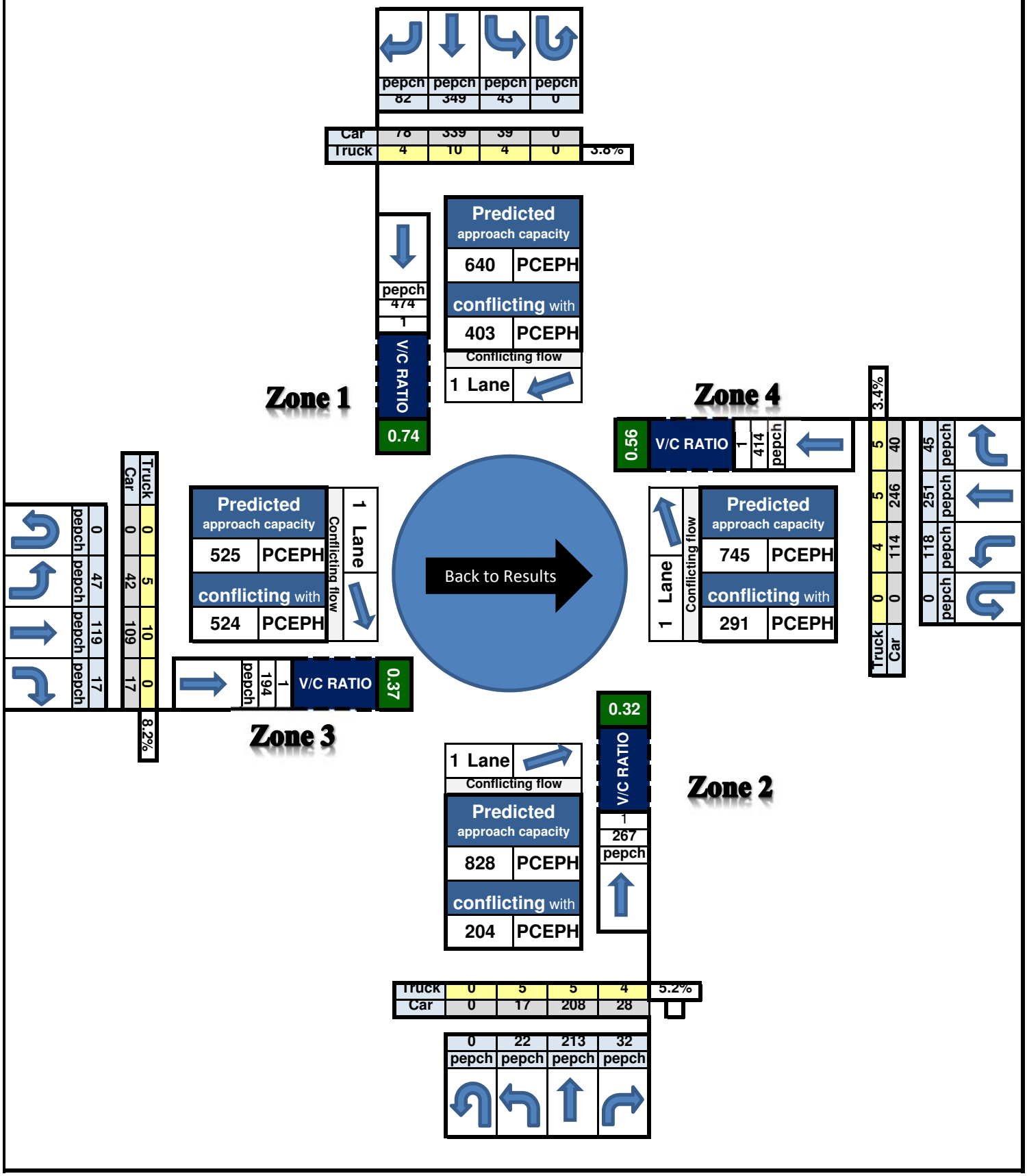
Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600

VOLUME / CAPACITY RATIO:				
Zone 1	0.74	Zone 4	0.56	
Zone 3	0.37	Zone 2	0.32	



75' ICD Mini-Roundabout

Data Input and Configuration



Appendix J
2022 Total Traffic Conditions
Level of Service Worksheets

Intersection	
Intersection Delay, s/veh	76.7
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	110	329	12	0	20	68	112	0	3	467	51
Future Vol, veh/h	0	110	329	12	0	20	68	112	0	3	467	51
Peak Hour Factor	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	8	3	9	2	8	16	2	2	0	3	2
Mvmt Flow	0	115	343	13	0	21	71	117	0	3	486	53
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	81.4	21.5	119.8
HCM LOS	F	C	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	24%	10%	17%
Vol Thru, %	90%	73%	34%	68%
Vol Right, %	10%	3%	56%	15%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	521	451	200	311
LT Vol	3	110	20	53
Through Vol	467	329	68	210
RT Vol	51	12	112	48
Lane Flow Rate	543	470	208	324
Geometry Grp	1	1	1	1
Degree of Util (X)	1.157	1.031	0.502	0.741
Departure Headway (Hd)	7.968	8.449	9.398	8.832
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	461	432	385	411
Service Time	5.968	6.449	7.398	6.832
HCM Lane V/C Ratio	1.178	1.088	0.54	0.788
HCM Control Delay	119.8	81.4	21.5	33.2
HCM Lane LOS	F	F	C	D
HCM 95th-tile Q	19.1	13.7	2.7	5.9

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	53	210	48
Future Vol, veh/h	0	53	210	48
Peak Hour Factor	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	2	5	9
Mvmt Flow	0	55	219	50
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	33.2
HCM LOS	D

Intersection	
Intersection Delay, s/veh	24.2
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations																
Traffic Vol, veh/h	0	139	229	65	0	22	50	3	0	110	285	126	0	1	25	39
Future Vol, veh/h	0	139	229	65	0	22	50	3	0	110	285	126	0	1	25	39
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	7	0	3	2	0	0	33	2	4	4	4	2	100	4	22
Mvmt Flow	0	151	249	71	0	24	54	3	0	120	310	137	0	1	27	42
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	27.3	11.1	25	12.9
HCM LOS	D	B	C	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	28%	0%	32%	29%	2%
Vol Thru, %	72%	0%	53%	67%	38%
Vol Right, %	0%	100%	15%	4%	60%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	395	126	433	75	65
LT Vol	110	0	139	22	1
Through Vol	285	0	229	50	25
RT Vol	0	126	65	3	39
Lane Flow Rate	429	137	471	82	71
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.787	0.219	0.781	0.156	0.162
Departure Headway (Hd)	6.598	5.745	5.977	6.876	8.278
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	545	620	602	524	436
Service Time	4.375	3.521	4.055	4.88	6.285
HCM Lane V/C Ratio	0.787	0.221	0.782	0.156	0.163
HCM Control Delay	29.7	10.1	27.3	11.1	12.9
HCM Lane LOS	D	B	D	B	B
HCM 95th-tile Q	7.3	0.8	7.4	0.5	0.6

Intersection	
Int Delay, s/veh	7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	346	10	32	76	15	43
Future Vol, veh/h	346	10	32	76	15	43
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	0	0	67	67	5
Mvmt Flow	376	11	35	83	16	47

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	117	0	-	0	839	77
Stage 1	-	-	-	-	76	-
Stage 2	-	-	-	-	763	-
Critical Hdwy	4.12	-	-	-	7.07	6.25
Critical Hdwy Stg 1	-	-	-	-	6.07	-
Critical Hdwy Stg 2	-	-	-	-	6.07	-
Follow-up Hdwy	2.218	-	-	-	4.103	3.345
Pot Cap-1 Maneuver	1471	-	-	-	262	976
Stage 1	-	-	-	-	806	-
Stage 2	-	-	-	-	363	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1470	-	-	-	195	975
Mov Cap-2 Maneuver	-	-	-	-	195	-
Stage 1	-	-	-	-	806	-
Stage 2	-	-	-	-	270	-

Approach	EB	WB	SB
HCM Control Delay, s	8.1	0	13.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1470	-	-	-	195	975
HCM Lane V/C Ratio	0.256	-	-	-	0.084	0.048
HCM Control Delay (s)	8.3	0	-	-	25.1	8.9
HCM Lane LOS	A	A	-	-	D	A
HCM 95th %tile Q(veh)	1	-	-	-	0.3	0.2

Intersection	
Int Delay, s/veh	18.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Traffic Vol, veh/h	738	23	78	361	98	519
Future Vol, veh/h	738	23	78	361	98	519
Conflicting Peds, #/hr	0	0	0	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	300	250	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	5	16	7	8	12	1
Mvmt Flow	802	25	85	392	107	564

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	802	0	1169	401
Stage 1	-	-	-	-	802	-
Stage 2	-	-	-	-	367	-
Critical Hdwy	-	-	4.24	-	7.04	6.92
Critical Hdwy Stg 1	-	-	-	-	6.04	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	-	-	2.27	-	3.62	3.31
Pot Cap-1 Maneuver	-	-	786	-	172	602
Stage 1	-	-	-	-	377	-
Stage 2	-	-	-	-	642	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	786	-	153	602
Mov Cap-2 Maneuver	-	-	-	-	153	-
Stage 1	-	-	-	-	377	-
Stage 2	-	-	-	-	572	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	52.3
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	153	602	-	-	786	-
HCM Lane V/C Ratio	0.696	0.937	-	-	0.108	-
HCM Control Delay (s)	69.9	49	-	-	10.1	-
HCM Lane LOS	F	E	-	-	B	-
HCM 95th %tile Q(veh)	4.1	12.4	-	-	0.4	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	4	13	421	1	2	56
Future Vol, veh/h	4	13	421	1	2	56
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	250	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	16	52	1684	4	8	224

Major/Minor	Major2		Major1		Minor2	
Conflicting Flow All	1684	-	0	0	842	1742
Stage 1	-	-	-	-	0	58
Stage 2	-	-	-	-	842	1684
Critical Hdwy	4.1	-	-	-	6.8	6.5
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	5.8	5.5
Follow-up Hdwy	2.2	-	-	-	3.5	4
Pot Cap-1 Maneuver	385	-	-	-	307	~ 88
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	388	~ 152
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	385	-	-	-	294	0
Mov Cap-2 Maneuver	-	-	-	-	294	0
Stage 1	-	-	-	-	-	0
Stage 2	-	-	-	-	388	0

Approach	WB	NB	SB
HCM Control Delay, s	3.5	0	
HCM LOS			-

Minor Lane/Major Mvmt	NBT	NBR	WBL	WBR	SBLn1	SBLn2	SBLn3
Capacity (veh/h)	-	-	385	-	294	-	-
HCM Lane V/C Ratio	-	-	0.042	-	0.027	-	-
HCM Control Delay (s)	-	-	14.8	-	17.6	-	-
HCM Lane LOS	-	-	B	-	C	-	-
HCM 95th %tile Q(veh)	-	-	0.1	-	0.1	-	-

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

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	15	0	0	68	0	1	0	0	0	0	8
Future Vol, veh/h	2	15	0	0	68	0	1	0	0	0	0	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	25	25	25	25	25	25	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	8	60	0	0	272	0	4	0	0	0	0	32

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	272	0	0	60	0	0	364	348	60	348	348	272
Stage 1	-	-	-	-	-	-	76	76	-	272	272	-
Stage 2	-	-	-	-	-	-	288	272	-	76	76	-
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	1303	-	-	1556	-	-	596	579	1011	610	579	772
Stage 1	-	-	-	-	-	-	938	836	-	738	688	-
Stage 2	-	-	-	-	-	-	724	688	-	938	836	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1303	-	-	1556	-	-	569	576	1011	607	576	772
Mov Cap-2 Maneuver	-	-	-	-	-	-	569	576	-	607	576	-
Stage 1	-	-	-	-	-	-	932	831	-	734	688	-
Stage 2	-	-	-	-	-	-	694	688	-	932	831	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.9	0	11.4	9.9
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	569	1303	-	-	1556	-	-	772
HCM Lane V/C Ratio	0.007	0.006	-	-	-	-	-	0.041
HCM Control Delay (s)	11.4	7.8	0	-	0	-	-	9.9
HCM Lane LOS	B	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	6	26	0	0	0
Future Vol, veh/h	1	6	26	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	4	24	104	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	104	0	-	0	136	104
Stage 1	-	-	-	-	104	-
Stage 2	-	-	-	-	32	-
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	1500	-	-	-	862	956
Stage 1	-	-	-	-	925	-
Stage 2	-	-	-	-	996	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1500	-	-	-	859	956
Mov Cap-2 Maneuver	-	-	-	-	859	-
Stage 1	-	-	-	-	925	-
Stage 2	-	-	-	-	993	-

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

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1500	-	-	-	-
HCM Lane V/C Ratio	0.003	-	-	-	-
HCM Control Delay (s)	7.4	0	-	-	0
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	13	60	0	0	7
Future Vol, veh/h	1	13	60	0	0	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, %	-	0	0	-	0	-
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	4	52	240	0	0	28

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	240	0	-	0	300	240
Stage 1	-	-	-	-	240	-
Stage 2	-	-	-	-	60	-
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	1339	-	-	-	696	804
Stage 1	-	-	-	-	805	-
Stage 2	-	-	-	-	968	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1339	-	-	-	694	804
Mov Cap-2 Maneuver	-	-	-	-	694	-
Stage 1	-	-	-	-	805	-
Stage 2	-	-	-	-	965	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1339	-	-	-	804
HCM Lane V/C Ratio	0.003	-	-	-	0.035
HCM Control Delay (s)	7.7	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	5	16	0	0	0
Future Vol, veh/h	0	5	16	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	20	64	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	64	0	-	0	84	64
Stage 1	-	-	-	-	64	-
Stage 2	-	-	-	-	20	-
Critical Hdwy	4.1	-	-	-	7.1	6.2
Critical Hdwy Stg 1	-	-	-	-	6.1	-
Critical Hdwy Stg 2	-	-	-	-	6.1	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1551	-	-	-	908	1006
Stage 1	-	-	-	-	952	-
Stage 2	-	-	-	-	1004	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1551	-	-	-	908	1006
Mov Cap-2 Maneuver	-	-	-	-	908	-
Stage 1	-	-	-	-	952	-
Stage 2	-	-	-	-	1004	-

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

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1551	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Intersection Delay, s/veh	7.8
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	3	10	0	0	0	44	0	0	0	0	0
Future Vol, veh/h	0	3	10	0	0	0	44	0	0	0	0	0
Peak Hour Factor	0.92	0.25	0.25	0.25	0.92	0.25	0.25	0.25	0.92	0.25	0.25	0.25
Heavy Vehicles, %	2	0	0	0	2	0	0	0	2	0	0	0
Mvmt Flow	0	12	40	0	0	0	176	0	0	0	0	0
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	7.5	8.1	0
HCM LOS	A	A	-

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	23%	0%	0%
Vol Thru, %	100%	77%	100%	0%
Vol Right, %	0%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	13	44	13
LT Vol	0	3	0	0
Through Vol	0	10	44	0
RT Vol	0	0	0	13
Lane Flow Rate	0	52	176	52
Geometry Grp	1	1	1	1
Degree of Util (X)	0	0.06	0.197	0.055
Departure Headway (Hd)	4.446	4.17	4.03	3.791
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	0	853	889	951
Service Time	2.448	2.223	2.06	1.791
HCM Lane V/C Ratio	0	0.061	0.198	0.055
HCM Control Delay	7.4	7.5	8.1	7
HCM Lane LOS	N	A	A	A
HCM 95th-tile Q	0	0.2	0.7	0.2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	0	0	13
Future Vol, veh/h	0	0	0	13
Peak Hour Factor	0.92	0.25	0.25	0.25
Heavy Vehicles, %	2	0	0	0
Mvmt Flow	0	0	0	52
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	7
HCM LOS	A

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	1	0	0	0	2	0	0	9	0
Future Vol, veh/h	0	0	0	1	0	0	0	2	0	0	9	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	25	25	25	25	25	25	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	0	0	4	0	0	0	8	0	0	36	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	44	44	36	44	44	8	36	0	0	8	0	0
Stage 1	36	36	-	8	8	-	-	-	-	-	-	-
Stage 2	8	8	-	36	36	-	-	-	-	-	-	-
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	963	852	1042	963	852	1080	1588	-	-	1625	-	-
Stage 1	985	869	-	1019	893	-	-	-	-	-	-	-
Stage 2	1019	893	-	985	869	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	963	852	1042	963	852	1080	1588	-	-	1625	-	-
Mov Cap-2 Maneuver	963	852	-	963	852	-	-	-	-	-	-	-
Stage 1	985	869	-	1019	893	-	-	-	-	-	-	-
Stage 2	1019	893	-	985	869	-	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1588	-	-	-	963	1625	-	-
HCM Lane V/C Ratio	-	-	-	-	0.004	-	-	-
HCM Control Delay (s)	0	-	-	0	8.8	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0	0	-	-

Intersection	
Int Delay, s/veh	7.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	1	0	7	2	0	0	0	4	0	0	12
Future Vol, veh/h	2	1	0	7	2	0	0	0	4	0	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	25	25	25	25	25	25	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	8	4	0	28	8	0	0	0	16	0	0	48

