Crosshaven Drive Corridor Study

August 2018

Prepared by:	Prepared for:	On Behalf of:
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INTRODUCTION

Neel-Schaffer Inc., in association with Skipper Consulting Inc., was contracted by the Regional Planning Commission of Greater Birmingham (RPCGB) as a part of an Advanced Planning, Programming and Logical Termini (APPLE) study to evaluate and propose recommendations for traffic operational improvements (including continuous turn lane) and pedestrian connectivity for Crosshaven Drive in Vestavia Hills, Alabama. The study limits along Crosshaven Drive extend from Cahaba Heights Road to Overton Road and involved seven (7) intersections, including four (4) signalized and three (3) unsignalized side road intersections. Additionally, the study evaluated potential environmental, right of way and utility impacts. Utilizing Jefferson County GIS Data, a base map was produced along the corridor showing opportunities and constraints that were considered in the study.

Sources of information used in the study included: the Institute of Transportation Engineers; Transportation Research Board; Federal Highway Administration; the City of Vestavia Hills; Jefferson County; Regional Planning Commission of Greater Birmingham; and information provided by Skipper Consulting, Inc.

PROJECT STUDY AREA

The study area focused on a segment along Crosshaven Drive in the City of Vestavia Hills from Cahaba Heights Road to Overton Road. Intersections within the study area included:

- Crosshaven Drive at Cahaba Heights Road
- Crosshaven Drive at Ridgely Drive
- Crosshaven Drive at Valley Park Drive
- Crosshaven Drive at Green Valley Road
- Crosshaven Drive at Bearden Court
- Crosshaven Drive at Greendale Drive
- Crosshaven Drive at Overton Road

A Vicinity Map illustrating the project study area is shown in **Figure 1.**

Figure 1 – Vicinity Map - Study Area

EXISTING CONDITIONS

Currently Crosshaven Drive, within the study area, is a two-lane roadway that is functionally classified as a minor arterial roadway from Overton Road to Green Valley Road and a collector roadway from Green Valley Road to Cahaba Heights Road. The posted speed limit throughout the corridor is 25 miles per hour. The west side of the corridor is characterized as established residential areas with some commercial development that has occurred in recent years. The east side of the corridor, also once mostly established residential areas, has undergone significant commercial development. With the recent commercial development along the corridor, increased traffic congestion in the peak hours has significantly affected the level of service along the corridor.

Base mapping of the study area existing conditions was developed with data provided by the RPCGB and Jefferson County. In addition to aerial mapping, features such as parcel data and utility locations were obtained and merged into the GIS database for the base mapping. Planned commercial developments and roadway improvements were also obtained from the City to display on the mapping. See **Figure 2** for base mapping of the existing conditions with parcel data displayed.

TRAFFIC OPERATIONS

A traffic operations study was performed to determine needed roadway improvements for Crosshaven Drive between Cahaba Heights Road and Overton Road in Vestavia Hills, Alabama. The study was completed by Skipper Consulting Inc., as a subconsultant to Neel-Schaffer, Inc. See **Appendix A** to view the complete report. The following is a summary of the findings of the traffic operations study (this summary includes excerpts from the traffic operations study report).

Detailed traffic analyses were performed for the seven (7) study intersections on Crosshaven Drive. Existing turning movement traffic counts and machine traffic counts were collected. The a.m. and p.m. peak hour counts are shown in Figure 2 of Appendix A. The machine traffic count data is included in included in Table 1 of Appendix A. In addition to the traffic counts, on site observations of the traffic flow during AM, Midday and PM peak periods were conducted. Significant queuing of vehicles during these periods and the locations were noted. Observations were made concerning green times at the signalized intersections to note whether sufficient green time was available to clear the queue of vehicles.

As a result of review of the existing traffic counts and the onsite observations at the signalized intersections, the following recommendations were offered for consideration for immediate improvements that could made on Crosshaven Drive (excerpt from traffic study report):

- Increase the Maximum Green time for Crosshaven Drive at Green Valley Road.
- Implement a Maximum Green 2 programming at Crosshaven Drive at Cahaba Heights Road to give more time to Crosshaven Drive during midday peak.
- Sunview Drive should be restricted to right-in/right-out only movements.

CROSSHAVEN DRIVE ROADWAY STUDY: APPLE

Figure 2 - Existing Conditions Base Map

Existing a.m. and p.m. peak hour intersection capacity analyses, 95th percentile queue calculations, roadway segment capacity analyses and turn lane warrant analysis were also performed.

In order to analyze future traffic conditions, historical traffic growth was calculated utilizing past years traffic counts obtained from the RPCGB and the Alabama Department of Transportation (ALDOT). The historical traffic counts and growth analysis is shown in Table 8 of Appendix A. A yearly traffic growth factor of +3.3% was therefore used to analyze future traffic conditions. Existing traffic was projected forward using the +3.3% traffic growth factor to obtain future year 2027 traffic volumes. See Figure 3 in Appendix A for the Future 2027 traffic volume at the study area roadway intersections and along the roadway segments. Future year peak hour intersection capacity analysis, intersection queues, roadway segment capacity analysis, and turn lane warrant analysis were performed. The results of these analyses are shown in Tables 9, 10, 11 and 12 of Appendix A.

Based on the results of the analyses, the following recommended improvements for Crosshaven Road were developed (excerpt from traffic study report):

Crosshaven Drive – entire roadway from Cahaba Heights Road to Overton Road

- Widen to a continuous three lane cross section

Crosshaven Drive at Cahaba Heights Road

- Construct a right turn lane on Cahaba Heights Road eastbound
- Construct a right turn lane on Cahaba Heights Road westbound
- Construct a right turn lane on Crosshaven Drive southbound

Crosshaven Drive at Green Valley Road

- Construct a left turn lane on Green Valley Road eastbound
- Construct a right turn lane on Green Valley Road eastbound
- Construct a right turn lane on Crosshaven Drive northbound
- Construct a left turn lane on Crosshaven Drive southbound

Crosshaven Drive at Bearden Court

- Construct a left turn lane on Crosshaven Drive southbound
- Install a traffic signal when warranted

Crosshaven Drive at Greendale Road

- Construct a right turn lane on Crosshaven Drive northbound
- Construct a left turn lane on Crosshaven Drive southbound

Crosshaven Drive at Overton Road

- Construct a right turn lane on Overton Road eastbound

CONCEPT PLAN DEVELOPMENT

Based on the recommendations from the Traffic Operations Study, a concept plan was developed that would serve as a tool for future implementation of the needed improvements along Crosshaven Drive within the study area. Consideration was given to the priority order of implementation of the improvements and fundable construction phasing.

Consideration was also given to an ongoing ALDOT project, TOPICS VIII, for improvements at the Crosshaven Drive and Green Valley Road intersection. This intersection is centrally located within the study area and all recommended improvements north or south of the intersection would need to be coordinated with the TOPICS VIII project.

Figure 3 – TOPICS VIII Project

Based on the traffic operations needs and improvements identified in the traffic operations study, implementation of the TOPICS VIII project at the Crosshaven Drive and Green Valley Road should be the priority as the first phase to be implemented. The TOPICS VIII project is underway and is fully funded. The improvements north of the TOPICS VIII project were identified as a second phase with the improvements to the south being a third phase (See Figure 4 for Phasing Plan). The recommended phasing plan for the improvements are as follows:

1st Phase: TOPICS VIII Project Phase (See Figure 5)
- According to the traffic operations study, the project addresses the largest traffic congestion need, so it is considered the highest priority of the three phases
- Ongoing ALDOT Project
- Right of way acquisition currently underway
- Project has a construction letting date of January 2020
- Estimated cost – N/A

2nd Phase: Northern Phase (See Figure 6)
- From Green Valley Road to Overton Road
- Next in priority after the TOPICS project Phase according to the traffic operations study
- Can be accomplished independently of other phases and with local funds
- Estimated cost – $2,535,336 (See Appendix B)

3rd Phase: Southern Phase (See Figure 7)
- From Cahaba Heights Road to Green Valley Road
- Next in priority after the Northern Phase
- Can be accomplished with local funds and independently of other phases
- Estimated cost - $2,076,418 (See Appendix B)

PUBLIC INVOLVEMENT

In order to obtain input from the public on the proposed improvements being developed as a part of this study, a neighborhood meeting was advertised and conducted. The meeting was held in the New Merkle House on November 14, 2017. The meeting was well attended by neighborhood residents and comments received in general were positive and in support of the proposed improvements to Crosshaven Drive. The following is a sample of the comments received:

"*As a resident of Cahaba Heights, I want to encourage you to continue with the idea of a sidewalk running the full length of Crosshaven Drive. I enjoy walking my dog in this area and have met many other people who regularly run and walk in the area. I think the sidewalks will add to the community and encourage some of us to walk short distances rather than get into our cars and drive to the businesses on Crosshaven."*

"*As far as the Crosshaven Drive Apple Study, it sounds like a good idea. It would however be even better if you could get new businesses along Crosshaven to chip in enough money to support acquiring enough width along Crosshaven to make sidewalks wide enough to accommodate walkers, bikers and golf carts thereby providing improvements to the overall neighborhood experience rather than just being a traffic conduit for the Summit and those coming from Liberty Park to Overton and Crosshaven."*

See Appendix B for the presentation and information presented at the meeting.

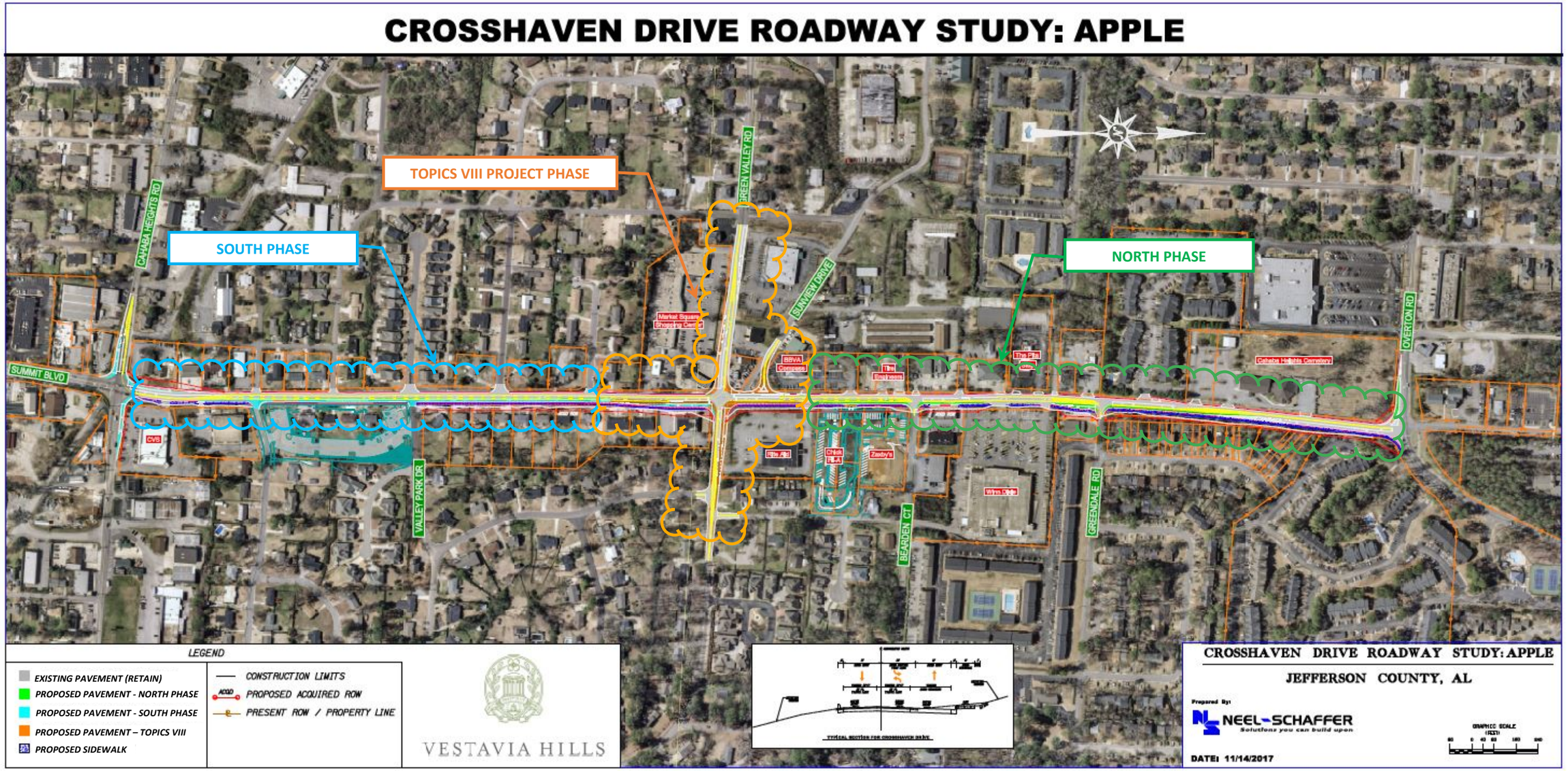

Figure 4 – Phasing Plan

Figure 5 – TOPICS VIII Project Phase

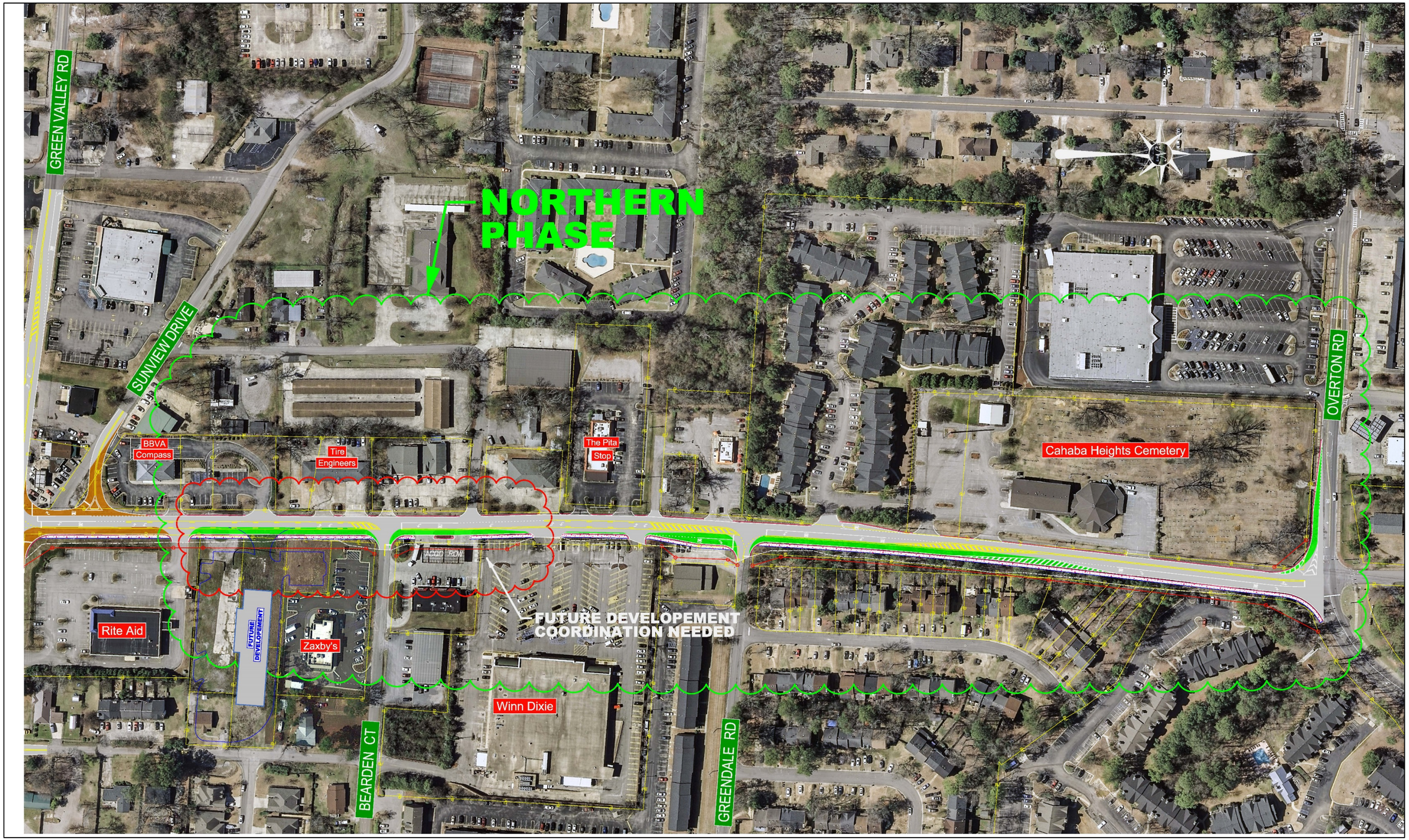

Figure 6 – Northern Phase

Figure 7 – Southern Phase

CONCLUSION

The overall objective for the "Crosshaven Drive Roadway Study: APPLE Program" was to evaluate and propose recommendations for traffic operational improvements and pedestrian connectivity for Crosshaven Drive. Existing physical and operational characteristics of the corridor were assessed. Skipper Consulting, Inc. conducted a Traffic Operations Study to determine roadway improvements for Crosshaven Drive between Cahaba Heights Road and Overton Road in Vestavia Hills, Alabama. The study documented existing conditions analyses and the existing traffic levels of service and congestion throughout the corridor. As a result of the study, recommended improvements were developed and outlined in their report (See Appendix A). These recommended improvements included widening Crosshaven Drive to a continuous three lane cross section. Recommendations for needed right and left turn lanes were also analyzed for all intersections along the corridor.

All recommended improvements were placed on base mapping displaying both existing and future known developments. All of the recommended improvements were determined to be feasible to construct with minimal additional right of way required or utility involvement. A concept plan was developed to prioritize fundable phases of construction. The corridor phases were prioritized based on traffic demand. The first priority is to pursue the construction of the TOPICS VIII project. The second phase of construction recommended is the Northern section with the third phase being the Southern section.

Input from the public was obtained through a neighborhood meeting conducted at the Merkle House near the project corridor. In general, the comments received were positive and consensus that the recommended improvements are needed.

APPENDIX A

Traffic Operations Study

Prepared by:

Skipper Consulting Inc.

TRAFFIC OPERATIONS STUDY

Crosshaven Drive
Vestavia Hills, Alabama

Advance Planning, Programming, and Logical Engineering (APPLE) Program

Prepared for:

NEEL-SCHAFFER, INC.

THE CITY OF VESTAVIA HILLS

THE REGIONAL PLANNING COMMISSION OF GREATER BIRMINGHAM

Prepared by:

SKIPPER CONSULTING INC.

AUGUST, 2018

TRAFFIC OPERATIONS STUDY
CROSSHAVEN DRIVE
VESTAVIA HILLS, ALABAMA

Advance Planning, Programming, and Logical Engineering (APPLE) Program

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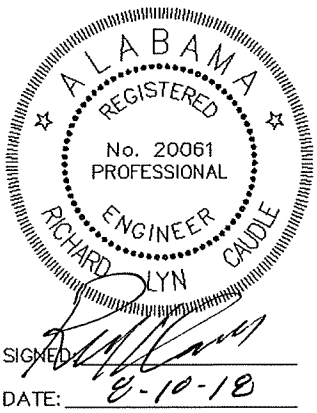

August, 2018

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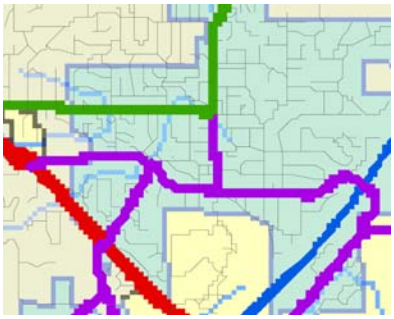
LIST OF ILLUSTRATIONS

INTRODUCTION

This report documents a traffic study to determine roadway improvements for Crosshaven Drive between Cahaba Heights Road and Overton Road in Vestavia Hills, Alabama. This study was performed as a part of an Advance Planning, Programming and Logical Engineering (APPLE) study being performed as a subconsultant to Neel-Schaffer, Inc. for the City of Vestavia Hills in conjunction with the Regional Planning Commission of Greater Birmingham.