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	8	0	0	4	0	0	108	84	4	92	84	8
Stage 1	-	-	-	-	-	-	20	20	-	64	64	-
Stage 2	-	-	-	-	-	-	88	64	-	28	20	-
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	1625	-	-	1631	-	-	876	810	1085	897	810	1080
Stage 1	-	-	-	-	-	-	1004	883	-	952	846	-
Stage 2	-	-	-	-	-	-	925	846	-	994	883	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1625	-	-	1631	-	-	823	792	1085	869	792	1080
Mov Cap-2 Maneuver	-	-	-	-	-	-	823	792	-	869	792	-
Stage 1	-	-	-	-	-	-	999	879	-	947	832	-
Stage 2	-	-	-	-	-	-	869	832	-	974	879	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4.8	5.6	8.4	8.5
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	1085	1625	-	-	1631	-	-	1080
HCM Lane V/C Ratio	0.015	0.005	-	-	0.017	-	-	0.044
HCM Control Delay (s)	8.4	7.2	0	-	7.2	0	-	8.5
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0.1	-	-	0.1

Intersection	
Intersection Delay, s/veh	45.7
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	47	126	17	0	122	253	47	0	22	213	39
Future Vol, veh/h	0	47	126	17	0	122	253	47	0	22	213	39
Peak Hour Factor	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	8	3	9	2	5	3	5	2	0	2	10
Mvmt Flow	0	48	129	17	0	124	258	48	0	22	217	40
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	19	50.5	23.3
HCM LOS	C	F	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	8%	25%	29%	10%
Vol Thru, %	78%	66%	60%	73%
Vol Right, %	14%	9%	11%	17%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	274	190	422	478
LT Vol	22	47	122	47
Through Vol	213	126	253	349
RT Vol	39	17	47	82
Lane Flow Rate	280	194	431	488
Geometry Grp	1	1	1	1
Degree of Util (X)	0.619	0.464	0.912	0.988
Departure Headway (Hd)	7.968	8.608	7.623	7.293
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	450	417	474	498
Service Time	6.049	6.697	5.69	5.357
HCM Lane V/C Ratio	0.622	0.465	0.909	0.98
HCM Control Delay	23.3	19	50.5	64.9
HCM Lane LOS	C	C	F	F
HCM 95th-tile Q	4.1	2.4	10.3	13.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations			↕	
Traffic Vol, veh/h	0	47	349	82
Future Vol, veh/h	0	47	349	82
Peak Hour Factor	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	0	2	4
Mvmt Flow	0	48	356	84
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	64.9
HCM LOS	F

Intersection	
Intersection Delay, s/veh	16.8
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations																
Traffic Vol, veh/h	0	54	106	44	0	40	142	4	0	57	68	23	0	14	237	223
Future Vol, veh/h	0	54	106	44	0	40	142	4	0	57	68	23	0	14	237	223
Peak Hour Factor	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	0	2	3	2	0	2	6	6	0	2	0	1	3
Mvmt Flow	0	57	112	46	0	42	149	4	0	60	72	24	0	15	249	235
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	12.7	12.6	11.4	21.8
HCM LOS	B	B	B	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	46%	0%	26%	22%	3%
Vol Thru, %	54%	0%	52%	76%	50%
Vol Right, %	0%	100%	22%	2%	47%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	125	23	204	186	474
LT Vol	57	0	54	40	14
Through Vol	68	0	106	142	237
RT Vol	0	23	44	4	223
Lane Flow Rate	132	24	215	196	499
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.25	0.04	0.364	0.341	0.735
Departure Headway (Hd)	6.836	5.889	6.102	6.261	5.305
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	521	602	584	570	679
Service Time	4.633	3.685	4.196	4.357	3.377
HCM Lane V/C Ratio	0.253	0.04	0.368	0.344	0.735
HCM Control Delay	11.9	8.9	12.7	12.6	21.8
HCM Lane LOS	B	A	B	B	C
HCM 95th-tile Q	1	0.1	1.7	1.5	6.4

Intersection	
Int Delay, s/veh	7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	75	28	16	34	76	105
Future Vol, veh/h	75	28	16	34	76	105
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	33	3
Mvmt Flow	82	30	17	37	83	114

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	54	0	-	0	229	37
Stage 1	-	-	-	-	36	-
Stage 2	-	-	-	-	193	-
Critical Hdwy	4.1	-	-	-	6.73	6.23
Critical Hdwy Stg 1	-	-	-	-	5.73	-
Critical Hdwy Stg 2	-	-	-	-	5.73	-
Follow-up Hdwy	2.2	-	-	-	3.797	3.327
Pot Cap-1 Maneuver	1564	-	-	-	696	1032
Stage 1	-	-	-	-	912	-
Stage 2	-	-	-	-	771	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1563	-	-	-	659	1031
Mov Cap-2 Maneuver	-	-	-	-	659	-
Stage 1	-	-	-	-	912	-
Stage 2	-	-	-	-	730	-

Approach	EB	WB	SB
HCM Control Delay, s	5.4	0	9.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1563	-	-	-	659	1031
HCM Lane V/C Ratio	0.052	-	-	-	0.125	0.111
HCM Control Delay (s)	7.4	0	-	-	11.2	8.9
HCM Lane LOS	A	A	-	-	B	A
HCM 95th %tile Q(veh)	0.2	-	-	-	0.4	0.4

Intersection	
Int Delay, s/veh	16.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Traffic Vol, veh/h	485	105	315	718	70	140
Future Vol, veh/h	485	105	315	718	70	140
Conflicting Peds, #/hr	0	1	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	300	250	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	4	5	0	3	16	0
Mvmt Flow	527	114	342	780	76	152

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	528	0	1603	266
Stage 1	-	-	-	-	528	-
Stage 2	-	-	-	-	1075	-
Critical Hdwy	-	-	4.1	-	7.12	6.9
Critical Hdwy Stg 1	-	-	-	-	6.12	-
Critical Hdwy Stg 2	-	-	-	-	6.12	-
Follow-up Hdwy	-	-	2.2	-	3.66	3.3
Pot Cap-1 Maneuver	-	-	1049	-	84	738
Stage 1	-	-	-	-	518	-
Stage 2	-	-	-	-	260	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1048	-	~ 57	737
Mov Cap-2 Maneuver	-	-	-	-	~ 57	-
Stage 1	-	-	-	-	518	-
Stage 2	-	-	-	-	175	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.1	124.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	57	737	-	-	1048	-
HCM Lane V/C Ratio	1.335	0.206	-	-	0.327	-
HCM Control Delay (s)	$ 352.3	11.2	-	-	10.1	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	6.7	0.8	-	-	1.4	-

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

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	6	105	4	12	179
Future Vol, veh/h	2	6	105	4	12	179
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	-	-	250	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	2	7	114	4	13	195

Major/Minor	Major2		Major1		Minor2	
Conflicting Flow All	114	-	0	0	57	122
Stage 1	-	-	-	-	0	8
Stage 2	-	-	-	-	57	114
Critical Hdwy	4.1	-	-	-	6.8	6.5
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	5.8	5.5
Follow-up Hdwy	2.2	-	-	-	3.5	4
Pot Cap-1 Maneuver	1488	-	-	-	949	772
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	965	805
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1488	-	-	-	948	0
Mov Cap-2 Maneuver	-	-	-	-	948	0
Stage 1	-	-	-	-	-	0
Stage 2	-	-	-	-	965	0

Approach	WB	NB	SB
HCM Control Delay, s	1.9	0	
HCM LOS			-

Minor Lane/Major Mvmt	NBT	NBR	WBL	WBR	SBLn1	SBLn2	SBLn3
Capacity (veh/h)	-	-	1488	-	948	-	-
HCM Lane V/C Ratio	-	-	0.001	-	0.014	-	-
HCM Control Delay (s)	-	-	7.4	-	8.9	-	-
HCM Lane LOS	-	-	A	-	A	-	-
HCM 95th %tile Q(veh)	-	-	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	65	0	0	33	0	1	0	0	0	0	4
Future Vol, veh/h	8	65	0	0	33	0	1	0	0	0	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, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	9	71	0	0	36	0	1	0	0	0	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	36	0	0	71	0	0	126	124	71	124	124	36
Stage 1	-	-	-	-	-	-	88	88	-	36	36	-
Stage 2	-	-	-	-	-	-	38	36	-	88	88	-
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	1588	-	-	1542	-	-	852	770	997	855	770	1042
Stage 1	-	-	-	-	-	-	925	826	-	985	869	-
Stage 2	-	-	-	-	-	-	982	869	-	925	826	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1588	-	-	1542	-	-	845	765	997	851	765	1042
Mov Cap-2 Maneuver	-	-	-	-	-	-	845	765	-	851	765	-
Stage 1	-	-	-	-	-	-	919	821	-	979	869	-
Stage 2	-	-	-	-	-	-	978	869	-	919	821	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0	9.3	8.5
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	845	1588	-	-	1542	-	-	1042
HCM Lane V/C Ratio	0.001	0.005	-	-	-	-	-	0.004
HCM Control Delay (s)	9.3	7.3	0	-	0	-	-	8.5
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	18	7	0	0	0
Future Vol, veh/h	1	18	7	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	1	20	8	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	8	0	-	0	30	8
Stage 1	-	-	-	-	8	-
Stage 2	-	-	-	-	22	-
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	1625	-	-	-	989	1080
Stage 1	-	-	-	-	1020	-
Stage 2	-	-	-	-	1006	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1625	-	-	-	988	1080
Mov Cap-2 Maneuver	-	-	-	-	988	-
Stage 1	-	-	-	-	1020	-
Stage 2	-	-	-	-	1005	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1625	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	-	-
HCM Control Delay (s)	7.2	0	-	-	0
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	7	56	28	0	0	3
Future Vol, veh/h	7	56	28	0	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	8	61	30	0	0	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	30	0	-	0	106	30
Stage 1	-	-	-	-	30	-
Stage 2	-	-	-	-	76	-
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	1596	-	-	-	897	1050
Stage 1	-	-	-	-	998	-
Stage 2	-	-	-	-	952	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1596	-	-	-	893	1050
Mov Cap-2 Maneuver	-	-	-	-	893	-
Stage 1	-	-	-	-	998	-
Stage 2	-	-	-	-	947	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	8.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1596	-	-	-	1050
HCM Lane V/C Ratio	0.005	-	-	-	0.003
HCM Control Delay (s)	7.3	0	-	-	8.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	8	4	0	0	0
Future Vol, veh/h	0	8	4	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	9	4	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	4	0	-	0	13	4
Stage 1	-	-	-	-	4	-
Stage 2	-	-	-	-	9	-
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	1631	-	-	-	1011	1085
Stage 1	-	-	-	-	1024	-
Stage 2	-	-	-	-	1019	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1631	-	-	-	1011	1085
Mov Cap-2 Maneuver	-	-	-	-	1011	-
Stage 1	-	-	-	-	1024	-
Stage 2	-	-	-	-	1019	-

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

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1631	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Intersection Delay, s/veh	7.2
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	14	42	0	0	0	20	0	0	0	0	0
Future Vol, veh/h	0	14	42	0	0	0	20	0	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	0	0	0	2	0	0	0	2	0	0	0
Mvmt Flow	0	15	46	0	0	0	22	0	0	0	0	0
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	7.3	7.1	0
HCM LOS	A	A	-

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	25%	0%	0%
Vol Thru, %	100%	75%	100%	0%
Vol Right, %	0%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	56	20	7
LT Vol	0	14	0	0
Through Vol	0	42	20	0
RT Vol	0	0	0	7
Lane Flow Rate	0	61	22	8
Geometry Grp	1	1	1	1
Degree of Util (X)	0	0.067	0.024	0.007
Departure Headway (Hd)	4.048	3.98	3.959	3.441
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	0	905	907	1036
Service Time	2.083	1.984	1.97	1.476
HCM Lane V/C Ratio	0	0.067	0.024	0.008
HCM Control Delay	7.1	7.3	7.1	6.5
HCM Lane LOS	N	A	A	A
HCM 95th-tile Q	0	0.2	0.1	0

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	0	0	7
Future Vol, veh/h	0	0	0	7
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	0	0	0
Mvmt Flow	0	0	0	8
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	6.5
HCM LOS	A

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	1	0	0	0	9	2	0	4	0
Future Vol, veh/h	0	0	0	1	0	0	0	9	2	0	4	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	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	0	0	1	0	0	0	10	2	0	4	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	15	16	4	15	15	11	4	0	0	12	0	0
Stage 1	4	4	-	11	11	-	-	-	-	-	-	-
Stage 2	11	12	-	4	4	-	-	-	-	-	-	-
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	1006	882	1085	1006	883	1076	1631	-	-	1620	-	-
Stage 1	1024	897	-	1015	890	-	-	-	-	-	-	-
Stage 2	1015	890	-	1024	897	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	1006	882	1085	1006	883	1076	1631	-	-	1620	-	-
Mov Cap-2 Maneuver	1006	882	-	1006	883	-	-	-	-	-	-	-
Stage 1	1024	897	-	1015	890	-	-	-	-	-	-	-
Stage 2	1015	890	-	1024	897	-	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1631	-	-	-	1006	1620	-	-
HCM Lane V/C Ratio	-	-	-	-	0.001	-	-	-
HCM Control Delay (s)	0	-	-	0	8.6	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0	0	-	-

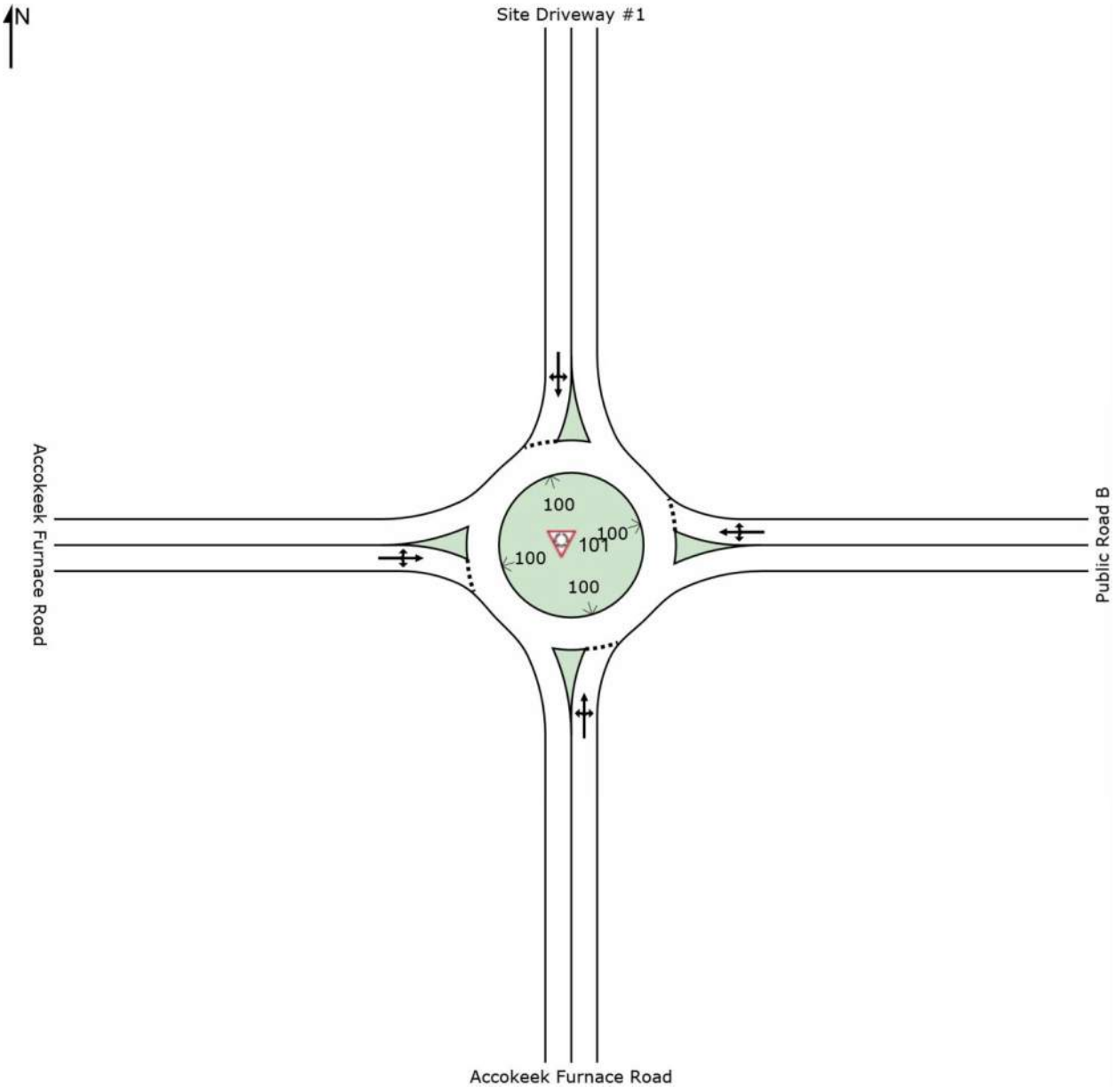
Intersection	
Int Delay, s/veh	6.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	11	3	0	0	1	0	0	0	0	0	0	6
Future Vol, veh/h	11	3	0	0	1	0	0	0	0	0	0	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	12	3	0	0	1	0	0	0	0	0	0	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1	0	0	3	0	0	31	28	3	28	28	1
Stage 1	-	-	-	-	-	-	27	27	-	1	1	-
Stage 2	-	-	-	-	-	-	4	1	-	27	27	-
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	1635	-	-	1632	-	-	982	869	1087	987	869	1090
Stage 1	-	-	-	-	-	-	996	877	-	1027	899	-
Stage 2	-	-	-	-	-	-	1024	899	-	996	877	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1635	-	-	1632	-	-	971	863	1087	982	863	1090
Mov Cap-2 Maneuver	-	-	-	-	-	-	971	863	-	982	863	-
Stage 1	-	-	-	-	-	-	989	871	-	1020	899	-
Stage 2	-	-	-	-	-	-	1018	899	-	989	871	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	5.7	0	0	8.3
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1635	-	-	1632	-	-	1090
HCM Lane V/C Ratio	-	0.007	-	-	-	-	-	0.006
HCM Control Delay (s)	0	7.2	0	-	0	-	-	8.3
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	0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Site Driveway #1
Accokeek Furnace Road
Public Road B
Accokeek Furnace Road
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MOVEMENT SUMMARY

Site: 101 [Accokeek Furnace Rd/Public Road B/Site Driveway #1 - AM - 2022 Total]

Accokeek Furnace Road Development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Accokeek Furnace Road											
3	L2	21	2.0	0.017	2.9	LOS A	0.1	1.8	0.10	0.02	33.8
8	T1	1	2.0	0.017	2.9	LOS A	0.1	1.8	0.10	0.02	33.7
18	R2	1	2.0	0.017	2.9	LOS A	0.1	1.8	0.10	0.02	32.8
Approach		23	2.0	0.017	2.9	LOS A	0.1	1.8	0.10	0.02	33.7
East: Public Road B											
1	L2	1	2.0	0.072	3.3	LOS A	0.3	8.1	0.10	0.03	36.3
6	T1	93	2.0	0.072	3.3	LOS A	0.3	8.1	0.10	0.03	36.2
16	R2	1	2.0	0.072	3.3	LOS A	0.3	8.1	0.10	0.03	35.1
Approach		96	2.0	0.072	3.3	LOS A	0.3	8.1	0.10	0.03	36.2
North: Site Driveway #1											
7	L2	1	2.0	0.005	3.0	LOS A	0.0	0.5	0.24	0.09	35.7
4	T1	1	2.0	0.005	3.0	LOS A	0.0	0.5	0.24	0.09	35.7
14	R2	3	2.0	0.005	3.0	LOS A	0.0	0.5	0.24	0.09	34.6
Approach		5	2.0	0.005	3.0	LOS A	0.0	0.5	0.24	0.09	35.0
West: Accokeek Furnace Road											
5	L2	1	2.0	0.020	2.8	LOS A	0.1	2.1	0.03	0.00	36.4
2	T1	23	2.0	0.020	2.8	LOS A	0.1	2.1	0.03	0.00	36.4
12	R2	3	2.0	0.020	2.8	LOS A	0.1	2.1	0.03	0.00	35.3
Approach		27	2.0	0.020	2.8	LOS A	0.1	2.1	0.03	0.00	36.2
All Vehicles		151	2.0	0.072	3.1	LOS A	0.3	8.1	0.09	0.02	35.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Accokeek Furnace Rd/Public Road B/Site Driveway #1 - PM - 2022 Total]

Accokeek Furnace Road Development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Accokeek Furnace Road											
3	L2	8	2.0	0.008	3.0	LOS A	0.0	0.8	0.20	0.07	34.1
8	T1	1	2.0	0.008	3.0	LOS A	0.0	0.8	0.20	0.07	34.0
18	R2	1	2.0	0.008	3.0	LOS A	0.0	0.8	0.20	0.07	33.1
Approach		10	2.0	0.008	3.0	LOS A	0.0	0.8	0.20	0.07	34.0
East: Public Road B											
1	L2	1	2.0	0.032	2.9	LOS A	0.1	3.4	0.07	0.01	36.4
6	T1	40	2.0	0.032	2.9	LOS A	0.1	3.4	0.07	0.01	36.3
16	R2	1	2.0	0.032	2.9	LOS A	0.1	3.4	0.07	0.01	35.2
Approach		42	2.0	0.032	2.9	LOS A	0.1	3.4	0.07	0.01	36.3
North: Site Driveway #1											
7	L2	1	2.0	0.004	2.8	LOS A	0.0	0.4	0.15	0.04	35.9
4	T1	1	2.0	0.004	2.8	LOS A	0.0	0.4	0.15	0.04	35.8
14	R2	3	2.0	0.004	2.8	LOS A	0.0	0.4	0.15	0.04	34.7
Approach		5	2.0	0.004	2.8	LOS A	0.0	0.4	0.15	0.04	35.1
West: Accokeek Furnace Road											
5	L2	5	2.0	0.078	3.3	LOS A	0.3	8.8	0.03	0.00	36.1
2	T1	79	2.0	0.078	3.3	LOS A	0.3	8.8	0.03	0.00	36.0
12	R2	21	2.0	0.078	3.3	LOS A	0.3	8.8	0.03	0.00	35.0
Approach		105	2.0	0.078	3.3	LOS A	0.3	8.8	0.03	0.00	35.8
All Vehicles		163	2.0	0.078	3.2	LOS A	0.3	8.8	0.06	0.01	35.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix K
2022 Mitigated Total Traffic Conditions Level of Service & Queuing Worksheets

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	927	27	93	459	118	626
v/c Ratio	0.76	0.03	0.18	0.19	0.49	0.75
Control Delay	26.4	3.2	21.6	3.6	38.0	20.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.4	3.2	21.6	3.6	38.0	20.2
Queue Length 50th (ft)	198	0	31	26	53	208
Queue Length 95th (ft)	306	10	74	52	108	360
Internal Link Dist (ft)	1281			1088	465	
Turn Bay Length (ft)		300	250			
Base Capacity (vph)	1534	987	654	2829	460	977
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.03	0.14	0.16	0.26	0.64

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	853	25	86	422	109	576
Future Volume (veh/h)	853	25	86	422	109	576
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1638	1776	1759	1696	1881
Adj Flow Rate, veh/h	927	27	93	459	118	626
Adj No. of Lanes	2	1	1	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	5	16	7	8	12	1
Cap, veh/h	1348	987	121	1794	512	621
Arrive On Green	0.39	0.39	0.07	0.54	0.32	0.32
Sat Flow, veh/h	3529	1392	1691	3431	1616	1599
Grp Volume(v), veh/h	927	27	93	459	118	626
Grp Sat Flow(s),veh/h/ln	1719	1392	1691	1671	1616	1599
Q Serve(g_s), s	13.8	0.4	3.3	4.5	3.3	19.5
Cycle Q Clear(g_c), s	13.8	0.4	3.3	4.5	3.3	19.5
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1348	987	121	1794	512	621
V/C Ratio(X)	0.69	0.03	0.77	0.26	0.23	1.01
Avail Cap(c_a), veh/h	1704	1131	728	3341	512	621
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.6	2.7	28.1	7.7	15.5	18.8
Incr Delay (d2), s/veh	0.8	0.0	9.8	0.1	0.2	38.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.6	0.3	1.9	2.1	1.5	17.0
LnGrp Delay(d),s/veh	16.4	2.7	37.8	7.7	15.7	56.9
LnGrp LOS	B	A	D	A	B	F
Approach Vol, veh/h	954			552	744	
Approach Delay, s/veh	16.0			12.8	50.4	
Approach LOS	B			B	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		24.0	8.9	28.6				37.5
Change Period (Y+Rc), s		4.5	4.5	4.5				4.5
Max Green Setting (Gmax), s		19.5	26.5	30.5				61.5
Max Q Clear Time (g_c+I1), s		21.5	5.3	15.8				6.5
Green Ext Time (p_c), s		0.0	0.2	8.3				14.5

Intersection Summary	
HCM 2010 Ctrl Delay	26.6
HCM 2010 LOS	C

Intersection: 4: Woodcutters Rd & Courthouse Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	264	243	55	110	103	86	146	259
Average Queue (ft)	156	131	9	46	41	21	63	135
95th Queue (ft)	234	218	35	89	84	59	120	229
Link Distance (ft)	1318	1318			1138	1138	481	481
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			300	250				
Storage Blk Time (%)		0						
Queuing Penalty (veh)		0						

Network Summary

Network wide Queuing Penalty: 0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	527	114	342	780	76	152
v/c Ratio	0.56	0.15	0.65	0.35	0.31	0.17
Control Delay	20.8	2.6	23.7	4.2	27.7	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.8	2.6	23.7	4.2	27.7	4.2
Queue Length 50th (ft)	73	0	91	41	22	10
Queue Length 95th (ft)	155	22	210	78	71	39
Internal Link Dist (ft)	1281			1088	465	
Turn Bay Length (ft)		300	250			
Base Capacity (vph)	1558	1078	1057	3195	637	1364
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.11	0.32	0.24	0.12	0.11

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	485	105	315	718	70	140
Future Volume (veh/h)	485	105	315	718	70	140
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1638	1776	1759	1696	1881
Adj Flow Rate, veh/h	527	114	342	780	76	152
Adj No. of Lanes	2	1	1	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	5	16	7	8	12	1
Cap, veh/h	1175	644	425	2300	196	595
Arrive On Green	0.34	0.34	0.25	0.69	0.12	0.12
Sat Flow, veh/h	3529	1392	1691	3431	1616	1599
Grp Volume(v), veh/h	527	114	342	780	76	152
Grp Sat Flow(s),veh/h/ln	1719	1392	1691	1671	1616	1599
Q Serve(g_s), s	5.6	2.3	9.0	4.5	2.0	3.1
Cycle Q Clear(g_c), s	5.6	2.3	9.0	4.5	2.0	3.1
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1175	644	425	2300	196	595
V/C Ratio(X)	0.45	0.18	0.81	0.34	0.39	0.26
Avail Cap(c_a), veh/h	1713	862	1165	4287	702	1096
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.1	7.4	16.6	3.0	19.1	10.3
Incr Delay (d2), s/veh	0.3	0.1	3.6	0.1	1.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	1.1	4.6	2.1	1.0	1.4
LnGrp Delay(d),s/veh	12.3	7.5	20.2	3.1	20.4	10.5
LnGrp LOS	B	A	C	A	C	B
Approach Vol, veh/h	641			1122	228	
Approach Delay, s/veh	11.5			8.3	13.8	
Approach LOS	B			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		10.2	16.3	20.6				37.0
Change Period (Y+Rc), s		4.5	4.5	4.5				4.5
Max Green Setting (Gmax), s		20.5	32.5	23.5				60.5
Max Q Clear Time (g_c+I1), s		5.1	11.0	7.6				6.5
Green Ext Time (p_c), s		0.6	1.0	8.5				13.7

Intersection Summary	
HCM 2010 Ctrl Delay	10.0
HCM 2010 LOS	A

Intersection: 4: Woodcutters Rd & Courthouse Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	179	152	98	223	144	111	105	68
Average Queue (ft)	99	68	34	117	60	49	42	29
95th Queue (ft)	155	128	78	191	113	94	87	56
Link Distance (ft)	1318	1318			1138	1138	481	481
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			300	250				
Storage Blk Time (%)				0	0			
Queuing Penalty (veh)				0	0			

Network Summary

Network wide Queuing Penalty: 0

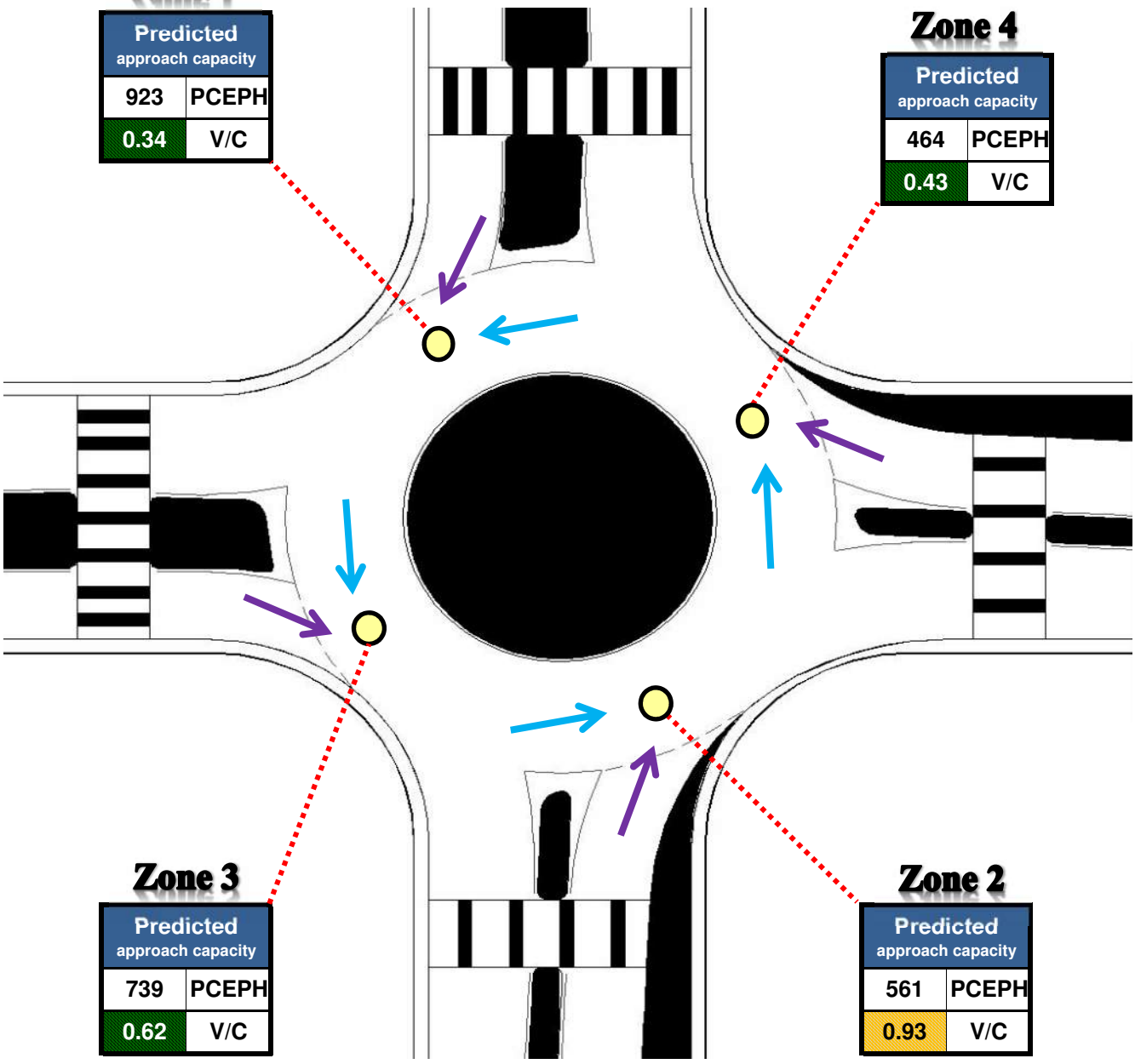
75' ICD Mini-Roundabout

Design and Results

Project Name:	*Accokeek Furnace Road Development*
Project Number:	*21446*
Location	*Stafford, VA*
Date	October 17, 2017