Study Area

The study area includes Crosshaven Drive from Cahaba Heights Road to Overton Road. The location of the study area is shown in Figure 1. Within the study area, Crosshaven Drive is a two lane roadway. The posted speed limit on Crosshaven Drive within the study area is 25 miles per hour. Crosshaven Drive is classified as minor arterial roadway from Overton Road to Green Valley Road and a collector roadway from Green Valley Road to Cahaba Heights Road. An excerpt of the roadway classification map is shown below.



Study Intersections

Detailed traffic analyses were performed for seven (7) study intersections on Crosshaven Drive. The locations of the seven study intersections are shown on Figure 1, and include:

- Crosshaven Drive at Cahaba Heights Road
- Crosshaven Drive at Ridgely Drive
- Crosshaven Drive at Valley Park Drive

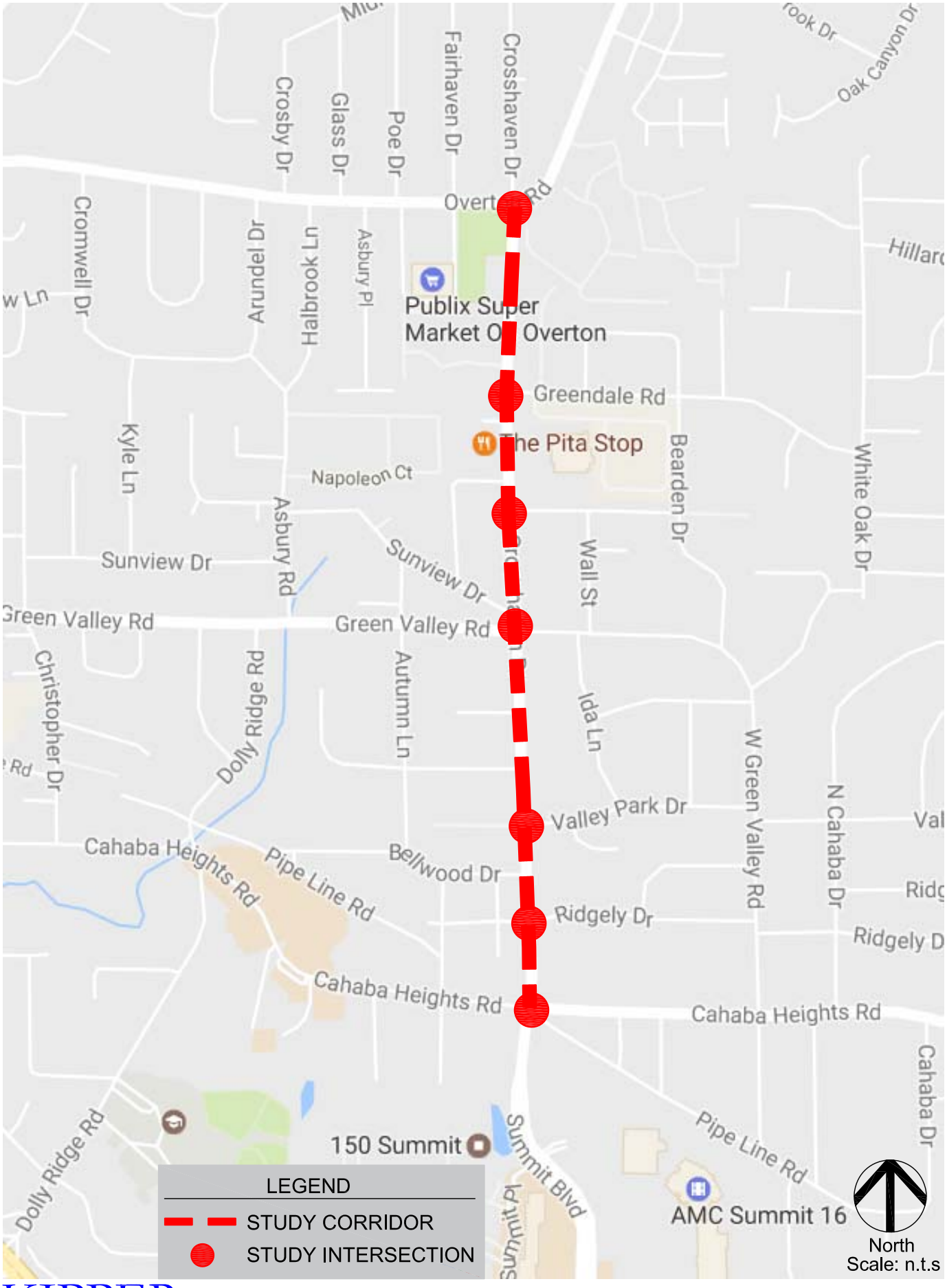


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Figure 1 - Project Location Map

Crosshaven Drive APPLE - Vestavia Hills, Alabama June 2017

- Crosshaven Drive at Green Valley Road
- Crosshaven Drive at Bearden Court
- Crosshaven Drive at Greendale Drive
- Crosshaven Drive at Overton Road

BACKGROUND INFORMATION

Intersection Turning Movement Traffic Counts

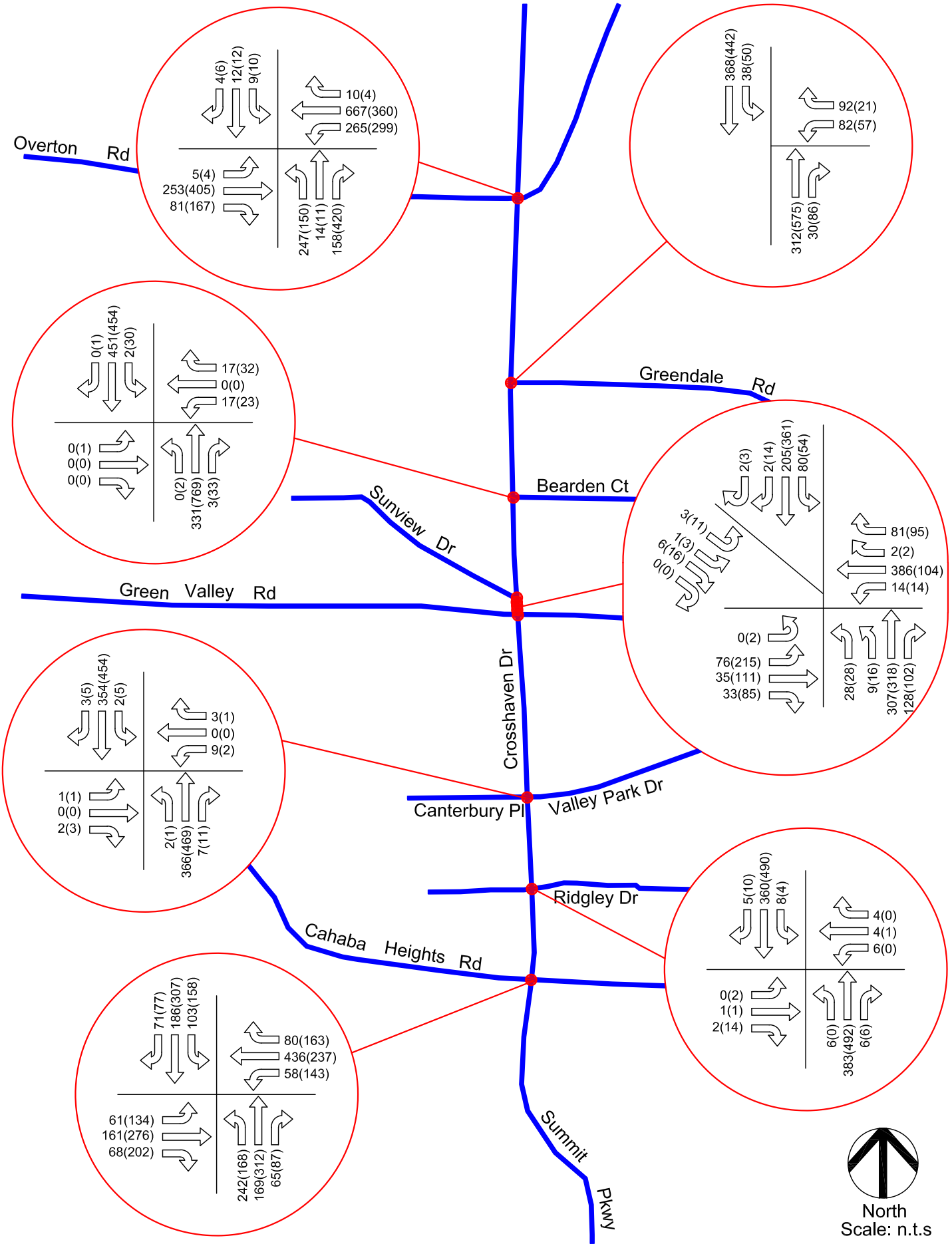
Intersection turning movement traffic counts were performed at the study intersections on Monday to Tuesday, October 3-4, 2016, and Tuesday to Thursday, May 2-4, 2017 by Traffic Data LLC on behalf of Skipper Consulting, Inc. The intersection turning movement traffic count data is included in Appendix A. Using the intersection turning movement traffic count data, the a.m. and p.m. peak hours of traffic flow were determined. The a.m. and p.m. peak hour intersection turning movement traffic counts are shown in Figure 2.

Machine Traffic Counts

Twenty-four (24) hour machine traffic counts were performed at Crosshaven Drive at two locations on Tuesday to Wednesday, May 2-3, 2017 by Traffic Data, LLC on behalf of Skipper Consulting, Inc. The locations of the two machine counts were as follows:

- Crosshaven Drive north of Crown Ridge Drive
- Crosshaven Drive north of Canterbury Place

The machine traffic count data is included in Appendix B. A summary of the machine traffic count data is included in Table 1.



SKIPPER CONSULTING INC.

Figure 2 - Existing Traffic Counts

Crosshaven Drive APPLE - Vestavia Hills, Alabama June 2017

Table 1
Summary of Machine Counts
Crosshaven Drive

North of Crown Ridge Drive		
	Northbound	*Southbound*
Daily	5,902	5,344
AM Peak Hour	409	430
PM Peak Hour	566	506
North of Canterbury Place		
	Northbound	*Southbound*
Daily	5,087	5,413
AM Peak Hour	366	450
PM Peak Hour	440	469

Speed Survey

The machine traffic counts included speed surveys. The speed data is included in Appendix B and is summarized in Table 2.

Table 2
Summary of Speed Survey
Crosshaven Drive

North of Crown Ridge Drive					
Average – 31 mph					
85th Percentile – 35 mph					
0-25	26-30	31-35	36-40	41-45	46+
976	3,695	4,955	1,413	161	46
8.7%	32.8%	44.1%	12.6%	1.4%	0.4%
North of Canterbury Place					
Average – 33 mph					
85th Percentile – 37 mph					
0-25	26-30	31-35	36-40	41-45	46+
432	1,907	4,946	2,675	480	60
4.1%	18.1%	47.1%	25.5%	4.6%	0.6%

Vehicle Classification

The machine traffic counts included vehicle classification. The vehicle classification data is included in Appendix B and is summarized in Table 3.

Table 3
Summary of Vehicle Classification Counts
Crosshaven Drive

North of Crown Ridge Drive		
Motorcycle	43	0.4%
Passenger Vehicle	10,574	94.0%
Bus	157	1.4%
Light Truck	353	3.1%
Heavy Truck	119	1.1%
North of Canterbury Place		
Motorcycle	21	0.2%
Passenger Vehicle	9,965	94.9%
Bus	124	1.2%
Light Truck	327	3.1%
Heavy Truck	63	0.6%

Traffic Control Devices

The following intersections are controlled by traffic signalization:

- Crosshaven Drive at Cahaba Heights Road – eight phase traffic signal with protected-permissive left turns
- Crosshaven Drive at Green Valley Road – two phase traffic signal
- Crosshaven Drive at Greendale Road – two phase traffic signal
- Crosshaven Drive at Overton Road – five phase traffic signal with protected-permissive left turn on Overton Road westbound and permissive-only left turns on Crosshaven Drive

All other intersections are controlled by side street stop signs.

Observations

Observations of traffic flow on Crosshaven Drive were conducted during the a.m., midday, and p.m. peak periods of traffic flow on Monday, May 8 and Thursday May 11, 2017 by Skipper Consulting, Inc. The following is a summary of observations:

AM Peak Period

- There is a significant queue of vehicles on Cahaba Heights Road westbound at Crosshaven Drive (13 vehicles counted).
- Vehicles turning left from Crosshaven Drive northbound onto Green Valley Road westbound disrupt traffic flow on Crosshaven Drive northbound.
- There is a significant queue of vehicles on Crosshaven Drive southbound at Green Valley Road (17 vehicles counted).
- There is a significant queue of vehicles on Overton Road westbound at Crosshaven Drive (22 vehicles counted).

Midday Peak Period

- Traffic is stop-and-go on Crosshaven Drive southbound between Greendale Road and Green Valley Road due to queue and turning vehicles. A left turn lane is particularly needed at Bearden Court.
- There is a significant queue of vehicles on Crosshaven Drive southbound at Green Valley Road (29 vehicles counted).
- The maximum green time on Crosshaven Drive southbound at Green Valley Road is insufficient to clear the queue of vehicles.
- There is a significant queue of vehicles on Crosshaven Drive northbound at Green Valley Road (21 vehicles counted).
- There is significant queue of vehicles on Crosshaven Drive southbound at Cahaba Heights Road (37 vehicles counted).
- The maximum green time on Crosshaven Drive southbound at Cahaba Heights Road is insufficient to clear the queue of vehicles.

- Vehicles turning left from Crosshaven Drive southbound onto Green Valley Road eastbound disrupt traffic flow in the entire intersection of Crosshaven Drive at Green Valley Road.
- Vehicles turning left from Sunview Drive onto Crosshaven Drive northbound disrupt traffic flow in the entire intersection of Crosshaven Drive at Green Valley Road.

PM Peak Period

- There is significant queue of vehicles on Crosshaven Drive southbound at Cahaba Heights Road (41 vehicles counted). Queue backs past Valley Park Drive.
- Left turns from Crosshaven Drive northbound onto Sunview Drive disrupt northbound and southbound traffic flow on Crosshaven Drive.
- A left turn lane is needed on Green Valley Road eastbound at Crosshaven Drive.
- A left turn lane is needed on Crosshaven Drive northbound at Green Valley Road.
- There is a significant queue of vehicles on Crosshaven Drive northbound at Green Valley Road (17 vehicles counted).
- There is a significant queue of vehicles on Green Valley Road eastbound at Crosshaven Drive.

Immediate Improvements

The following recommendations are offered for consideration for immediate improvements to make on Crosshaven Drive:

- Increase the Maximum Green time for Crosshaven Drive at Green Valley Road.
- Implement a Maximum Green 2 programming at Crosshaven Drive at Cahaba Heights Road to give more time to Crosshaven Drive during midday peak.
- Sunview Drive should be restricted to right-in/right-out only movements.

EXISTING CONDITIONS ANALYSIS

Existing Peak Hour Intersection Capacity Analysis

Existing a.m. and p.m. peak hour intersection capacity analyses were performed for the study intersections using the method of analysis included in the 2010 *Highway Capacity Manual*, published by the Transportation Research Board. Capacities are expressed as levels of service, and range from a level of service "A" (highest quality of service) to a level of service "F" (jammed conditions). As a general rule, operation at a level of service "C" or better is desirable, with a level of service "D" considered acceptable during peak hours of traffic flow. The results of the a.m. and p.m. peak hour intersection capacity analyses are included in Appendix C and are summarized in Table 4.

Existing Peak Hour Intersection Queues

Existing a.m. and p.m. peak hour 95th percentile queue calculations were performed for the study intersections. The results of the queue calculations are included in Appendix D and are summarized in Table 5.

Existing Peak Hour Roadway Segment Capacity Analysis

Existing a.m. and p.m. peak hour roadway segment capacity analyses were performed for the two study roadway segments using the method of analysis included in the 2010 *Highway Capacity Manual*, published by the Transportation Research Board. The results of the peak hour segment capacity analyses are included in Appendix E and are summarized in Table 6.

Table 4
Existing Intersection Capacity Analysis

Intersection	*Approach*	*Movement*	*Level of Service*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	B	C
		Through-Right	B	C
		Overall approach	*B*	*C*
	Cahaba Heights Road Westbound	Left	B	C
		Through-Right	D	C
		Overall approach	*D*	*C*
	Summit Parkway Northbound	Left	C	C
		Through-Right	C	C
		Overall approach	*C*	*C*
	Crosshaven Drive Southbound	Left	C	C
		Through-Right	D	C
		Overall approach	*C*	*C*
		Overall intersection	***C***	***C***
Crosshaven Drive at Ridgely Drive	Ridgely Drive Eastbound	Left-Through-Right	B	B
	Ridgely Drive Westbound	Left-Through-Right	C	C
	Crosshaven Drive Northbound	Left-Through-Right	A	A
	Crosshaven Drive Southbound	Left-Through-Right	A	A
Crosshaven Drive at Valley Park Drive/ Canterbury Place	Canterbury Place Eastbound	Left-Through-Right	B	B
	Valley Park Drive Westbound	Left-Through-Right	C	C
	Crosshaven Drive Northbound	Left-Through-Right	A	A
	Crosshaven Drive Southbound	Left-Through-Right	A	A
Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left-Through-Right	A	C
	Green Valley Road Westbound	Left-Through-Right	C	A
	Crosshaven Drive Northbound	Left-Through-Right	B	B
	Crosshaven Drive Southbound	Left-Through-Right	B	B
	Sunview Drive Southeastbound	Left-Through-Right	A	A
		Overall intersection	***B***	***B***

Table 4 (Continued)
Existing Intersection Capacity Analysis

Intersection	*Approach*	*Movement*	*Level of Service*	
			AM Peak	*PM Peak*
Crosshaven Drive at Bearden Court	Office Access Eastbound	Left-Through-Right	A	E
	Bearden Court Westbound	Left-Through-Right	C	E
	Crosshaven Drive Northbound	Left-Through-Right	A	A
	Crosshaven Drive Southbound	Left-Through-Right	A	A
Crosshaven Drive at Greendale Drive	Greendale Road Westbound	Left-Right	B	C
	Crosshaven Drive Northbound	Through-Right	A	A
	Crosshaven Drive Southbound	Left-Through	A	A
		Overall intersection	***A***	***A***
Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	B	B
		Through-Right	C	C
		Overall approach	*C*	*C*
	Overton Road Westbound	Left	B	B
		Through-Right	B	A
		Overall approach	*B*	*B*
	Crosshaven Drive Northbound	Left-Through	C	C
		Right	B	C
		Overall approach	*C*	*C*
	Crosshaven Drive Southbound	Left-Through-Right	B	C
		Overall intersection	***B***	***B***

Table 5
Existing Intersection Queue Analysis

Intersection	*Approach*	*Movement*	*95th Percentile Queue*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	40’	77’
		Through-Right	147’	369’
	Cahaba Heights Road Westbound	Left	39’	82’
		Through-Right	465’	281’
	Summit Parkway Northbound	Left	178’	125’
		Through-Right	178’	355’
	Crosshaven Drive Southbound	Left	74’	137’
		Through-Right	220’	376’
Crosshaven Drive at Ridgely Drive	Ridgely Drive Eastbound	Left-Through-Right	2’	5’
	Ridgely Drive Westbound	Left-Through-Right	8’	2’
	Crosshaven Drive Northbound	Left-Through-Right	0’	0’
	Crosshaven Drive Southbound	Left-Through-Right	1’	0’
Crosshaven Drive at Valley Park Drive/ Canterbury Place	Canterbury Place Eastbound	Left-Through-Right	1’	2’
	Valley Park Drive Westbound	Left-Through-Right	5’	2’
	Crosshaven Drive Northbound	Left-Through-Right	0’	0’
	Crosshaven Drive Southbound	Left-Through-Right	0’	0’
Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left-Through-Right	48’	238’
	Green Valley Road Westbound	Left-Through-Right	226’	54’
	Crosshaven Drive Northbound	Left-Through-Right	241’	241’
	Crosshaven Drive Southbound	Left-Through-Right	125’	213’
	Sunview Drive Southeastbound	Left-Through-Right	7’	14’