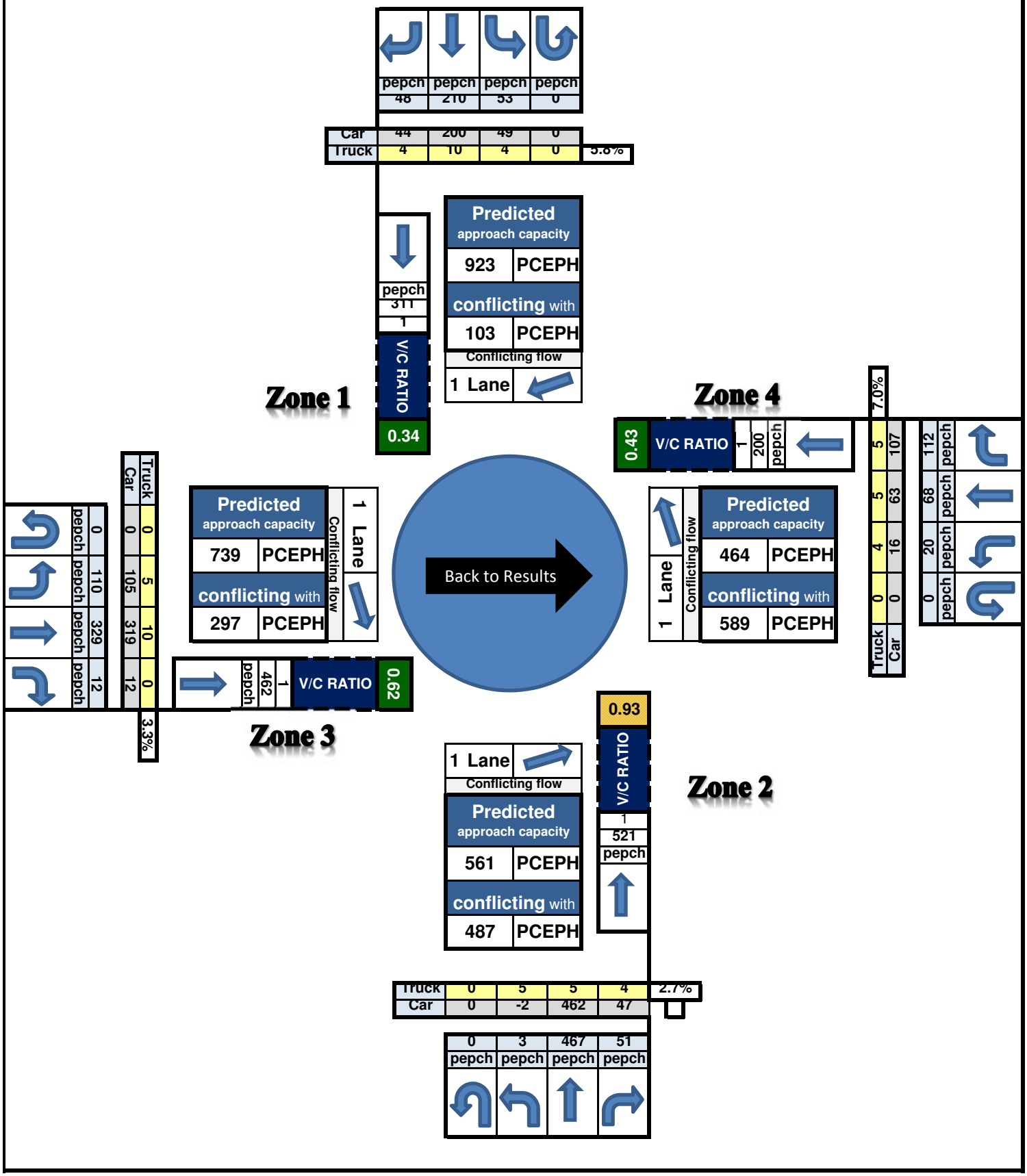
Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600

VOLUME / CAPACITY RATIO:				
Zone 1	0.34	Zone 4	0.43	
Zone 3	0.62	Zone 2	0.93	



75' ICD Mini-Roundabout

Data Input and Configuration



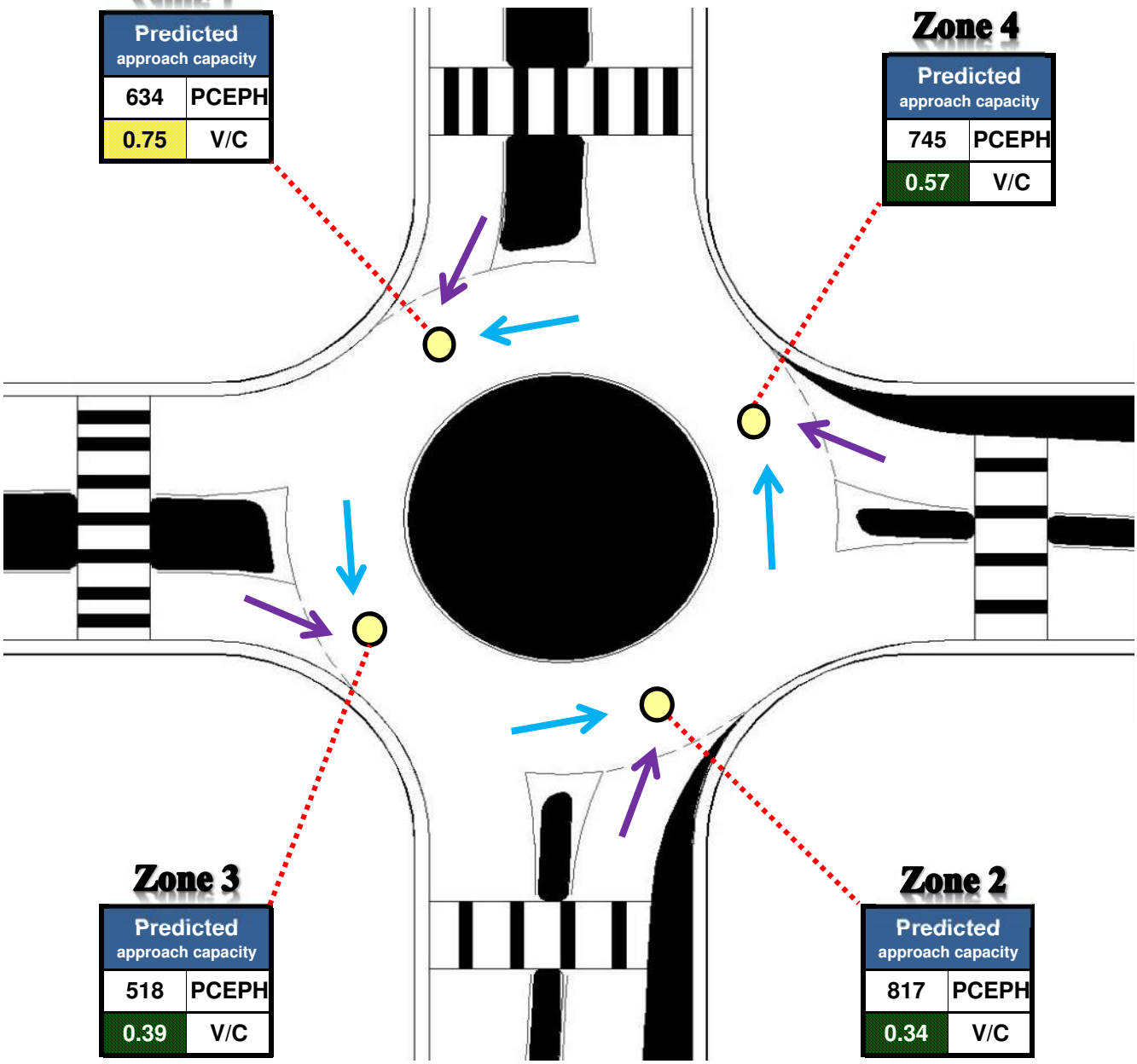
75' ICD Mini-Roundabout

Design and Results

Project Name:	*Accokeek Furnace Road Development*
Project Number:	*21446*
Location	*Stafford, VA*
Date	October 17, 2017

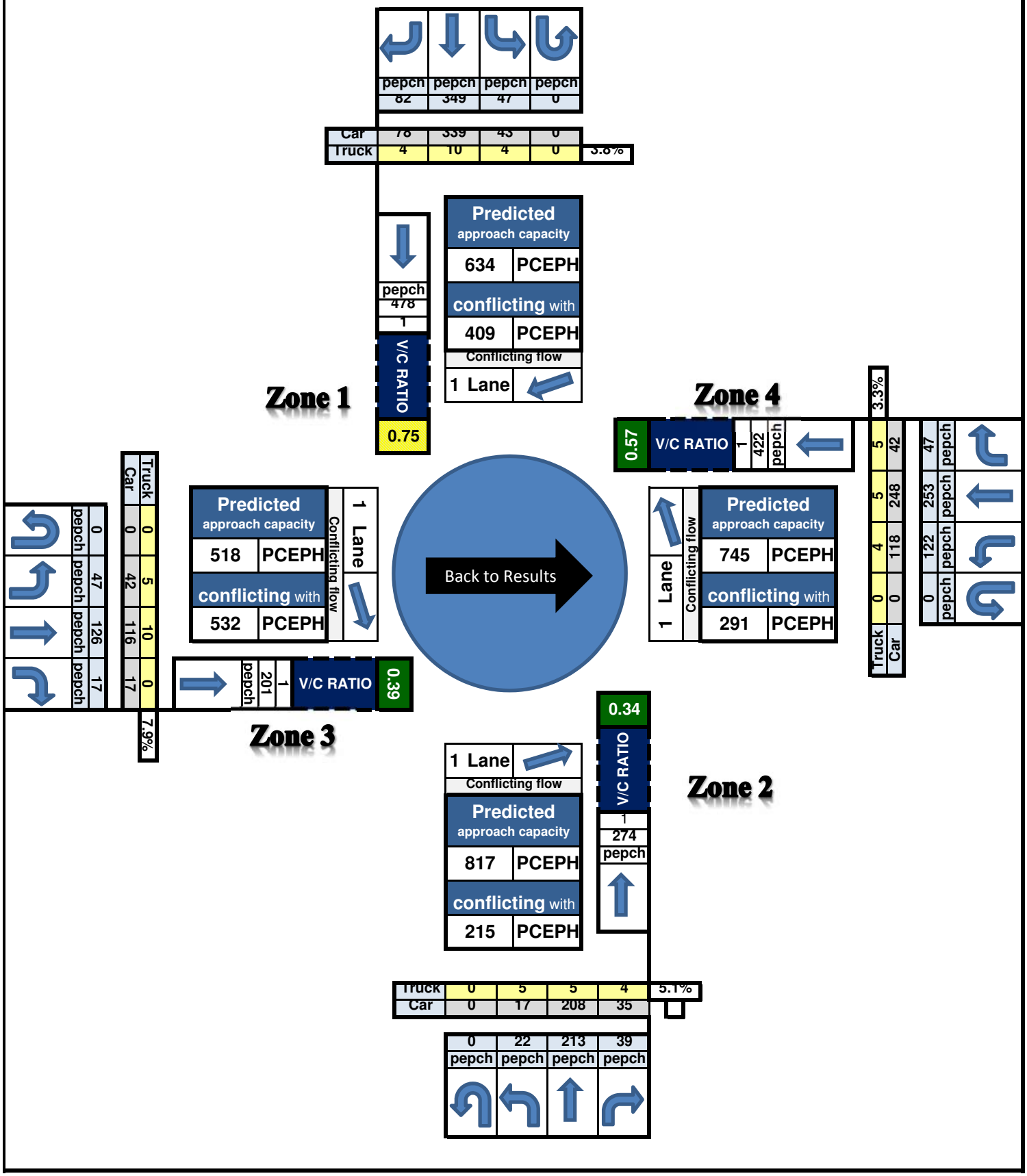
Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600

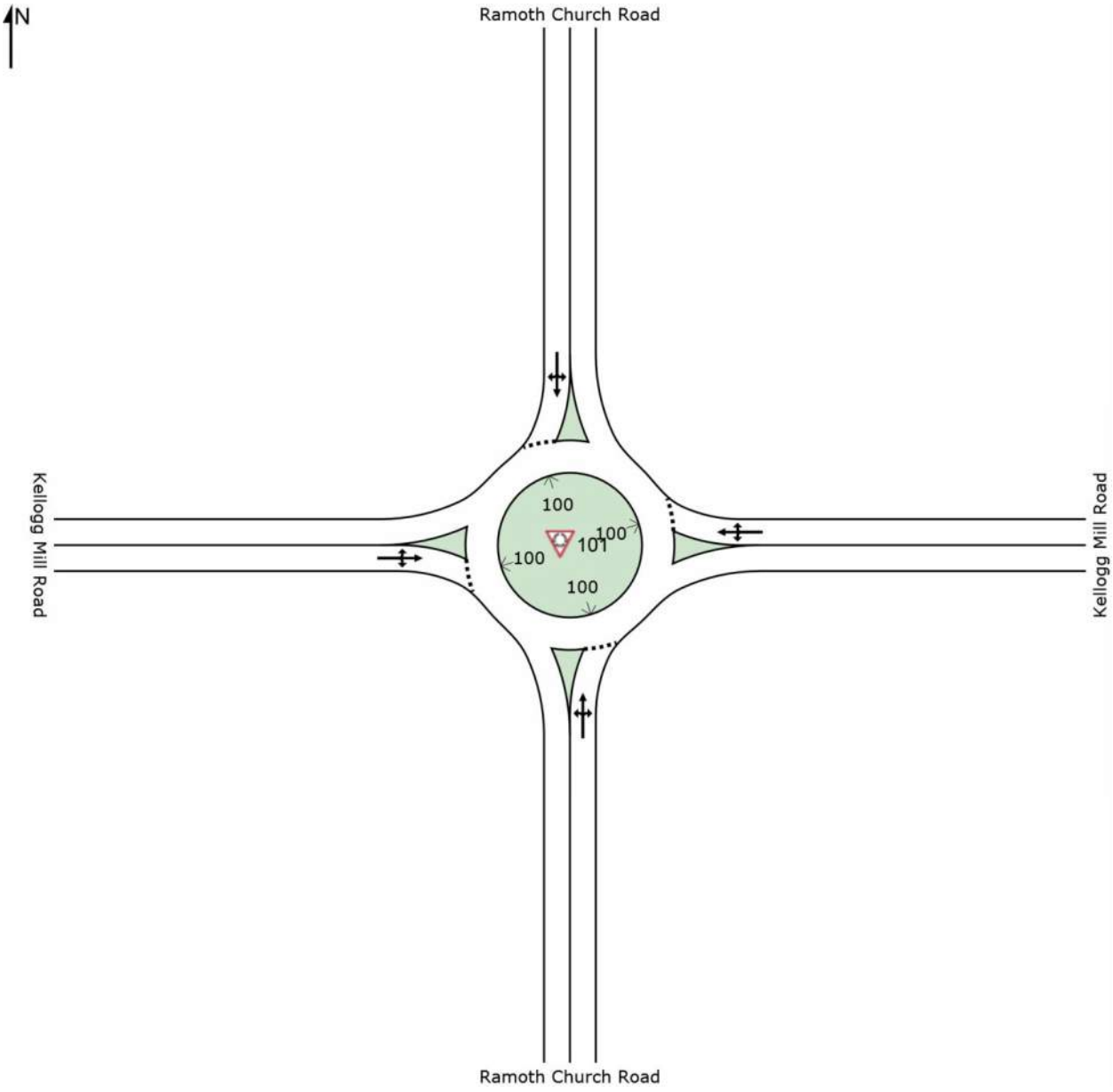
VOLUME / CAPACITY RATIO:				
Zone 1	0.75	Zone 4	0.57	
Zone 3	0.39	Zone 2	0.34	



75' ICD Mini-Roundabout

Data Input and Configuration




N
Ramoth Church Road
Kellogg Mill Road
Kellogg Mill Road
100
100
101
100
100
Ramoth Church Road

MOVEMENT SUMMARY

Site: 101 [Ramoth Church Rd/Kellogg Mill Rd - AM - Year 2022 Total]

Accokeek Furnace Road Development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Ramoth Church Road											
3	L2	120	4.0	0.650	14.7	LOS B	5.4	139.1	0.78	0.83	30.1
8	T1	310	4.0	0.650	14.7	LOS B	5.4	139.1	0.78	0.83	30.1
18	R2	137	4.0	0.650	14.7	LOS B	5.4	139.1	0.78	0.83	29.3
Approach		566	4.0	0.650	14.7	LOS B	5.4	139.1	0.78	0.83	29.9
East: Kellogg Mill Road											
1	L2	24	0.0	0.111	6.1	LOS A	0.4	11.3	0.58	0.53	34.0
6	T1	54	0.0	0.111	6.1	LOS A	0.4	11.3	0.58	0.53	33.9
16	R2	3	33.0	0.111	6.1	LOS A	0.4	11.3	0.58	0.53	32.2
Approach		82	1.3	0.111	6.1	LOS A	0.4	11.3	0.58	0.53	33.8
North: Ramoth Church Road											
7	L2	1	100.0	0.073	4.4	LOS A	0.3	7.6	0.34	0.20	33.9
4	T1	27	4.0	0.073	4.4	LOS A	0.3	7.6	0.34	0.20	35.5
14	R2	42	22.0	0.073	4.4	LOS A	0.3	7.6	0.34	0.20	33.9
Approach		71	16.3	0.073	4.4	LOS A	0.3	7.6	0.34	0.20	34.5
West: Kellogg Mill Road											
5	L2	151	7.0	0.370	6.3	LOS A	2.3	58.2	0.23	0.10	33.6
2	T1	249	0.0	0.370	6.3	LOS A	2.3	58.2	0.23	0.10	33.7
12	R2	71	3.0	0.370	6.3	LOS A	2.3	58.2	0.23	0.10	32.7
Approach		471	2.7	0.370	6.3	LOS A	2.3	58.2	0.23	0.10	33.5
All Vehicles		1189	4.0	0.650	10.2	LOS B	5.4	139.1	0.52	0.48	31.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Ramoth Church Rd/Kellogg Mill Rd - PM - Year 2022 Total]

Accokeek Furnace Road Development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Ramoth Church Road											
3	L2	62	6.0	0.149	4.7	LOS A	0.7	17.0	0.36	0.22	34.2
8	T1	74	6.0	0.149	4.7	LOS A	0.7	17.0	0.36	0.22	34.2
18	R2	25	0.0	0.149	4.7	LOS A	0.7	17.0	0.36	0.22	33.4
Approach		161	5.1	0.149	4.7	LOS A	0.7	17.0	0.36	0.22	34.1
East: Kellogg Mill Road											
1	L2	43	3.0	0.184	4.9	LOS A	0.9	21.9	0.38	0.25	34.7
6	T1	154	2.0	0.184	4.9	LOS A	0.9	21.9	0.38	0.25	34.6
16	R2	4	0.0	0.184	4.9	LOS A	0.9	21.9	0.38	0.25	33.7
Approach		202	2.2	0.184	4.9	LOS A	0.9	21.9	0.38	0.25	34.6
North: Ramoth Church Road											
7	L2	15	0.0	0.500	9.4	LOS A	3.2	80.1	0.59	0.48	33.0
4	T1	258	1.0	0.500	9.4	LOS A	3.2	80.1	0.59	0.48	32.9
14	R2	242	3.0	0.500	9.4	LOS A	3.2	80.1	0.59	0.48	31.9
Approach		515	1.9	0.500	9.4	LOS A	3.2	80.1	0.59	0.48	32.4
West: Kellogg Mill Road											
5	L2	59	2.0	0.226	5.9	LOS A	1.1	26.9	0.49	0.38	34.1
2	T1	115	2.0	0.226	5.9	LOS A	1.1	26.9	0.49	0.38	34.0
12	R2	48	0.0	0.226	5.9	LOS A	1.1	26.9	0.49	0.38	33.1
Approach		222	1.6	0.226	5.9	LOS A	1.1	26.9	0.49	0.38	33.8
All Vehicles		1100	2.4	0.500	7.2	LOS A	3.2	80.1	0.50	0.38	33.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix L
Design Year 2028 Total Traffic Conditions Level of Service Worksheets

Intersection	
Intersection Delay, s/veh	152
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	124	370	13	0	22	75	125	0	4	558	57
Future Vol, veh/h	0	124	370	13	0	22	75	125	0	4	558	57
Peak Hour Factor	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	8	3	9	2	8	16	2	2	0	3	2
Mvmt Flow	0	129	385	14	0	23	78	130	0	4	581	59
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	156.1	29	248.2
HCM LOS	F	D	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	24%	10%	16%
Vol Thru, %	90%	73%	34%	69%
Vol Right, %	9%	3%	56%	15%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	619	507	222	364
LT Vol	4	124	22	59
Through Vol	558	370	75	251
RT Vol	57	13	125	54
Lane Flow Rate	645	528	231	379
Geometry Grp	1	1	1	1
Degree of Util (X)	1.469	1.236	0.585	0.892
Departure Headway (Hd)	8.982	9.623	11.282	10.353
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	413	380	321	353
Service Time	6.982	7.623	9.282	8.353
HCM Lane V/C Ratio	1.562	1.389	0.72	1.074
HCM Control Delay	248.2	156.1	29	57.9
HCM Lane LOS	F	F	D	F
HCM 95th-tile Q	30.7	19.8	3.5	8.7

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	59	251	54
Future Vol, veh/h	0	59	251	54
Peak Hour Factor	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	2	5	9
Mvmt Flow	0	61	261	56
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	57.9
HCM LOS	F

Intersection	
Intersection Delay, s/veh	41.4
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations																
Traffic Vol, veh/h	0	156	257	73	0	23	54	4	0	123	321	142	0	1	28	44
Future Vol, veh/h	0	156	257	73	0	23	54	4	0	123	321	142	0	1	28	44
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	7	0	3	2	0	0	33	2	4	4	4	2	100	4	22
Mvmt Flow	0	170	279	79	0	25	59	4	0	134	349	154	0	1	30	48
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	48.8	12.1	42.7	14
HCM LOS	E	B	E	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	28%	0%	32%	28%	1%
Vol Thru, %	72%	0%	53%	67%	38%
Vol Right, %	0%	100%	15%	5%	60%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	444	142	486	81	73
LT Vol	123	0	156	23	1
Through Vol	321	0	257	54	28
RT Vol	0	142	73	4	44
Lane Flow Rate	483	154	528	88	79
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.941	0.264	0.936	0.181	0.195
Departure Headway (Hd)	7.016	6.16	6.381	7.408	8.83
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	516	582	571	483	405
Service Time	4.766	3.909	4.381	5.473	6.904
HCM Lane V/C Ratio	0.936	0.265	0.925	0.182	0.195
HCM Control Delay	52.8	11.1	48.8	12.1	14
HCM Lane LOS	F	B	E	B	B
HCM 95th-tile Q	11.7	1.1	12	0.7	0.7

Intersection	
Int Delay, s/veh	7.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	390	10	33	77	16	48
Future Vol, veh/h	390	10	33	77	16	48
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	0	0	67	67	5
Mvmt Flow	424	11	36	84	17	52

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	120	0	-	0	937	79
Stage 1	-	-	-	-	78	-
Stage 2	-	-	-	-	859	-
Critical Hdwy	4.12	-	-	-	7.07	6.25
Critical Hdwy Stg 1	-	-	-	-	6.07	-
Critical Hdwy Stg 2	-	-	-	-	6.07	-
Follow-up Hdwy	2.218	-	-	-	4.103	3.345
Pot Cap-1 Maneuver	1468	-	-	-	227	973
Stage 1	-	-	-	-	804	-
Stage 2	-	-	-	-	323	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1467	-	-	-	161	972
Mov Cap-2 Maneuver	-	-	-	-	161	-
Stage 1	-	-	-	-	804	-
Stage 2	-	-	-	-	229	-

Approach	EB	WB	SB
HCM Control Delay, s	8.2	0	14.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1467	-	-	-	161	972
HCM Lane V/C Ratio	0.289	-	-	-	0.108	0.054
HCM Control Delay (s)	8.4	0	-	-	30.1	8.9
HCM Lane LOS	A	A	-	-	D	A
HCM 95th %tile Q(veh)	1.2	-	-	-	0.4	0.2

Intersection	
Int Delay, s/veh	39.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Traffic Vol, veh/h	853	25	86	422	109	576
Future Vol, veh/h	853	25	86	422	109	576
Conflicting Peds, #/hr	0	0	0	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	300	250	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	5	16	7	8	12	1
Mvmt Flow	927	27	93	459	118	626

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	927	0	1344	464
Stage 1	-	-	-	-	927	-
Stage 2	-	-	-	-	417	-
Critical Hdwy	-	-	4.24	-	7.04	6.92
Critical Hdwy Stg 1	-	-	-	-	6.04	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	-	-	2.27	-	3.62	3.31
Pot Cap-1 Maneuver	-	-	703	-	131	~ 548
Stage 1	-	-	-	-	323	-
Stage 2	-	-	-	-	605	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	703	-	~ 114	~ 548
Mov Cap-2 Maneuver	-	-	-	-	~ 114	-
Stage 1	-	-	-	-	323	-
Stage 2	-	-	-	-	524	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	119.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	114	548	-	-	703	-
HCM Lane V/C Ratio	1.039	1.142	-	-	0.133	-
HCM Control Delay (s)	167.3	110	-	-	10.9	-
HCM Lane LOS	F	F	-	-	B	-
HCM 95th %tile Q(veh)	7	21	-	-	0.5	-

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

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	4	13	466	1	2	62
Future Vol, veh/h	4	13	466	1	2	62
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	-	-	250	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	16	52	1864	4	8	248

Major/Minor	Major2		Major1		Minor2	
Conflicting Flow All	1864	-	0	0	932	1922
Stage 1	-	-	-	-	0	58
Stage 2	-	-	-	-	932	1864
Critical Hdwy	4.1	-	-	-	6.8	6.5
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	5.8	5.5
Follow-up Hdwy	2.2	-	-	-	3.5	4
Pot Cap-1 Maneuver	328	-	-	-	269	~ 68
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	348	~ 124
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	328	-	-	-	256	0
Mov Cap-2 Maneuver	-	-	-	-	256	0
Stage 1	-	-	-	-	-	0
Stage 2	-	-	-	-	348	0

Approach	WB	NB	SB
HCM Control Delay, s	3.9	0	
HCM LOS			-

Minor Lane/Major Mvmt	NBT	NBR	WBL	WBR	SBLn1	SBLn2	SBLn3
Capacity (veh/h)	-	-	328	-	256	-	-
HCM Lane V/C Ratio	-	-	0.049	-	0.031	-	-
HCM Control Delay (s)	-	-	16.5	-	19.5	-	-
HCM Lane LOS	-	-	C	-	C	-	-
HCM 95th %tile Q(veh)	-	-	0.2	-	0.1	-	-

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

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	15	0	0	68	0	1	0	0	0	0	8
Future Vol, veh/h	2	15	0	0	68	0	1	0	0	0	0	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	25	25	25	25	25	25	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	8	60	0	0	272	0	4	0	0	0	0	32

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	272	0	0	60	0	0	364	348	60	348	348	272
Stage 1	-	-	-	-	-	-	76	76	-	272	272	-
Stage 2	-	-	-	-	-	-	288	272	-	76	76	-
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	1303	-	-	1556	-	-	596	579	1011	610	579	772
Stage 1	-	-	-	-	-	-	938	836	-	738	688	-
Stage 2	-	-	-	-	-	-	724	688	-	938	836	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1303	-	-	1556	-	-	569	576	1011	607	576	772
Mov Cap-2 Maneuver	-	-	-	-	-	-	569	576	-	607	576	-
Stage 1	-	-	-	-	-	-	932	831	-	734	688	-
Stage 2	-	-	-	-	-	-	694	688	-	932	831	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.9	0	11.4	9.9
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	569	1303	-	-	1556	-	-	772
HCM Lane V/C Ratio	0.007	0.006	-	-	-	-	-	0.041
HCM Control Delay (s)	11.4	7.8	0	-	0	-	-	9.9
HCM Lane LOS	B	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	7	28	0	0	0
Future Vol, veh/h	1	7	28	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	4	28	112	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	112	0	-	0	148	112
Stage 1	-	-	-	-	112	-
Stage 2	-	-	-	-	36	-
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	1490	-	-	-	849	947
Stage 1	-	-	-	-	918	-
Stage 2	-	-	-	-	992	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1490	-	-	-	846	947
Mov Cap-2 Maneuver	-	-	-	-	846	-
Stage 1	-	-	-	-	918	-
Stage 2	-	-	-	-	989	-

Approach	EB	WB	SB
HCM Control Delay, s	0.9	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1490	-	-	-	-
HCM Lane V/C Ratio	0.003	-	-	-	-
HCM Control Delay (s)	7.4	0	-	-	0
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	13	60	0	0	7
Future Vol, veh/h	1	13	60	0	0	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, %	-	0	0	-	0	-
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	4	52	240	0	0	28

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	240	0	-	0	300	240
Stage 1	-	-	-	-	240	-
Stage 2	-	-	-	-	60	-
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	1339	-	-	-	696	804
Stage 1	-	-	-	-	805	-
Stage 2	-	-	-	-	968	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1339	-	-	-	694	804
Mov Cap-2 Maneuver	-	-	-	-	694	-
Stage 1	-	-	-	-	805	-
Stage 2	-	-	-	-	965	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1339	-	-	-	804
HCM Lane V/C Ratio	0.003	-	-	-	0.035
HCM Control Delay (s)	7.7	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	6	18	0	0	0
Future Vol, veh/h	0	6	18	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	24	72	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	72	0	-	0	96	72
Stage 1	-	-	-	-	72	-
Stage 2	-	-	-	-	24	-
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	1541	-	-	-	908	996
Stage 1	-	-	-	-	956	-
Stage 2	-	-	-	-	1004	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1541	-	-	-	908	996
Mov Cap-2 Maneuver	-	-	-	-	908	-
Stage 1	-	-	-	-	956	-
Stage 2	-	-	-	-	1004	-

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

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1541	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Intersection Delay, s/veh	7.8
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	3	10	0	0	0	44	0	0	0	0	0
Future Vol, veh/h	0	3	10	0	0	0	44	0	0	0	0	0
Peak Hour Factor	0.92	0.25	0.25	0.25	0.92	0.25	0.25	0.25	0.92	0.25	0.25	0.25
Heavy Vehicles, %	2	0	0	0	2	0	0	0	2	0	0	0
Mvmt Flow	0	12	40	0	0	0	176	0	0	0	0	0
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	7.5	8.1	0
HCM LOS	A	A	-

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	23%	0%	0%
Vol Thru, %	100%	77%	100%	0%
Vol Right, %	0%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	13	44	13
LT Vol	0	3	0	0
Through Vol	0	10	44	0
RT Vol	0	0	0	13
Lane Flow Rate	0	52	176	52
Geometry Grp	1	1	1	1
Degree of Util (X)	0	0.06	0.197	0.055
Departure Headway (Hd)	4.446	4.17	4.03	3.791
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	0	853	889	951
Service Time	2.448	2.223	2.06	1.791
HCM Lane V/C Ratio	0	0.061	0.198	0.055
HCM Control Delay	7.4	7.5	8.1	7
HCM Lane LOS	N	A	A	A
HCM 95th-tile Q	0	0.2	0.7	0.2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	0	0	13
Future Vol, veh/h	0	0	0	13
Peak Hour Factor	0.92	0.25	0.25	0.25
Heavy Vehicles, %	2	0	0	0
Mvmt Flow	0	0	0	52
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	7
HCM LOS	A

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	1	0	0	0	2	0	0	9	0
Future Vol, veh/h	0	0	0	1	0	0	0	2	0	0	9	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	25	25	25	25	25	25	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	0	0	4	0	0	0	8	0	0	36	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	44	44	36	44	44	8	36	0	0	8	0	0
Stage 1	36	36	-	8	8	-	-	-	-	-	-	-
Stage 2	8	8	-	36	36	-	-	-	-	-	-	-
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	963	852	1042	963	852	1080	1588	-	-	1625	-	-
Stage 1	985	869	-	1019	893	-	-	-	-	-	-	-
Stage 2	1019	893	-	985	869	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	963	852	1042	963	852	1080	1588	-	-	1625	-	-
Mov Cap-2 Maneuver	963	852	-	963	852	-	-	-	-	-	-	-
Stage 1	985	869	-	1019	893	-	-	-	-	-	-	-
Stage 2	1019	893	-	985	869	-	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1588	-	-	-	963	1625	-	-
HCM Lane V/C Ratio	-	-	-	-	0.004	-	-	-
HCM Control Delay (s)	0	-	-	0	8.8	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0	0	-	-

Intersection	
Int Delay, s/veh	7.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	1	0	9	2	0	0	0	5	0	0	12
Future Vol, veh/h	2	1	0	9	2	0	0	0	5	0	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	25	25	25	25	25	25	25	25	25	25	25	25
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	8	4	0	36	8	0	0	0	20	0	0	48

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	8	0	0	4	0	0	124	100	4	110	100	8
Stage 1	-	-	-	-	-	-	20	20	-	80	80	-
Stage 2	-	-	-	-	-	-	104	80	-	30	20	-
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	1625	-	-	1631	-	-	855	794	1085	873	794	1080
Stage 1	-	-	-	-	-	-	1004	883	-	934	832	-
Stage 2	-	-	-	-	-	-	907	832	-	992	883	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1625	-	-	1631	-	-	800	773	1085	839	773	1080
Mov Cap-2 Maneuver	-	-	-	-	-	-	800	773	-	839	773	-
Stage 1	-	-	-	-	-	-	999	879	-	929	814	-
Stage 2	-	-	-	-	-	-	848	814	-	969	879	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	4.8	5.9	8.4	8.5
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	1085	1625	-	-	1631	-	-	1080
HCM Lane V/C Ratio	0.018	0.005	-	-	0.022	-	-	0.044
HCM Control Delay (s)	8.4	7.2	0	-	7.3	0	-	8.5
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0.1

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	5	15	0	0	10
Future Vol, veh/h	2	5	15	0	0	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, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	5	16	0	0	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	16	0	-	0	26	16
Stage 1	-	-	-	-	16	-
Stage 2	-	-	-	-	10	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1602	-	-	-	989	1063
Stage 1	-	-	-	-	1007	-
Stage 2	-	-	-	-	1013	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1602	-	-	-	988	1063
Mov Cap-2 Maneuver	-	-	-	-	988	-
Stage 1	-	-	-	-	1007	-
Stage 2	-	-	-	-	1012	-

Approach	EB	WB	SB
HCM Control Delay, s	2.1	0	8.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1602	-	-	-	1063
HCM Lane V/C Ratio	0.001	-	-	-	0.01
HCM Control Delay (s)	7.2	0	-	-	8.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Intersection Delay, s/veh	93.2
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	52	141	20	0	137	285	53	0	24	254	44
Future Vol, veh/h	0	52	141	20	0	137	285	53	0	24	254	44
Peak Hour Factor	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	8	3	9	2	5	3	5	2	0	2	10
Mvmt Flow	0	53	144	20	0	140	291	54	0	24	259	45
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	24.5	93.3	35.8
HCM LOS	C	F	E

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	7%	24%	29%	9%
Vol Thru, %	79%	66%	60%	74%
Vol Right, %	14%	9%	11%	17%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	322	213	475	563
LT Vol	24	52	137	53
Through Vol	254	141	285	417
RT Vol	44	20	53	93
Lane Flow Rate	329	217	485	574
Geometry Grp	1	1	1	1
Degree of Util (X)	0.758	0.545	1.068	1.241
Departure Headway (Hd)	9.188	10.085	8.667	8.163
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	398	361	422	448
Service Time	7.188	8.085	6.667	6.163
HCM Lane V/C Ratio	0.827	0.601	1.149	1.281
HCM Control Delay	35.8	24.5	93.3	152
HCM Lane LOS	E	C	F	F
HCM 95th-tile Q	6.2	3.1	14.8	22.4