Table 5 (Continued)
Existing Intersection Queue Analysis

Intersection	*Approach*	*Movement*	*95th Percentile Queue*	
			AM Peak	*PM Peak*
Crosshaven Drive at Bearden Court	Office Access Eastbound	Left-Through-Right	0’	3’
	Bearden Court Westbound	Left-Through-Right	11’	49’
	Crosshaven Drive Northbound	Left-Through-Right	0’	0’
	Crosshaven Drive Southbound	Left-Through-Right	0’	3’
Crosshaven Drive at Greendale Drive	Greendale Road Westbound	Left-Right	42’	36’
	Crosshaven Drive Northbound	Through-Right	83’	161’
	Crosshaven Drive Southbound	Left-Through	110’	105’
Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	9’	6’
		Through-Right	232’	397’
	Overton Road Westbound	Left	119’	141’
		Through-Right	419’	103’
	Crosshaven Drive Northbound	Left-Through	235’	159’
		Right	40’	80’
	Crosshaven Drive Southbound	Left-Through-Right	19’	29’

Table 6
Existing Peak Hour Roadway Segment Capacity Analysis
Crosshaven Drive

Segment	*AM Peak*				*PM Peak*			
	Traffic Volumes		*Level of Service*	*v/c Ratio*	*Traffic Volumes*		*Level of Service*	*v/c Ratio*
	Analysis Direction	*Opposing Direction*			*Analysis Direction*	*Opposing Direction*		
Cahaba Heights Rd to Green Valley Rd	450 vph	366 vph	C	0.53	469 vph	399 vph	C	0.53
Green Valley Rd to Overton Rd	430 vph	352 vph	C	0.53	566 vph	494 vph	D	0.53

Existing Daily Roadway Segment Capacity Analysis

Existing daily roadway segment capacity analyses were performed for the two study roadway segments using the capacity chart prepared by the Alabama Department of Transportation with level of service thresholds assigned according to the 2010 *Highway Capacity Manual*. The level of service chart is included in Appendix F. The results of the analysis are shown in Table 7. All segments of Crosshaven Drive currently operate at a level of service "C" or "D". The corridor can sustain the following traffic increases before the level of service will decline to a level of service "E":

North segment – +2,100 vehicles per day

South segment – +1,950 vehicles per day

Table 7
Existing Daily Roadway Segment Capacity Analysis
Crosshaven Drive

Segment	*Classification*	*Cross Section*	*Daily Volume*	*Capacity*	*v/c Ratio*	*Level of Service*
Cahaba Heights Road to Green Valley Road	Collector	2 Lane Undivided	10,500 vpd	16,600 vpd	0.63	D
Green Valley Road to Overton Road	Minor Arterial	2 Lane Undivided	11,246 vpd	17,800 vpd	0.63	C

Existing Turn Lane Warrant Analysis

Existing a.m. and p.m. peak hour turn lane warrant analyses were performed for each turning movement at each study intersection where there is not an existing turn lane provided. The methods of analysis used for the turn lane warrants were as follows:

- For unsignalized intersections and for right turns, the method of analysis presented in the National Cooperative Highway Research Program Report 279, *Intersection Channelization Design Guide*, was used.

- For left turns at signalized intersections, the method of analysis presented in the Virginia Transportation Research Council Final Report *Development of Left Turn Lane Guidelines for Signalized and Unsignalized Intersections* was used.

The results of the turn lane warrant analyses are presented as follows:

Crosshaven Drive at Cahaba Heights Road

Construct a right turn lane on Cahaba Heights Road eastbound

Construct a right turn lane on Cahaba Heights Road westbound

Construct a right turn lane on Crosshaven Drive southbound

Crosshaven Drive at Green Valley Road

Construct a left turn lane on Green Valley Road eastbound

Construct a right turn lane on Green Valley Road eastbound

Construct a right turn lane on Crosshaven Drive northbound

Construct a left turn lane on Crosshaven Drive southbound

Crosshaven Drive at Bearden Court

Construct a left turn lane on Crosshaven Drive southbound

Crosshaven Drive at Greendale Road

Construct a right turn lane on Crosshaven Drive northbound

Construct a left turn lane on Crosshaven Drive southbound

Crosshaven Drive at Overton Road

Construct a right turn lane on Overton Road eastbound

Crosshaven Drive - segment from Cahaba Heights Road to Green Valley Road

A center turn lane is warranted at any driveway or public roadway where the hourly left turn traffic flow exceeds 32 vehicles per hour. This indicates that a continuous center turn lane is not necessarily warranted while the development along the segment of roadway remains primarily residential. As the land along this roadway segment converts to commercial, the need for a center turn lane will become evident.

Crosshaven Drive - segment from Green Valley Road to Overton Road

A center turn lane is warranted at any driveway or public roadway where the hourly left turn traffic flow exceeds 19 vehicles per hour. This indicates that a continuous center turn lane is warranted due to the predominance of commercial land uses in this segment of Crosshaven Drive.

FUTURE CONDITIONS ANALYSIS

Historical Traffic Growth

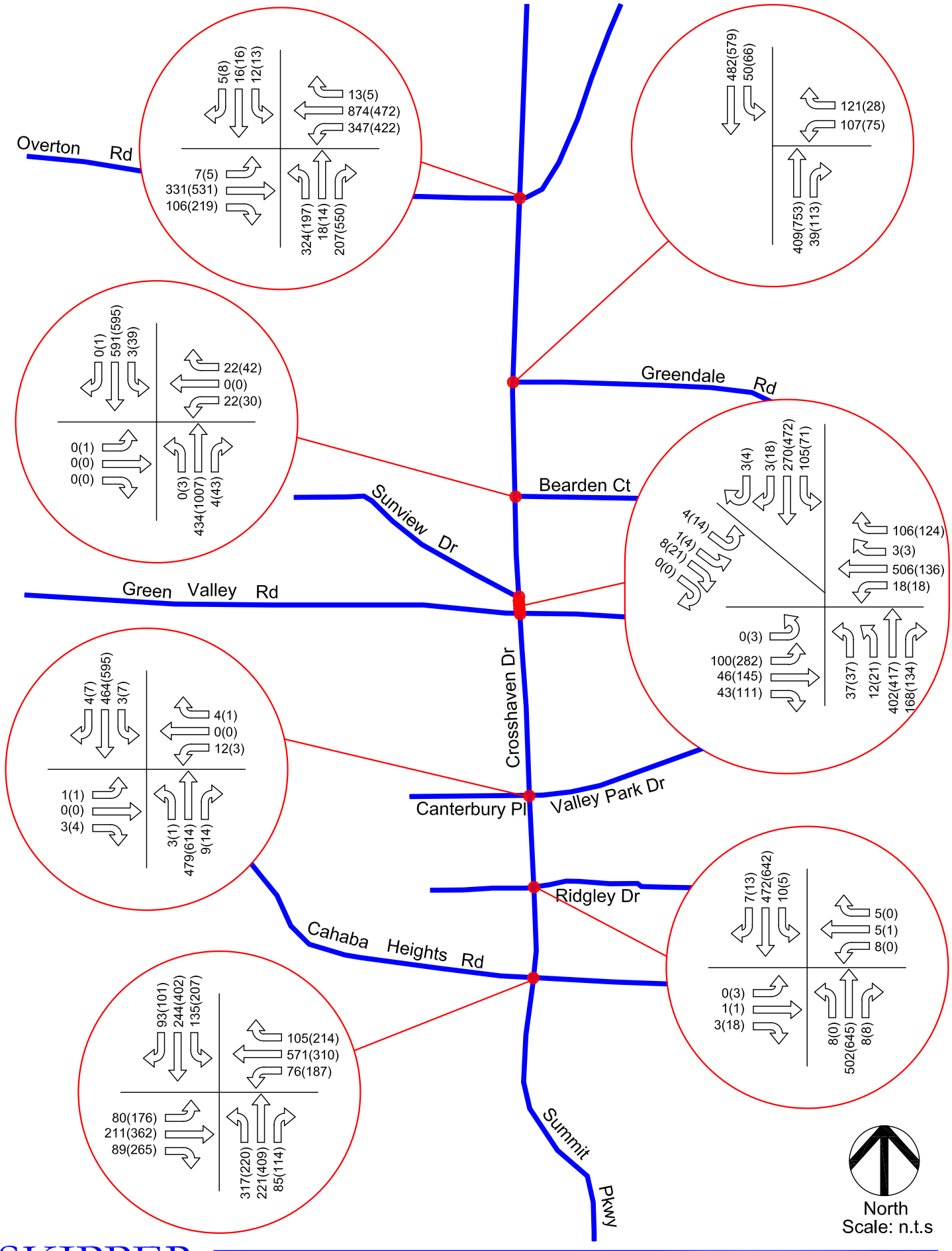
Historical traffic growth on Crosshaven Drive was calculated based on traffic counts obtained from the Regional Planning Commission of Greater Birmingham and the Alabama Department of Transportation. The historical traffic counts and growth analysis is shown in Table 8. For the purposes of this study, a yearly traffic growth rate of +3.3% per year was used.

Table 8
Historical Traffic Growth
Crosshaven Drive

Year	*Cahaba Heights Rd to Green Valley Rd*		*Green Valley Rd to Overton Rd*	
	Count	*Growth*	*Count*	*Growth*
1988	5000		8300	
1989			7600	-8.4%
1990	5600	6.0%		
1993	7900	13.7%	8800	3.9%
1998	8310	1.0%	11330	5.8%
2000	10550	13.5%	13150	8.0%
2013	11580	0.8%	12500	-0.4%
2014	11670	0.8%	14650	17.2%
2015	10860	-6.9%	13650	-6.8%
Average		***4.3%***		***2.4%***

Future Peak Hour Traffic Volumes

Traffic on the study area roadway intersections and roadway segments was projected forward to the year 2027 using the +3.3% per year historical traffic growth rate. The future a.m. and p.m. peak hour traffic volumes are shown in Figure 3.