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	53	417	93
Future Vol, veh/h	0	53	417	93
Peak Hour Factor	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	0	2	4
Mvmt Flow	0	54	426	95
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	152
HCM LOS	F

Intersection	
Intersection Delay, s/veh	25.7
Intersection LOS	D

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations																
Traffic Vol, veh/h	0	61	117	50	0	45	159	5	0	65	77	25	0	16	267	251
Future Vol, veh/h	0	61	117	50	0	45	159	5	0	65	77	25	0	16	267	251
Peak Hour Factor	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	0	2	3	2	0	2	6	6	0	2	0	1	3
Mvmt Flow	0	64	123	53	0	47	167	5	0	68	81	26	0	17	281	264
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	15.1	14.8	12.9	38.5
HCM LOS	C	B	B	E

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	46%	0%	27%	22%	3%
Vol Thru, %	54%	0%	51%	76%	50%
Vol Right, %	0%	100%	22%	2%	47%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	142	25	228	209	534
LT Vol	65	0	61	45	16
Through Vol	77	0	117	159	267
RT Vol	0	25	50	5	251
Lane Flow Rate	149	26	240	220	562
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.308	0.047	0.446	0.419	0.893
Departure Headway (Hd)	7.42	6.468	6.683	6.853	5.718
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	483	551	538	524	635
Service Time	5.192	4.239	4.75	4.923	3.769
HCM Lane V/C Ratio	0.308	0.047	0.446	0.42	0.885
HCM Control Delay	13.5	9.6	15.1	14.8	38.5
HCM Lane LOS	B	A	C	B	E
HCM 95th-tile Q	1.3	0.1	2.3	2.1	10.9

Intersection	
Int Delay, s/veh	7.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	84	29	16	34	77	118
Future Vol, veh/h	84	29	16	34	77	118
Conflicting Peds, #/hr	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	33	3
Mvmt Flow	91	32	17	37	84	128

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	54	0	-	0	250	37
Stage 1	-	-	-	-	36	-
Stage 2	-	-	-	-	214	-
Critical Hdwy	4.1	-	-	-	6.73	6.23
Critical Hdwy Stg 1	-	-	-	-	5.73	-
Critical Hdwy Stg 2	-	-	-	-	5.73	-
Follow-up Hdwy	2.2	-	-	-	3.797	3.327
Pot Cap-1 Maneuver	1564	-	-	-	676	1032
Stage 1	-	-	-	-	912	-
Stage 2	-	-	-	-	753	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1563	-	-	-	636	1031
Mov Cap-2 Maneuver	-	-	-	-	636	-
Stage 1	-	-	-	-	912	-
Stage 2	-	-	-	-	709	-

Approach	EB	WB	SB
HCM Control Delay, s	5.5	0	10
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1563	-	-	-	636	1031
HCM Lane V/C Ratio	0.058	-	-	-	0.132	0.124
HCM Control Delay (s)	7.4	0	-	-	11.5	9
HCM Lane LOS	A	A	-	-	B	A
HCM 95th %tile Q(veh)	0.2	-	-	-	0.5	0.4

Intersection	
Int Delay, s/veh	28.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Traffic Vol, veh/h	562	116	346	828	78	154
Future Vol, veh/h	562	116	346	828	78	154
Conflicting Peds, #/hr	0	1	1	0	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	300	250	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	4	5	0	3	16	0
Mvmt Flow	592	122	364	872	82	162

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	593	0	1757	298
Stage 1	-	-	-	-	593	-
Stage 2	-	-	-	-	1164	-
Critical Hdwy	-	-	4.1	-	7.12	6.9
Critical Hdwy Stg 1	-	-	-	-	6.12	-
Critical Hdwy Stg 2	-	-	-	-	6.12	-
Follow-up Hdwy	-	-	2.2	-	3.66	3.3
Pot Cap-1 Maneuver	-	-	993	-	~ 65	704
Stage 1	-	-	-	-	478	-
Stage 2	-	-	-	-	232	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	992	-	~ 41	703
Mov Cap-2 Maneuver	-	-	-	-	~ 41	-
Stage 1	-	-	-	-	478	-
Stage 2	-	-	-	-	147	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.2	236
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	41	703	-	-	992	-
HCM Lane V/C Ratio	2.003	0.231	-	-	0.367	-
HCM Control Delay (s)	$ 679	11.6	-	-	10.7	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	8.7	0.9	-	-	1.7	-

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

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	6	115	4	12	192
Future Vol, veh/h	2	6	115	4	12	192
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	-	-	250	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	2	7	125	4	13	209

Major/Minor	Major2		Major1		Minor2	
Conflicting Flow All	125	-	0	0	63	133
Stage 1	-	-	-	-	0	8
Stage 2	-	-	-	-	63	125
Critical Hdwy	4.1	-	-	-	6.8	6.5
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	5.8	5.5
Follow-up Hdwy	2.2	-	-	-	3.5	4
Pot Cap-1 Maneuver	1474	-	-	-	941	761
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	958	796
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1474	-	-	-	940	0
Mov Cap-2 Maneuver	-	-	-	-	940	0
Stage 1	-	-	-	-	-	0
Stage 2	-	-	-	-	958	0

Approach	WB	NB	SB
HCM Control Delay, s	1.9	0	
HCM LOS			-

Minor Lane/Major Mvmt	NBT	NBR	WBL	WBR	SBLn1	SBLn2	SBLn3
Capacity (veh/h)	-	-	1474	-	940	-	-
HCM Lane V/C Ratio	-	-	0.001	-	0.014	-	-
HCM Control Delay (s)	-	-	7.4	-	8.9	-	-
HCM Lane LOS	-	-	A	-	A	-	-
HCM 95th %tile Q(veh)	-	-	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	65	0	0	33	0	1	0	0	0	0	4
Future Vol, veh/h	8	65	0	0	33	0	1	0	0	0	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, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	9	71	0	0	36	0	1	0	0	0	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	36	0	0	71	0	0	126	124	71	124	124	36
Stage 1	-	-	-	-	-	-	88	88	-	36	36	-
Stage 2	-	-	-	-	-	-	38	36	-	88	88	-
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	1588	-	-	1542	-	-	852	770	997	855	770	1042
Stage 1	-	-	-	-	-	-	925	826	-	985	869	-
Stage 2	-	-	-	-	-	-	982	869	-	925	826	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1588	-	-	1542	-	-	845	765	997	851	765	1042
Mov Cap-2 Maneuver	-	-	-	-	-	-	845	765	-	851	765	-
Stage 1	-	-	-	-	-	-	919	821	-	979	869	-
Stage 2	-	-	-	-	-	-	978	869	-	919	821	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0	9.3	8.5
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	845	1588	-	-	1542	-	-	1042
HCM Lane V/C Ratio	0.001	0.005	-	-	-	-	-	0.004
HCM Control Delay (s)	9.3	7.3	0	-	0	-	-	8.5
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	18	7	0	0	0
Future Vol, veh/h	1	18	7	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	1	20	8	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	8	0	-	0	30	8
Stage 1	-	-	-	-	8	-
Stage 2	-	-	-	-	22	-
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	1625	-	-	-	989	1080
Stage 1	-	-	-	-	1020	-
Stage 2	-	-	-	-	1006	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1625	-	-	-	988	1080
Mov Cap-2 Maneuver	-	-	-	-	988	-
Stage 1	-	-	-	-	1020	-
Stage 2	-	-	-	-	1005	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1625	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	-	-
HCM Control Delay (s)	7.2	0	-	-	0
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	7	56	28	0	0	3
Future Vol, veh/h	7	56	28	0	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	8	61	30	0	0	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	30	0	-	0	106	30
Stage 1	-	-	-	-	30	-
Stage 2	-	-	-	-	76	-
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	1596	-	-	-	897	1050
Stage 1	-	-	-	-	998	-
Stage 2	-	-	-	-	952	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1596	-	-	-	893	1050
Mov Cap-2 Maneuver	-	-	-	-	893	-
Stage 1	-	-	-	-	998	-
Stage 2	-	-	-	-	947	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	8.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1596	-	-	-	1050
HCM Lane V/C Ratio	0.005	-	-	-	0.003
HCM Control Delay (s)	7.3	0	-	-	8.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	8	4	0	0	0
Future Vol, veh/h	0	8	4	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	9	4	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	4	0	-	0	13	4
Stage 1	-	-	-	-	4	-
Stage 2	-	-	-	-	9	-
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	1631	-	-	-	1011	1085
Stage 1	-	-	-	-	1024	-
Stage 2	-	-	-	-	1019	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1631	-	-	-	1011	1085
Mov Cap-2 Maneuver	-	-	-	-	1011	-
Stage 1	-	-	-	-	1024	-
Stage 2	-	-	-	-	1019	-

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

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1631	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Intersection Delay, s/veh	7.2
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	14	42	0	0	0	20	0	0	0	0	0
Future Vol, veh/h	0	14	42	0	0	0	20	0	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	0	0	0	2	0	0	0	2	0	0	0
Mvmt Flow	0	15	46	0	0	0	22	0	0	0	0	0
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	7.3	7.1	0
HCM LOS	A	A	-

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	25%	0%	0%
Vol Thru, %	100%	75%	100%	0%
Vol Right, %	0%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	56	20	7
LT Vol	0	14	0	0
Through Vol	0	42	20	0
RT Vol	0	0	0	7
Lane Flow Rate	0	61	22	8
Geometry Grp	1	1	1	1
Degree of Util (X)	0	0.067	0.024	0.007
Departure Headway (Hd)	4.048	3.98	3.959	3.441
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	0	905	907	1036
Service Time	2.083	1.984	1.97	1.476
HCM Lane V/C Ratio	0	0.067	0.024	0.008
HCM Control Delay	7.1	7.3	7.1	6.5
HCM Lane LOS	N	A	A	A
HCM 95th-tile Q	0	0.2	0.1	0

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	0	0	7
Future Vol, veh/h	0	0	0	7
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	0	0	0
Mvmt Flow	0	0	0	8
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	6.5
HCM LOS	A

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	1	0	0	0	9	2	0	4	0
Future Vol, veh/h	0	0	0	1	0	0	0	9	2	0	4	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	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	0	0	1	0	0	0	10	2	0	4	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	15	16	4	15	15	11	4	0	0	12	0	0
Stage 1	4	4	-	11	11	-	-	-	-	-	-	-
Stage 2	11	12	-	4	4	-	-	-	-	-	-	-
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	1006	882	1085	1006	883	1076	1631	-	-	1620	-	-
Stage 1	1024	897	-	1015	890	-	-	-	-	-	-	-
Stage 2	1015	890	-	1024	897	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	1006	882	1085	1006	883	1076	1631	-	-	1620	-	-
Mov Cap-2 Maneuver	1006	882	-	1006	883	-	-	-	-	-	-	-
Stage 1	1024	897	-	1015	890	-	-	-	-	-	-	-
Stage 2	1015	890	-	1024	897	-	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1631	-	-	-	1006	1620	-	-
HCM Lane V/C Ratio	-	-	-	-	0.001	-	-	-
HCM Control Delay (s)	0	-	-	0	8.6	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0	0	-	-

Intersection	
Int Delay, s/veh	6.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	11	3	0	0	1	0	0	0	0	0	0	6
Future Vol, veh/h	11	3	0	0	1	0	0	0	0	0	0	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	12	3	0	0	1	0	0	0	0	0	0	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1	0	0	3	0	0	31	28	3	28	28	1
Stage 1	-	-	-	-	-	-	27	27	-	1	1	-
Stage 2	-	-	-	-	-	-	4	1	-	27	27	-
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	1635	-	-	1632	-	-	982	869	1087	987	869	1090
Stage 1	-	-	-	-	-	-	996	877	-	1027	899	-
Stage 2	-	-	-	-	-	-	1024	899	-	996	877	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1635	-	-	1632	-	-	971	863	1087	982	863	1090
Mov Cap-2 Maneuver	-	-	-	-	-	-	971	863	-	982	863	-
Stage 1	-	-	-	-	-	-	989	871	-	1020	899	-
Stage 2	-	-	-	-	-	-	1018	899	-	989	871	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	5.7	0	0	8.3
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1635	-	-	1632	-	-	1090
HCM Lane V/C Ratio	-	0.007	-	-	-	-	-	0.006
HCM Control Delay (s)	0	7.2	0	-	0	-	-	8.3
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	0

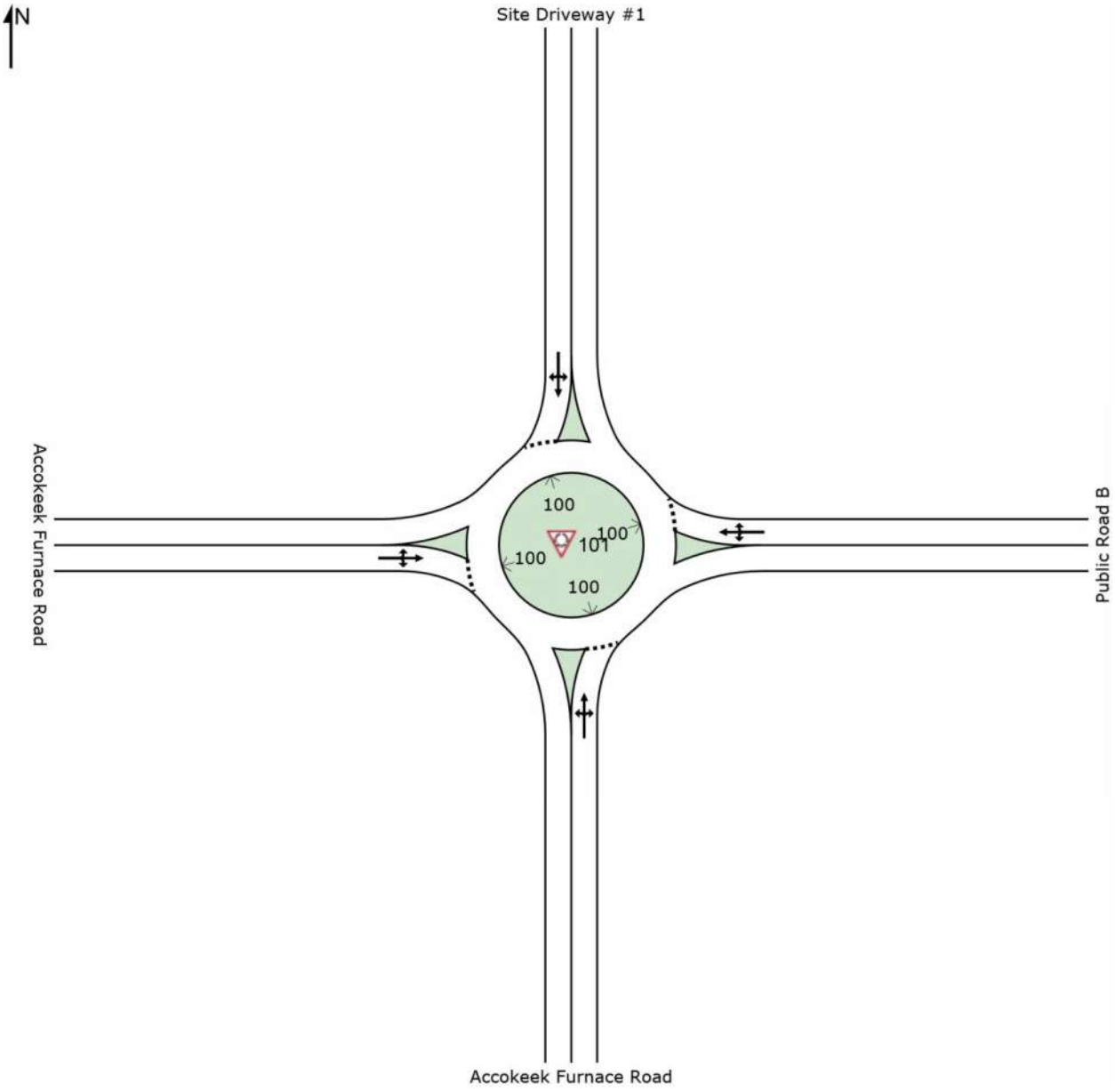
Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	5	15	0	0	10
Future Vol, veh/h	2	5	15	0	0	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, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	5	16	0	0	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	16	0	-	0	26	16
Stage 1	-	-	-	-	16	-
Stage 2	-	-	-	-	10	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1602	-	-	-	989	1063
Stage 1	-	-	-	-	1007	-
Stage 2	-	-	-	-	1013	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1602	-	-	-	988	1063
Mov Cap-2 Maneuver	-	-	-	-	988	-
Stage 1	-	-	-	-	1007	-
Stage 2	-	-	-	-	1012	-

Approach	EB	WB	SB
HCM Control Delay, s	2.1	0	8.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1602	-	-	-	1063
HCM Lane V/C Ratio	0.001	-	-	-	0.01
HCM Control Delay (s)	7.2	0	-	-	8.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0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Site Driveway #1
Accokeek Furnace Road
Public Road B
Accokeek Furnace Road
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MOVEMENT SUMMARY

Site: 101 [Accokeek Furnace Rd/Public Road B/Site Driveway #1 - AM - 2028 Total]

Accokeek Furnace Road Development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Accokeek Furnace Road											
3	L2	21	2.0	0.017	2.9	LOS A	0.1	1.8	0.10	0.02	33.8
8	T1	1	2.0	0.017	2.9	LOS A	0.1	1.8	0.10	0.02	33.7
18	R2	1	2.0	0.017	2.9	LOS A	0.1	1.8	0.10	0.02	32.8
Approach		23	2.0	0.017	2.9	LOS A	0.1	1.8	0.10	0.02	33.7
East: Public Road B											
1	L2	1	2.0	0.074	3.3	LOS A	0.3	8.3	0.10	0.03	36.3
6	T1	96	2.0	0.074	3.3	LOS A	0.3	8.3	0.10	0.03	36.2
16	R2	1	2.0	0.074	3.3	LOS A	0.3	8.3	0.10	0.03	35.1
Approach		98	2.0	0.074	3.3	LOS A	0.3	8.3	0.10	0.03	36.2
North: Site Driveway #1											
7	L2	1	2.0	0.005	3.0	LOS A	0.0	0.5	0.24	0.09	35.7
4	T1	1	2.0	0.005	3.0	LOS A	0.0	0.5	0.24	0.09	35.7
14	R2	3	2.0	0.005	3.0	LOS A	0.0	0.5	0.24	0.09	34.6
Approach		5	2.0	0.005	3.0	LOS A	0.0	0.5	0.24	0.09	35.0
West: Accokeek Furnace Road											
5	L2	1	2.0	0.021	2.8	LOS A	0.1	2.2	0.03	0.00	36.4
2	T1	24	2.0	0.021	2.8	LOS A	0.1	2.2	0.03	0.00	36.4
12	R2	3	2.0	0.021	2.8	LOS A	0.1	2.2	0.03	0.00	35.3
Approach		28	2.0	0.021	2.8	LOS A	0.1	2.2	0.03	0.00	36.2
All Vehicles		154	2.0	0.074	3.1	LOS A	0.3	8.3	0.09	0.02	35.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Accokeek Furnace Rd/Public Road B/Site Driveway #1 - PM - 2028 Total]

Accokeek Furnace Road Development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Accokeek Furnace Road											
3	L2	8	2.0	0.008	3.0	LOS A	0.0	0.8	0.20	0.07	34.1
8	T1	1	2.0	0.008	3.0	LOS A	0.0	0.8	0.20	0.07	34.0
18	R2	1	2.0	0.008	3.0	LOS A	0.0	0.8	0.20	0.07	33.1
Approach		10	2.0	0.008	3.0	LOS A	0.0	0.8	0.20	0.07	34.0
East: Public Road B											
1	L2	1	2.0	0.032	2.9	LOS A	0.1	3.4	0.07	0.01	36.4
6	T1	40	2.0	0.032	2.9	LOS A	0.1	3.4	0.07	0.01	36.3
16	R2	1	2.0	0.032	2.9	LOS A	0.1	3.4	0.07	0.01	35.2
Approach		42	2.0	0.032	2.9	LOS A	0.1	3.4	0.07	0.01	36.3
North: Site Driveway #1											
7	L2	1	2.0	0.004	2.8	LOS A	0.0	0.4	0.15	0.04	35.9
4	T1	1	2.0	0.004	2.8	LOS A	0.0	0.4	0.15	0.04	35.8
14	R2	3	2.0	0.004	2.8	LOS A	0.0	0.4	0.15	0.04	34.7
Approach		5	2.0	0.004	2.8	LOS A	0.0	0.4	0.15	0.04	35.1
West: Accokeek Furnace Road											
5	L2	5	2.0	0.078	3.3	LOS A	0.3	8.8	0.03	0.00	36.1
2	T1	79	2.0	0.078	3.3	LOS A	0.3	8.8	0.03	0.00	36.0
12	R2	21	2.0	0.078	3.3	LOS A	0.3	8.8	0.03	0.00	35.0
Approach		105	2.0	0.078	3.3	LOS A	0.3	8.8	0.03	0.00	35.8
All Vehicles		163	2.0	0.078	3.2	LOS A	0.3	8.8	0.06	0.01	35.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix M
Design Year 2028 Mitigated Total Traffic Conditions Level of Service Worksheets

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	802	23	72	392	90	487
v/c Ratio	0.66	0.03	0.18	0.17	0.36	0.61
Control Delay	19.8	3.0	20.4	3.5	30.6	14.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.8	3.0	20.4	3.5	30.6	14.4
Queue Length 50th (ft)	115	0	19	18	27	97
Queue Length 95th (ft)	233	9	59	39	86	241
Internal Link Dist (ft)	1281			1088	465	
Turn Bay Length (ft)		300	250			
Base Capacity (vph)	1996	1136	761	3098	609	1119
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.02	0.09	0.13	0.15	0.44

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	738	21	66	361	83	448
Future Volume (veh/h)	738	21	66	361	83	448
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1638	1776	1759	1696	1881
Adj Flow Rate, veh/h	802	23	72	392	90	487
Adj No. of Lanes	2	1	1	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	5	16	7	8	12	1
Cap, veh/h	1291	970	102	1728	519	610
Arrive On Green	0.38	0.38	0.06	0.52	0.32	0.32
Sat Flow, veh/h	3529	1392	1691	3431	1616	1599
Grp Volume(v), veh/h	802	23	72	392	90	487
Grp Sat Flow(s),veh/h/ln	1719	1392	1691	1671	1616	1599
Q Serve(g_s), s	10.6	0.3	2.3	3.6	2.2	15.1
Cycle Q Clear(g_c), s	10.6	0.3	2.3	3.6	2.2	15.1
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1291	970	102	1728	519	610
V/C Ratio(X)	0.62	0.02	0.71	0.23	0.17	0.80
Avail Cap(c_a), veh/h	1949	1236	746	3639	596	686
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.1	2.6	25.6	7.3	13.6	15.3
Incr Delay (d2), s/veh	0.5	0.0	8.6	0.1	0.2	6.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.1	0.2	1.3	1.6	1.0	7.6
LnGrp Delay(d),s/veh	14.6	2.6	34.2	7.4	13.7	21.2
LnGrp LOS	B	A	C	A	B	C
Approach Vol, veh/h	825			464	577	
Approach Delay, s/veh	14.3			11.6	20.1	
Approach LOS	B			B	C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		22.3	7.9	25.4				33.2
Change Period (Y+Rc), s		4.5	4.5	4.5				4.5
Max Green Setting (Gmax), s		20.5	24.5	31.5				60.5
Max Q Clear Time (g_c+I1), s		17.1	4.3	12.6				5.6
Green Ext Time (p_c), s		0.8	0.1	8.3				11.5

Intersection Summary	
HCM 2010 Ctrl Delay	15.4
HCM 2010 LOS	B

Intersection: 4: Woodcutters Rd & Courthouse Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	226	217	55	93	97	75	116	188
Average Queue (ft)	124	100	8	37	40	20	46	88
95th Queue (ft)	190	179	33	74	80	57	92	154
Link Distance (ft)	1318	1318			1138	1138	481	481
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			300	250				
Storage Blk Time (%)		0						
Queuing Penalty (veh)		0						

Network Summary

Network wide Queuing Penalty: 0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	611	126	376	900	85	167
v/c Ratio	0.62	0.16	0.69	0.39	0.35	0.18
Control Delay	23.0	2.7	26.0	4.4	31.0	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	2.7	26.0	4.4	31.0	5.5
Queue Length 50th (ft)	95	0	112	53	27	17
Queue Length 95th (ft)	196	25	242	99	82	49
Internal Link Dist (ft)	1281			1088	465	
Turn Bay Length (ft)		300	250			
Base Capacity (vph)	1489	1025	969	3098	555	1281
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.12	0.39	0.29	0.15	0.13

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	562	116	346	828	78	154
Future Volume (veh/h)	562	116	346	828	78	154
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1638	1776	1759	1696	1881
Adj Flow Rate, veh/h	611	126	376	900	85	167
Adj No. of Lanes	2	1	1	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	5	16	7	8	12	1
Cap, veh/h	1222	664	452	2367	196	622
Arrive On Green	0.36	0.36	0.27	0.71	0.12	0.12
Sat Flow, veh/h	3529	1392	1691	3431	1616	1599
Grp Volume(v), veh/h	611	126	376	900	85	167
Grp Sat Flow(s),veh/h/ln	1719	1392	1691	1671	1616	1599
Q Serve(g_s), s	7.4	2.7	11.1	5.7	2.6	3.8
Cycle Q Clear(g_c), s	7.4	2.7	11.1	5.7	2.6	3.8
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1222	664	452	2367	196	622
V/C Ratio(X)	0.50	0.19	0.83	0.38	0.43	0.27
Avail Cap(c_a), veh/h	1595	815	1041	3893	597	1018
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.3	7.9	18.2	3.1	21.5	11.0
Incr Delay (d2), s/veh	0.3	0.1	4.0	0.1	1.5	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	1.3	5.6	2.5	1.2	1.7
LnGrp Delay(d),s/veh	13.7	8.1	22.2	3.2	23.0	11.2
LnGrp LOS	B	A	C	A	C	B
Approach Vol, veh/h	737			1276	252	
Approach Delay, s/veh	12.7			8.8	15.2	
Approach LOS	B			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		10.9	18.6	23.3				41.9
Change Period (Y+Rc), s		4.5	4.5	4.5				4.5
Max Green Setting (Gmax), s		19.5	32.5	24.5				61.5
Max Q Clear Time (g_c+I1), s		5.8	13.1	9.4				7.7
Green Ext Time (p_c), s		0.6	1.1	9.4				17.3

Intersection Summary	
HCM 2010 Ctrl Delay	10.8
HCM 2010 LOS	B

Intersection: 4: Woodcutters Rd & Courthouse Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	189	182	103	233	189	152	112	78
Average Queue (ft)	117	87	36	134	63	60	43	30
95th Queue (ft)	172	156	78	212	132	117	88	59
Link Distance (ft)	1318	1318			1138	1138	481	481
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			300	250				
Storage Blk Time (%)				0	0			
Queuing Penalty (veh)				1	0			

Network Summary

Network wide Queuing Penalty: 1

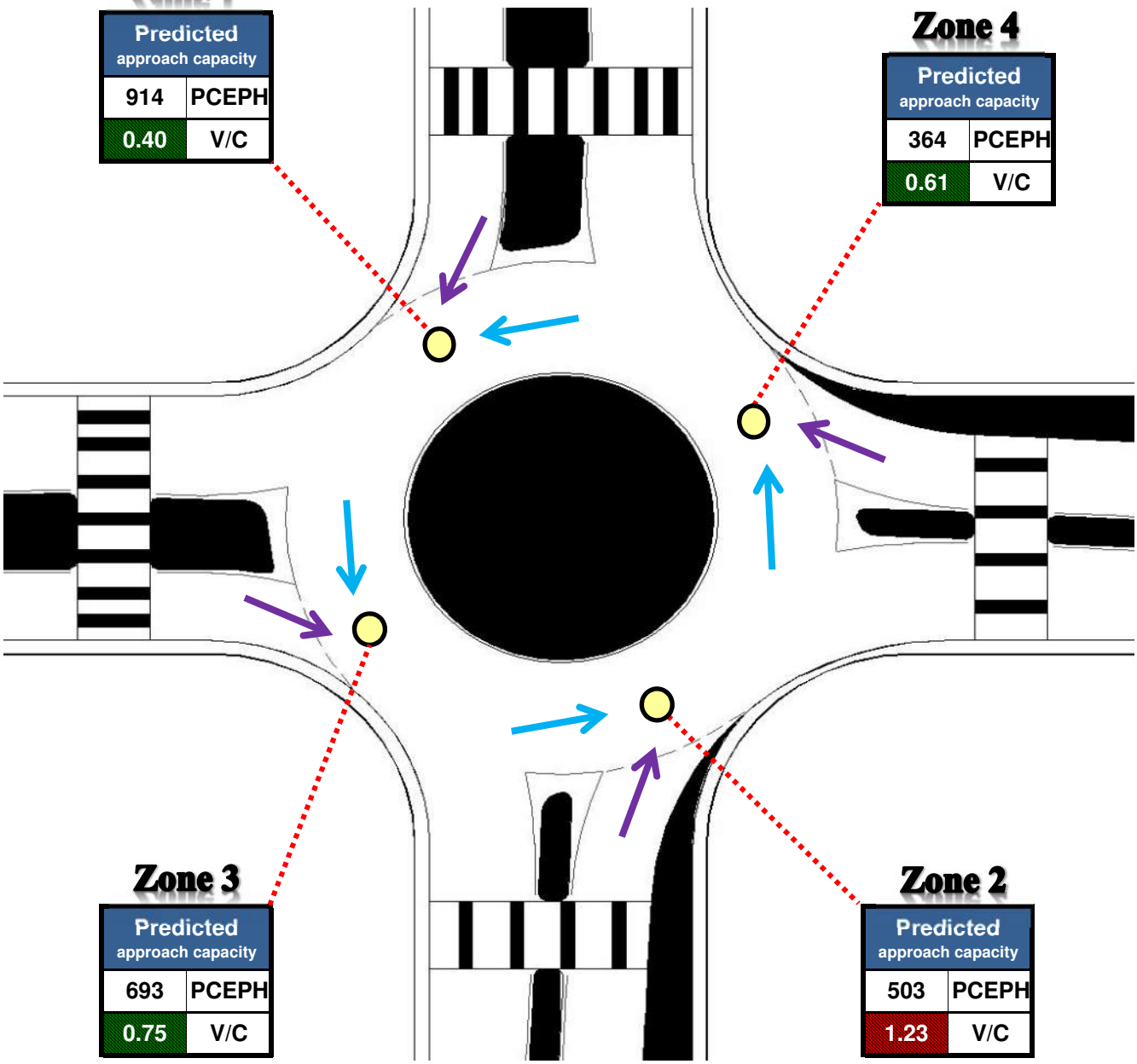
75' ICD Mini-Roundabout

Design and Results

Project Name:	*Accokeek Furnace Road Development*
Project Number:	*21446*
Location	*Stafford, VA*
Date	October 17, 2017

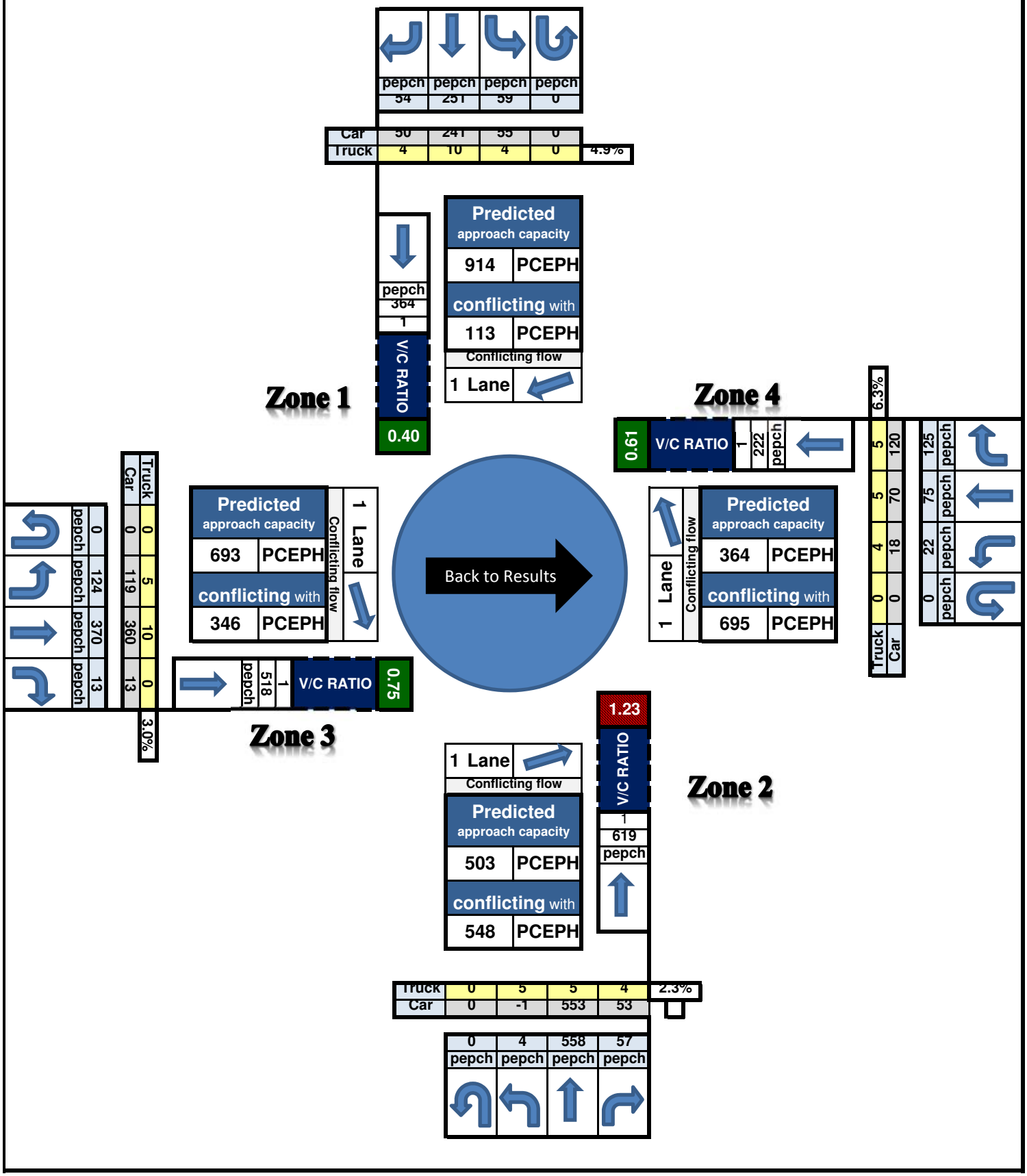
Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600