SKIPPER CONSULTING INC.

Figure 3 - Future 2027 Traffic Volumes

Crosshaven Drive APPLE - Vestavia Hills, Alabama June 2017

Future Peak Hour Intersection Capacity Analysis

Future a.m. and p.m. peak hour intersection capacity analyses were performed for the study intersections using the method of analysis included in the 2010 *Highway Capacity Manual*, published by the Transportation Research Board. The results of the a.m. and p.m. peak hour intersection capacity analyses are included in Appendix G and are summarized in Table 9.

Future Peak Hour Intersection Queues

Future a.m. and p.m. peak hour 95th percentile queue calculations were performed for the study intersections. The results of the queue calculations are included in Appendix H and are summarized in Table 10.

Future Peak Hour Roadway Segment Capacity Analysis

Future a.m. and p.m. peak hour roadway segment capacity analyses were performed for the two study roadway segments using the method of analysis included in the 2010 *Highway Capacity Manual*, published by the Transportation Research Board. The results of the peak hour segment capacity analyses are included in Appendix I and are summarized in Table 11.

Future Daily Roadway Segment Capacity Analysis

Future daily roadway segment capacity analyses were performed for the two study roadway segments using the capacity chart prepared by the Alabama Department of Transportation with level of service thresholds assigned according to the 2010 *Highway Capacity Manual*. The level of service chart is included in Appendix F. The results of the analysis are shown in Table 12.

Future Turn Lane Warrant Analysis

No additional turn lanes are warranted based on future traffic volumes beyond those turn lanes warranted for existing traffic volumes.

Table 9
Future Intersection Capacity Analysis

Intersection	*Approach*	*Movement*	*Level of Service*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	C	F
		Through-Right	C	E
		Overall approach	*C*	*E*
	Cahaba Heights Road Westbound	Left	B	F
		Through-Right	F	D
		Overall approach	*F*	*E*
	Summit Parkway Northbound	Left	F	F
		Through-Right	C	F
		Overall approach	*F*	*F*
	Crosshaven Drive Southbound	Left	C	F
		Through-Right	E	F
		Overall approach	*D*	*F*
		Overall intersection	***F***	***F***
Crosshaven Drive at Ridgely Drive	Ridgely Drive Eastbound	Left-Through-Right	C	C
	Ridgely Drive Westbound	Left-Through-Right	D	E
	Crosshaven Drive Northbound	Left-Through-Right	A	A
	Crosshaven Drive Southbound	Left-Through-Right	A	A
Crosshaven Drive at Valley Park Drive/ Canterbury Place	Canterbury Place Eastbound	Left-Through-Right	C	C
	Valley Park Drive Westbound	Left-Through-Right	C	D
	Crosshaven Drive Northbound	Left-Through-Right	A	A
	Crosshaven Drive Southbound	Left-Through-Right	A	A
Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left-Through-Right	C	F
	Green Valley Road Westbound	Left-Through-Right	F	A
	Crosshaven Drive Northbound	Left-Through-Right	E	F
	Crosshaven Drive Southbound	Left-Through-Right	E	D
	Sunview Drive Southeastbound	Left-Through-Right	A	A
		Overall intersection	***E***	***E***

Table 9 (Continued)
Future Intersection Capacity Analysis

Intersection	*Approach*	*Movement*	*Level of Service*	
			AM Peak	*PM Peak*
Crosshaven Drive at Bearden Court	Office Access Eastbound	Left-Through-Right	A	F
	Bearden Court Westbound	Left-Through-Right	D	F
	Crosshaven Drive Northbound	Left-Through-Right	A	A
	Crosshaven Drive Southbound	Left-Through-Right	A	A
Crosshaven Drive at Greendale Drive	Greendale Road Westbound	Left-Right	B	C
	Crosshaven Drive Northbound	Through-Right	A	A
	Crosshaven Drive Southbound	Left-Through	A	A
		Overall intersection	***A***	***A***
Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	B	B
		Through-Right	D	E
		Overall approach	*D*	*E*
	Overton Road Westbound	Left	E	F
		Through-Right	D	A
		Overall approach	*D*	*D*
	Crosshaven Drive Northbound	Left-Through	D	D
		Right	B	D
		Overall approach	*D*	*D*
	Crosshaven Drive Southbound	Left-Through-Right	B	C
		Overall intersection	***D***	***D***

Table 10
Future Intersection Queue Analysis

Intersection	*Approach*	*Movement*	*95th Percentile Queue*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	50′	173′
		Through-Right	200′	604′
	Cahaba Heights Road Westbound	Left	48′	223′
		Through-Right	700′	463′
	Summit Parkway Northbound	Left	363′	245′
		Through-Right	243′	526′
	Crosshaven Drive Southbound	Left	94′	253′
		Through-Right	350′	550′
Crosshaven Drive at Ridgely Drive	Ridgely Drive Eastbound	Left-Through-Right	4′	11′
	Ridgely Drive Westbound	Left-Through-Right	19′	4′
	Crosshaven Drive Northbound	Left-Through-Right	1′	0′
	Crosshaven Drive Southbound	Left-Through-Right	1′	1′
Crosshaven Drive at Valley Park Drive/ Canterbury Place	Canterbury Place Eastbound	Left-Through-Right	2′	3′
	Valley Park Drive Westbound	Left-Through-Right	11′	5′
	Crosshaven Drive Northbound	Left-Through-Right	0′	0′
	Crosshaven Drive Southbound	Left-Through-Right	0′	1′
Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left-Through-Right	107′	353′
	Green Valley Road Westbound	Left-Through-Right	340′	77′
	Crosshaven Drive Northbound	Left-Through-Right	356′	360′
	Crosshaven Drive Southbound	Left-Through-Right	248′	327′
	Sunview Drive Southeastbound	Left-Through-Right	8′	18′

Table 10 (Continued)
Future Intersection Queue Analysis

Intersection	*Approach*	*Movement*	*95th Percentile Queue*	
			AM Peak	*PM Peak*
Crosshaven Drive at Bearden Court	Office Access Eastbound	Left-Through-Right	0'	12'
	Bearden Court Westbound	Left-Through-Right	26'	177'
	Crosshaven Drive Northbound	Left-Through-Right	0'	0'
	Crosshaven Drive Southbound	Left-Through-Right	0'	7'
Crosshaven Drive at Greendale Drive	Greendale Road Westbound	Left-Right	57'	44'
	Crosshaven Drive Northbound	Through-Right	119'	382'
	Crosshaven Drive Southbound	Left-Through	180'	312'
Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	12'	8'
		Through-Right	368'	652'
	Overton Road Westbound	Left	328'	374'
		Through-Right	754'	146'
	Crosshaven Drive Northbound	Left-Through	340'	217'
		Right	45'	320'
	Crosshaven Drive Southbound	Left-Through-Right	24'	35'

Table 11
Future Peak Hour Roadway Segment Capacity Analysis
Crosshaven Drive

Segment	*AM Peak*				*PM Peak*			
	Traffic Volumes		*Level of Service*	*v/c Ratio*	*Traffic Volumes*		*Level of Service*	*v/c Ratio*
	Analysis Direction	*Opposing Direction*			*Analysis Direction*	*Opposing Direction*		
Cahaba Heights Rd to Green Valley Rd	590 vph	479 vph	D	0.53	614 vph	522 vph	D	0.53
Green Valley Rd to Overton Rd	563 vph	461 vph	D	0.53	741 vph	647 vph	D	0.53

Table 12
Future Daily Roadway Segment Capacity Analysis
Crosshaven Drive

Segment	*Classification*	*Cross Section*	*Daily Volume*	*Capacity*	*v/c Ratio*	*Level of Service*
Cahaba Heights Road to Green Valley Road	Collector	2 Lane Undivided	13,750 vpd	16,600 vpd	0.83	E
Green Valley Road to Overton Road	Minor Arterial	2 Lane Undivided	14,750 vpd	17,800 vpd	0.83	E

RECOMMENDED IMPROVEMENTS

Based on the results of the analyses presented in this report, the following is a list of recommended improvements for Crosshaven Drive:

Crosshaven Drive – entire roadway from Cahaba Heights Road to Overton Road

Widen to a continuous three lane cross section

Crosshaven Drive at Cahaba Heights Road

Construct a right turn lane on Cahaba Heights Road eastbound

Construct a right turn lane on Cahaba Heights Road westbound

Construct a right turn lane on Crosshaven Drive southbound

Crosshaven Drive at Green Valley Road

Construct a left turn lane on Green Valley Road eastbound

Construct a right turn lane on Green Valley Road eastbound

Construct a right turn lane on Crosshaven Drive northbound

Construct a left turn lane on Crosshaven Drive southbound

Crosshaven Drive at Bearden Court

Construct a left turn lane on Crosshaven Drive southbound

Install a traffic signal when warranted

Crosshaven Drive at Greendale Road

Construct a right turn lane on Crosshaven Drive northbound

Construct a left turn lane on Crosshaven Drive southbound

Crosshaven Drive at Overton Road

Construct a right turn lane on Overton Road eastbound

ANALYSIS OF RECOMMENDED IMPROVEMENTS

Future Peak Hour Intersection Capacity Analysis with Improvements

Future a.m. and p.m. peak hour intersection capacity analyses were performed for the study intersections using the method of analysis included in the 2010 *Highway Capacity Manual*, published by the Transportation Research Board. The results of the a.m. and p.m. peak hour intersection capacity analyses are included in Appendix J and are summarized in Table 13.

Future Peak Hour Intersection Queues with Improvements

Future a.m. and p.m. peak hour 95th percentile queue calculations were performed for the study intersections. The results of the queue calculations are included in Appendix K and are summarized in Table 14.

Future Peak Hour Roadway Segment Capacity Analysis with Improvements

Future a.m. and p.m. peak hour roadway segment capacity analyses were performed for the two study roadway segments using the method of analysis included in the 2010 *Highway Capacity Manual*, published by the Transportation Research Board. The results of the peak hour segment capacity analyses are included in Appendix L and are summarized in Table 15.

Future Daily Roadway Segment Capacity Analysis with Improvements

Future daily roadway segment capacity analyses were performed for the two study roadway segments using the capacity chart prepared by the Alabama Department of Transportation with level of service thresholds assigned according to the 2010 *Highway Capacity Manual*. The level of service chart is included in Appendix F. The results of the analysis are shown in Table 16.

Table 13
Future Intersection Capacity Analysis with Improvements

Intersection	*Approach*	*Movement*	*Level of Service*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	D	C
		Through	C	C
		Right	B	C
		Overall approach	*C*	*C*
	Cahaba Heights Road Westbound	Left	B	D
		Through	D	C
		Right	B	C
		Overall approach	*D*	*C*
	Summit Parkway Northbound	Left	D	C
		Through-Right	C	D
		Overall approach	*D*	*D*
	Crosshaven Drive Southbound	Left	C	D
		Through	D	C
		Right	C	B
		Overall approach	*D*	*C*
		Overall intersection	***D***	***C***
Crosshaven Drive at Ridgely Drive	Ridgely Drive Eastbound	Left-Through-Right	C	C
	Ridgely Drive Westbound	Left-Through-Right	D	E
	Crosshaven Drive Northbound	Left	A	A
	Crosshaven Drive Southbound	Left	A	A
Crosshaven Drive at Valley Park Drive/ Canterbury Place	Canterbury Place Eastbound	Left-Through-Right	C	C
	Valley Park Drive Westbound	Left-Through-Right	C	D
	Crosshaven Drive Northbound	Left	A	A
	Crosshaven Drive Southbound	Left	A	A
Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left	B	B
		Through	A	A
		Right	A	A
		Overall approach	*B*	*B*
	Green Valley Road Westbound	Left-Through-Right	D	A
	Crosshaven Drive Northbound	Left	A	A
		Through	B	B
		Right	A	A
		Overall approach	*B*	*B*
	Crosshaven Drive Southbound	Left	B	A
		Through-Right	B	B
		Overall approach	*B*	*B*
	Sunview Drive Southeastbound	Left-Through-Right	A	A
		Overall intersection	***C***	***B***

Table 13 (Continued)
Future Intersection Capacity Analysis with Improvements

Intersection	*Approach*	*Movement*	*Level of Service*	
			AM Peak	*PM Peak*
Crosshaven Drive at Bearden Court	Office Access Eastbound	Left-Through-Right	A	C
	Bearden Court Westbound	Left-Through-Right	D	C
	Crosshaven Drive Northbound	Left	A	A
		Through-Right	A	B
		Overall approach	*A*	*B*
	Crosshaven Drive Southbound	Left	*A*	*A*
		Through-Right	*A*	*A*
		Overall approach	*A*	*A*
		Overall intersection	***A***	***A***
Crosshaven Drive at Greendale Drive	Greendale Road Westbound	Left-Right	B	C
	Crosshaven Drive Northbound	Through	A	A
		Right	A	A
		Overall approach	*A*	*A*
	Crosshaven Drive Southbound	Left	A	A
		Through	A	A
		Overall approach	*A*	*A*
		Overall intersection	***A***	***A***
Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	B	B
		Through	C	C
		Right	B	B
		Overall approach	*C*	*C*
	Overton Road Westbound	Left	C	D
		Through-Right	D	A
		Overall approach	*D*	*B*
	Crosshaven Drive Northbound	Left-Through	D	D
		Right	B	C
		Overall approach	*D*	*C*
	Crosshaven Drive Southbound	Left-Through-Right	B	C
		Overall intersection	***C***	***C***

Table 14
Future Intersection Queue Analysis with Improvements

Intersection	*Approach*	*Movement*	*95th Percentile Queue*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	62’	101’
		Through	155’	268’
		Right	27’	49
	Cahaba Heights Road Westbound	Left	52’	109’
		Through	566’	224’
		Right	31’	36’
	Summit Parkway Northbound	Left	267’	213’
		Through-Right	243’	538’
	Crosshaven Drive Southbound	Left	88’	230’
		Through	260’	402’
		Right	35’	37’
Crosshaven Drive at Ridgely Drive	Ridgely Drive Eastbound	Left-Through-Right	4’	11’
	Ridgely Drive Westbound	Left-Through-Right	18’	4’
	Crosshaven Drive Northbound	Left	1’	0’
		Through-Right	0’	0’
	Crosshaven Drive Southbound	Left	1’	1’
		Through-Right	0	0’
Crosshaven Drive at Valley Park Drive/ Canterbury Place	Canterbury Place Eastbound	Left-Through-Right	2’	3’
	Valley Park Drive Westbound	Left-Through-Right	11’	5’
	Crosshaven Drive Northbound	Left	0’	0’
		Through-Right	0’	0’
	Crosshaven Drive Southbound	Left	0’	1’
		Through-Right	0’	0’
Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left	71’	178’
		Through	19’	53’
		Right	9’	21’
	Green Valley Road Westbound	Left-Through-Right	328’	76’
	Crosshaven Drive Northbound	Left	26’	35’
		Through	176’	169’
		Right	26’	22’
	Crosshaven Drive Southbound	Left	76’	38’
		Through-Right	106	240’
	Sunview Drive Southeastbound	Left-Through-Right	9’	18’

Table 14 (Continued)
Future Intersection Queue Analysis with Improvements

Intersection	*Approach*	*Movement*	*95th Percentile Queue*	
			AM Peak	*PM Peak*
Crosshaven Drive at Bearden Court	Office Access Eastbound	Left-Through-Right	0’	2’
	Bearden Court Westbound	Left-Through-Right	20’	21’
	Crosshaven Drive Northbound	Left	0’	0’
		Through-Right	101’	517’
	Crosshaven Drive Southbound	Left	2’	20’
		Through-Right	161’	208’
Crosshaven Drive at Greendale Drive	Greendale Road Westbound	Left-Right	57’	44’
	Crosshaven Drive Northbound	Through	107’	307’
		Right	8’	11’
	Crosshaven Drive Southbound	Left	18’	22’
		Through	135’	122’
Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	12’	8’
		Through	237’	344’
		Right	27’	36’
	Overton Road Westbound	Left	227’	247’
		Through-Right	754’	146’
	Crosshaven Drive Northbound	Left-Through	340’	217’
		Right	45’	229’
	Crosshaven Drive Southbound	Left-Through-Right	24’	35’

Table 15
Future Peak Hour Roadway Segment Capacity Analysis with Improvements
Crosshaven Drive

Segment	*AM Peak*				*PM Peak*			
	Traffic Volumes		*Level of Service*	*v/c Ratio*	*Traffic Volumes*		*Level of Service*	*v/c Ratio*
	Analysis Direction	*Opposing Direction*			*Analysis Direction*	*Opposing Direction*		
Cahaba Heights Rd to Green Valley Rd	590 vph	479 vph	C	0.53	614 vph	522 vph	C	0.53
Green Valley Rd to Overton Rd	563 vph	461 vph	C	0.53	741 vph	647 vph	D	0.53

Table 16
Future Daily Roadway Segment Capacity Analysis with Improvements
Crosshaven Drive

Segment	*Classification*	*Cross Section*	*Daily Volume*	*Capacity*	*v/c Ratio*	*Level of Service*
Cahaba Heights Road to Green Valley Road	Collector	3 Lane	13,750 vpd	20,800 vpd	0.66	D
Green Valley Road to Overton Road	Minor Arterial	3 Lane	14,750 vpd	22,000 vpd	0.67	D

Appendix A

Existing Intersection Turning Movement Traffic Counts

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Vestavia Hills, AL

File Name : vestaviahills02
Site Code : 00000000
Start Date : 05/03/2017
Page No : 1

Groups Printed- Unshifted

	CROSSHAVEN DR Southbound			CAHABA HEIGHTS RD Westbound			CROSSHAVEN DR Northbound			CAHABA HEIGHTS RD Eastbound			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	10	37	15	15	54	15	25	23	15	4	19	15	247
07:15 AM	18	34	12	13	106	16	33	27	17	11	41	10	338
07:30 AM	16	60	26	13	134	17	61	42	10	21	47	18	465
07:45 AM	39	57	12	18	108	25	77	54	21	14	36	15	476
Total	83	188	65	59	402	73	196	146	63	50	143	58	1526
08:00 AM	30	35	21	14	88	22	71	46	17	15	37	25	421
08:15 AM	31	38	16	11	69	15	43	48	9	10	28	17	335
08:30 AM	16	50	9	11	57	18	26	31	5	7	27	20	277
08:45 AM	26	43	22	17	40	16	26	43	9	14	31	17	304
Total	103	166	68	53	254	71	166	168	40	46	123	79	1337
04:00 PM	28	75	26	18	27	32	34	66	12	24	51	51	444
04:15 PM	27	65	18	25	60	24	38	69	22	26	41	41	456
04:30 PM	34	80	18	30	55	38	42	74	18	45	68	46	548
04:45 PM	42	70	19	27	48	40	46	70	27	33	59	41	522
Total	131	290	81	100	190	134	160	279	79	128	219	179	1970
05:00 PM	37	77	18	51	79	31	37	90	19	35	70	60	604
05:15 PM	45	80	22	35	55	54	43	78	23	21	79	55	590
05:30 PM	24	59	33	28	40	51	38	68	32	26	75	59	533
05:45 PM	34	78	21	40	42	33	37	66	22	21	67	61	522
Total	140	294	94	154	216	169	155	302	96	103	291	235	2249
Grand Total	457	938	308	366	1062	447	677	895	278	327	776	551	7082
Apprch %	26.8	55.1	18.1	19.5	56.6	23.8	36.6	48.4	15.0	19.8	46.9	33.3	
Total %	6.5	13.2	4.3	5.2	15.0	6.3	9.6	12.6	3.9	4.6	11.0	7.8	