VOLUME / CAPACITY RATIO:				
Zone 1	0.40	Zone 4	0.61	
Zone 3	0.75	Zone 2	1.23	



75' ICD Mini-Roundabout

Data Input and Configuration



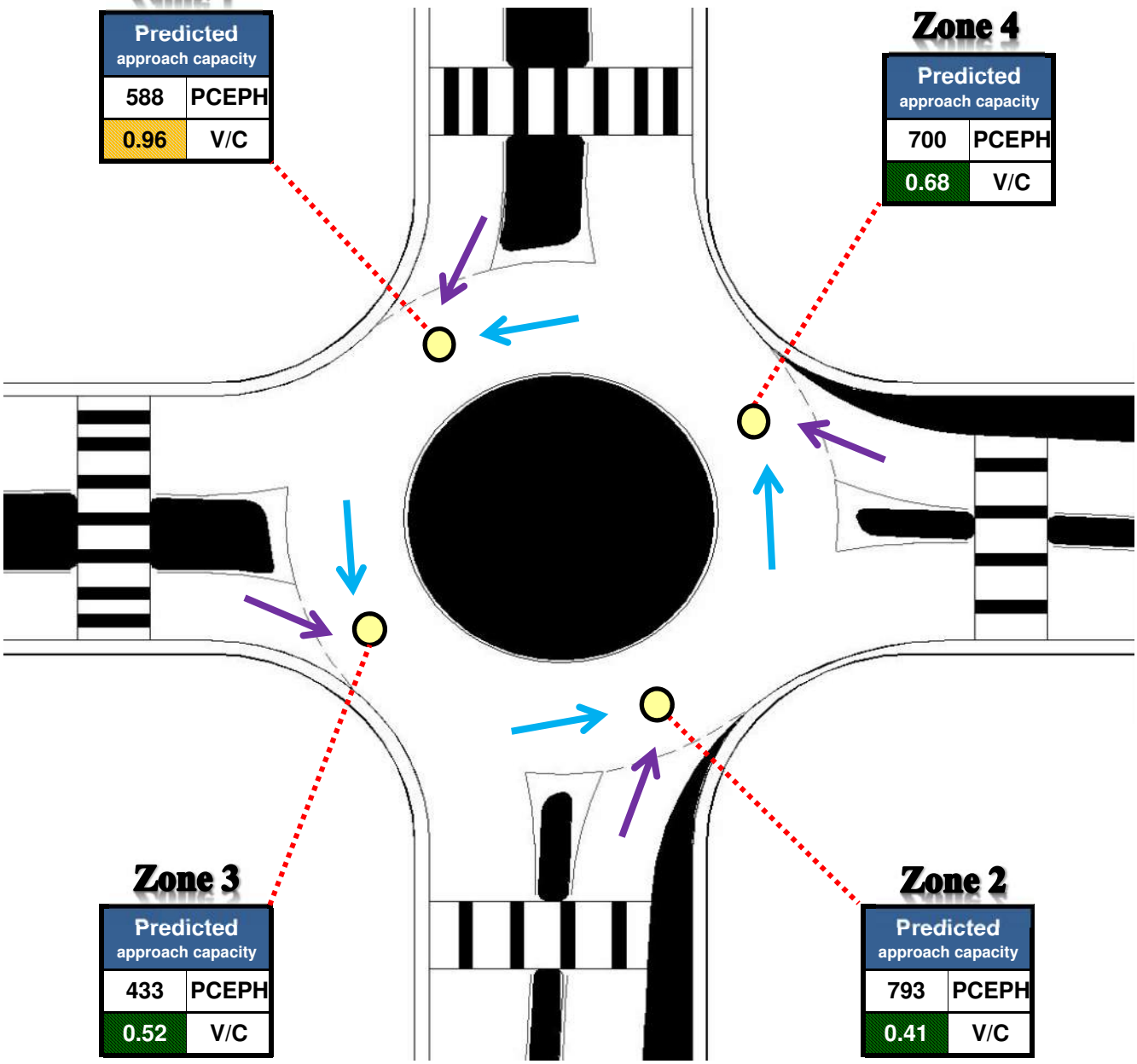
75' ICD Mini-Roundabout

Design and Results

Project Name:	*Accokeek Furnace Road Development*
Project Number:	*21446*
Location	*Stafford, VA*
Date	October 17, 2017

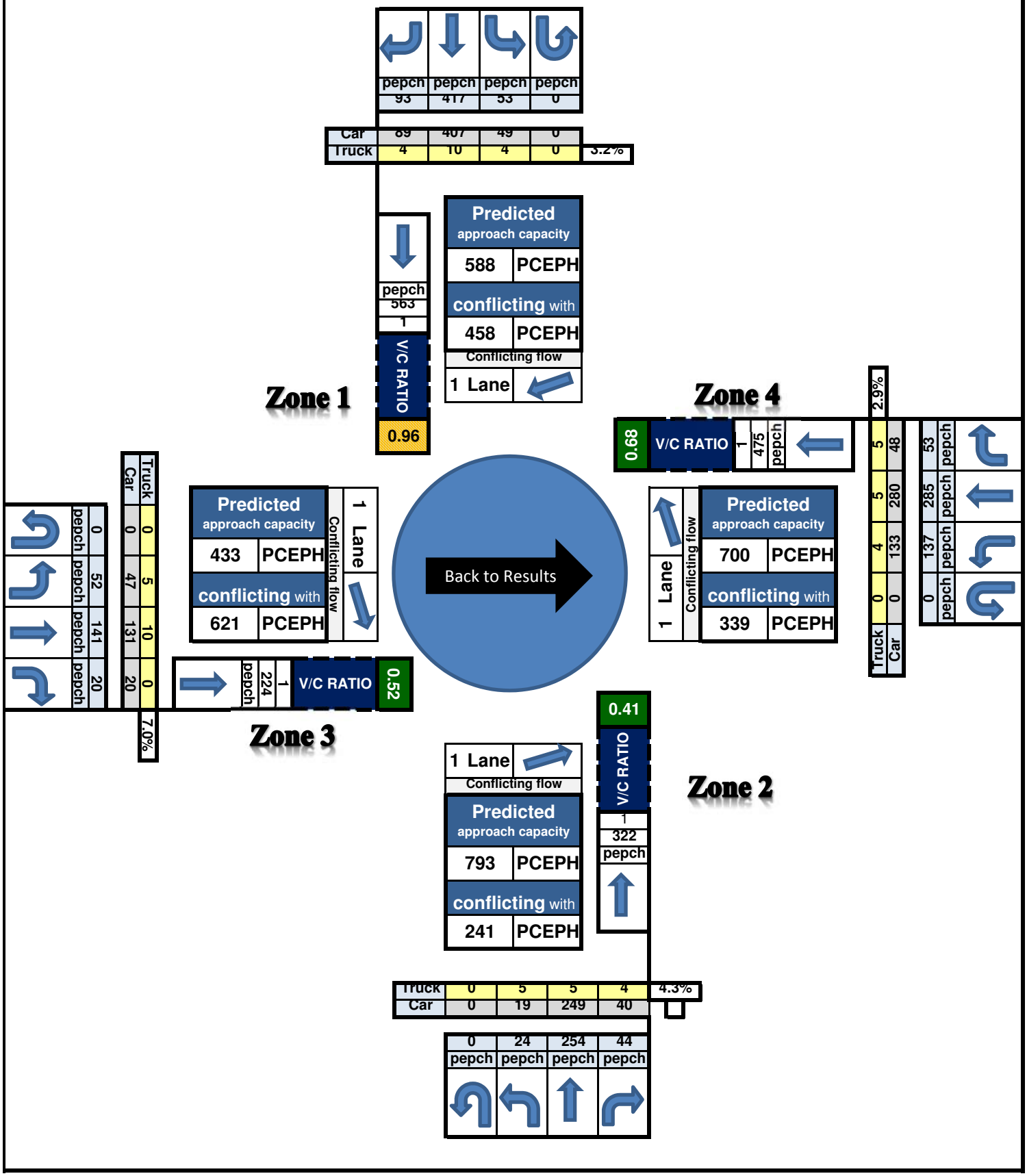
Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600

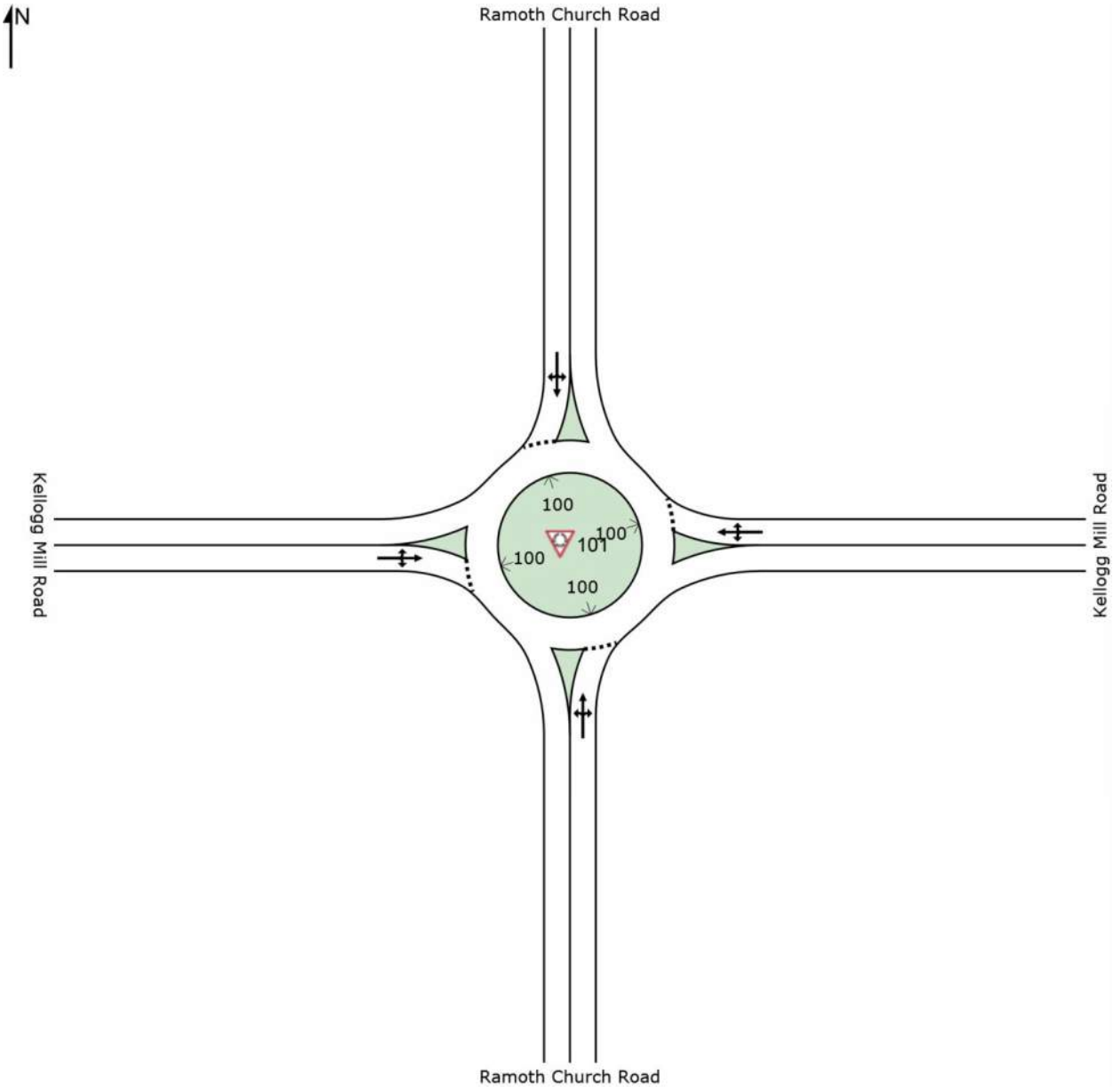
VOLUME / CAPACITY RATIO:				
Zone 1	0.96	Zone 4	0.68	
Zone 3	0.52	Zone 2	0.41	



75' ICD Mini-Roundabout

Data Input and Configuration




N
Ramoth Church Road
Kellogg Mill Road
Kellogg Mill Road
100
100
101
100
100
Ramoth Church Road

MOVEMENT SUMMARY

Site: 101 [Ramoth Church Rd/Kellogg Mill Rd - AM - Year 2028 Total]

Accokeek Furnace Road Development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Ramoth Church Road											
3	L2	134	4.0	0.770	21.1	LOS C	8.2	211.0	0.90	1.07	27.8
8	T1	349	4.0	0.770	21.1	LOS C	8.2	211.0	0.90	1.07	27.8
18	R2	154	4.0	0.770	21.1	LOS C	8.2	211.0	0.90	1.07	27.1
Approach		637	4.0	0.770	21.1	LOS C	8.2	211.0	0.90	1.07	27.6
East: Kellogg Mill Road											
1	L2	25	0.0	0.130	6.8	LOS A	0.5	13.1	0.61	0.59	33.6
6	T1	59	0.0	0.130	6.8	LOS A	0.5	13.1	0.61	0.59	33.5
16	R2	4	33.0	0.130	6.8	LOS A	0.5	13.1	0.61	0.59	31.9
Approach		88	1.6	0.130	6.8	LOS A	0.5	13.1	0.61	0.59	33.5
North: Ramoth Church Road											
7	L2	1	100.0	0.084	4.6	LOS A	0.3	8.8	0.36	0.23	33.8
4	T1	30	4.0	0.084	4.6	LOS A	0.3	8.8	0.36	0.23	35.4
14	R2	48	22.0	0.084	4.6	LOS A	0.3	8.8	0.36	0.23	33.9
Approach		79	16.2	0.084	4.6	LOS A	0.3	8.8	0.36	0.23	34.4
West: Kellogg Mill Road											
5	L2	170	7.0	0.417	7.0	LOS A	2.7	70.0	0.26	0.12	33.3
2	T1	279	0.0	0.417	7.0	LOS A	2.7	70.0	0.26	0.12	33.4
12	R2	79	3.0	0.417	7.0	LOS A	2.7	70.0	0.26	0.12	32.4
Approach		528	2.7	0.417	7.0	LOS A	2.7	70.0	0.26	0.12	33.2
All Vehicles		1333	4.1	0.770	13.6	LOS B	8.2	211.0	0.59	0.61	30.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Ramoth Church Rd/Kellogg Mill Rd - PM - Year 2028 Total]

Accokeek Furnace Road Development
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Ramoth Church Road											
3	L2	71	6.0	0.172	5.0	LOS A	0.8	19.9	0.38	0.25	34.0
8	T1	84	6.0	0.172	5.0	LOS A	0.8	19.9	0.38	0.25	34.0
18	R2	27	0.0	0.172	5.0	LOS A	0.8	19.9	0.38	0.25	33.2
Approach		182	5.1	0.172	5.0	LOS A	0.8	19.9	0.38	0.25	33.9
East: Kellogg Mill Road											
1	L2	49	3.0	0.213	5.3	LOS A	1.0	25.7	0.41	0.29	34.5
6	T1	173	2.0	0.213	5.3	LOS A	1.0	25.7	0.41	0.29	34.4
16	R2	5	0.0	0.213	5.3	LOS A	1.0	25.7	0.41	0.29	33.5
Approach		227	2.2	0.213	5.3	LOS A	1.0	25.7	0.41	0.29	34.4
North: Ramoth Church Road											
7	L2	17	0.0	0.583	11.5	LOS B	4.5	113.8	0.68	0.61	32.0
4	T1	290	1.0	0.583	11.5	LOS B	4.5	113.8	0.68	0.61	31.9
14	R2	273	3.0	0.583	11.5	LOS B	4.5	113.8	0.68	0.61	31.0
Approach		580	1.9	0.583	11.5	LOS B	4.5	113.8	0.68	0.61	31.5
West: Kellogg Mill Road											
5	L2	66	2.0	0.264	6.5	LOS A	1.3	31.8	0.53	0.44	33.7
2	T1	127	2.0	0.264	6.5	LOS A	1.3	31.8	0.53	0.44	33.7
12	R2	54	0.0	0.264	6.5	LOS A	1.3	31.8	0.53	0.44	32.8
Approach		248	1.6	0.264	6.5	LOS A	1.3	31.8	0.53	0.44	33.5
All Vehicles		1237	2.4	0.583	8.4	LOS A	4.5	113.8	0.56	0.47	32.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.