	CROSSHAVEN DR Southbound				CAHABA HEIGHTS RD Westbound				CROSSHAVEN DR Northbound				CAHABA HEIGHTS RD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	103	186	71	360	58	436	80	574	242	169	65	476	61	161	68	290	1700
Percent	28.6	51.7	19.7		10.1	76.0	13.9		50.8	35.5	13.7		21.0	55.5	23.4		
07:45 Volume	39	57	12	108	18	108	25	151	77	54	21	152	14	36	15	65	476
Peak Factor																	0.893
High Int.	07:45 AM				07:30 AM				07:45 AM				07:30 AM				
Volume	39	57	12	108	13	134	17	164	77	54	21	152	21	47	18	86	
Peak Factor				0.833				0.875				0.783				0.843	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
By Approach	07:30 AM				07:15 AM				07:30 AM				07:15 AM				
Volume	116	190	75	381	58	436	80	574	252	190	57	499	61	161	68	290	
Percent	30.4	49.9	19.7		10.1	76.0	13.9		50.5	38.1	11.4		21.0	55.5	23.4		
High Int.	07:45 AM				07:30 AM				07:45 AM				07:30 AM				
Volume	39	57	12	108	13	134	17	164	77	54	21	152	21	47	18	86	
Peak Factor				0.882				0.875				0.821				0.843	

TRAFFIC DATA, LLC
1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

File Name : vestaviahills02
Site Code : 00000000
Start Date : 05/03/2017
Page No : 2

	CROSSHAVEN DR Southbound				CAHABA HEIGHTS RD Westbound				CROSSHAVEN DR Northbound				CAHABA HEIGHTS RD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:30 PM																
Volume	158	307	77	542	143	237	163	543	168	312	87	567	134	276	202	612	2264
Percent	29.2	56.6	14.2		26.3	43.6	30.0		29.6	55.0	15.3		21.9	45.1	33.0		
05:00 Volume	37	77	18	132	51	79	31	161	37	90	19	146	35	70	60	165	604
Peak Factor																	0.937
High Int.	05:15 PM				05:00 PM				05:00 PM				05:00 PM				
Volume	45	80	22	147	51	79	31	161	37	90	19	146	35	70	60	165	
Peak Factor				0.922				0.843				0.971				0.927	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
By Approach	04:30 PM				04:30 PM				04:45 PM				05:00 PM				
Volume	158	307	77	542	143	237	163	543	164	306	101	571	103	291	235	629	
Percent	29.2	56.6	14.2		26.3	43.6	30.0		28.7	53.6	17.7		16.4	46.3	37.4		
High Int.	05:15 PM				05:00 PM				05:00 PM				05:00 PM				
Volume	45	80	22	147	51	79	31	161	37	90	19	146	35	70	60	165	
Peak Factor				0.922				0.843				0.978				0.953	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Vestavia Hills, AL

File Name : vestaviahills01
Site Code : 00000000
Start Date : 10/03/2016
Page No : 1

Groups Printed- Unshifted

	CROSSHAVEN DR Southbound			RIDGLEY DR Westbound			CROSSHAVEN DR Northbound			RIDGLEY DR Eastbound			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
04:00 PM	1	110	2	1	1	0	1	127	0	0	0	1	244
04:15 PM	2	124	5	0	0	0	0	131	1	0	0	5	268
04:30 PM	0	109	2	0	1	0	0	114	0	1	0	5	232
04:45 PM	0	139	3	0	0	0	0	115	4	1	0	1	263
Total	3	482	12	1	2	0	1	487	5	2	0	12	1007
05:00 PM	2	118	0	0	0	0	0	132	1	0	1	3	257
05:15 PM	2	98	0	0	0	1	0	118	1	0	0	2	222
05:30 PM	2	116	0	0	1	0	0	128	0	0	0	1	248
05:45 PM	0	114	2	1	0	0	1	93	0	0	1	0	212
Total	6	446	2	1	1	1	1	471	2	0	2	6	939
07:00 AM	1	48	1	1	0	0	0	43	0	1	2	0	97
07:15 AM	0	63	0	4	1	1	2	50	1	0	1	2	125
07:30 AM	1	100	1	2	1	0	0	105	1	0	0	0	211
07:45 AM	1	96	3	3	2	3	1	86	1	0	0	0	196
Total	3	307	5	10	4	4	3	284	3	1	3	2	629
08:00 AM	5	75	0	0	1	1	2	97	0	0	1	2	184
08:15 AM	1	89	1	1	0	0	3	95	4	0	0	0	194
08:30 AM	0	80	2	1	0	1	2	84	0	0	0	1	171
08:45 AM	0	84	1	0	0	0	0	62	1	1	1	2	152
Total	6	328	4	2	1	2	7	338	5	1	2	5	701
Grand Total	18	1563	23	14	8	7	12	1580	15	4	7	25	3276
Apprch %	1.1	97.4	1.4	48.3	27.6	24.1	0.7	98.3	0.9	11.1	19.4	69.4	
Total %	0.5	47.7	0.7	0.4	0.2	0.2	0.4	48.2	0.5	0.1	0.2	0.8	

	CROSSHAVEN DR Southbound				RIDGLEY DR Westbound				CROSSHAVEN DR Northbound				RIDGLEY DR Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:15 PM																
Volume	4	490	10	504	0	1	0	1	0	492	6	498	2	1	14	17	1020
Percent	0.8	97.2	2.0		0.0	100.0	0.0		0.0	98.8	1.2		11.8	5.9	82.4		
04:15 Volume	2	124	5	131	0	0	0	0	0	131	1	132	0	0	5	5	268
Peak Factor																	0.951
High Int.	04:45 PM				04:30 PM				05:00 PM				04:30 PM				
Volume	0	139	3	142	0	1	0	1	0	132	1	133	1	0	5	6	
Peak Factor				0.887				0.250				0.936				0.708	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
By Approach	04:15 PM				04:00 PM				04:45 PM				04:15 PM				
Volume	4	490	10	504	1	2	0	3	0	493	6	499	2	1	14	17	
Percent	0.8	97.2	2.0		33.3	66.7	0.0		0.0	98.8	1.2		11.8	5.9	82.4		
High Int.	04:45 PM				04:00 PM				05:00 PM				04:30 PM				
Volume	0	139	3	142	1	1	0	2	0	132	1	133	1	0	5	6	
Peak Factor				0.887				0.375				0.938				0.708	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

File Name : vestaviahills01
Site Code : 00000000
Start Date : 10/03/2016

	CROSSHAVEN DR Southbound				RIDGLEY DR Westbound				CROSSHAVEN DR Northbound				RIDGLEY DR Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Intersection	07:30 AM																
Volume	8	360	5	373	6	4	4	14	6	383	6	395	0	1	2	3	785
Percent	2.1	96.5	1.3		42.9	28.6	28.6		1.5	97.0	1.5		0.0	33.3	66.7		
07:30 Volume	1	100	1	102	2	1	0	3	0	105	1	106	0	0	0	0	211
Peak Factor																	0.930
High Int.	07:30 AM				07:45 AM				07:30 AM				08:00 AM				
Volume	1	100	1	102	3	2	3	8	0	105	1	106	0	1	2	3	
Peak Factor				0.914				0.438				0.932				0.250	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
By Approach	07:30 AM				07:15 AM				07:30 AM				08:00 AM				
Volume	8	360	5	373	9	5	5	19	6	383	6	395	1	2	5	8	
Percent	2.1	96.5	1.3		47.4	26.3	26.3		1.5	97.0	1.5		12.5	25.0	62.5		
High Int.	07:30 AM				07:45 AM				07:30 AM				08:45 AM				
Volume	1	100	1	102	3	2	3	8	0	105	1	106	1	1	2	4	
Peak Factor				0.914				0.594				0.932				0.500	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Vestavia Hills, AL

File Name : vestaviahills02
Site Code : 00000000
Start Date : 10/03/2016
Page No : 1

Groups Printed- Unshifted

	CROSSHAVEN DR Southbound			VALLEY PARK DR Westbound			CROSSHAVEN DR Northbound			CANTERBURY PL Eastbound			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
04:00 PM	3	107	0	0	0	0	0	124	6	0	0	0	240
04:15 PM	1	122	0	0	0	0	0	129	4	0	0	1	257
04:30 PM	4	105	0	0	0	1	0	103	7	1	0	0	221
04:45 PM	2	94	0	1	0	0	4	79	6	0	0	1	187
Total	10	428	0	1	0	1	4	435	23	1	0	2	905
05:00 PM	1	115	1	0	0	0	0	132	2	0	0	0	251
05:15 PM	2	109	2	0	0	0	0	124	4	0	0	0	241
05:30 PM	1	110	1	1	0	0	0	125	4	1	0	1	244
05:45 PM	1	120	1	1	0	1	1	88	1	0	0	2	216
Total	5	454	5	2	0	1	1	469	11	1	0	3	952
07:00 AM	0	53	0	2	0	0	0	40	1	0	0	0	96
07:15 AM	0	68	1	1	0	1	0	52	0	0	1	0	124
07:30 AM	0	96	0	5	0	1	0	93	1	0	0	1	197
07:45 AM	2	95	1	2	0	1	0	85	3	0	0	0	189
Total	2	312	2	10	0	3	0	270	5	0	1	1	606
08:00 AM	0	80	0	2	0	1	1	93	2	0	0	0	179
08:15 AM	0	83	2	0	0	0	1	95	1	1	0	1	184
08:30 AM	0	80	0	0	0	2	0	83	2	0	0	2	169
08:45 AM	2	91	0	1	0	0	0	59	2	0	0	0	155
Total	2	334	2	3	0	3	2	330	7	1	0	3	687
Grand Total	19	1528	9	16	0	8	7	1504	46	3	1	9	3150
Apprch %	1.2	98.2	0.6	66.7	0.0	33.3	0.4	96.6	3.0	23.1	7.7	69.2	
Total %	0.6	48.5	0.3	0.5	0.0	0.3	0.2	47.7	1.5	0.1	0.0	0.3	

	CROSSHAVEN DR Southbound				VALLEY PARK DR Westbound				CROSSHAVEN DR Northbound				CANTERBURY PL Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	05:00 PM																
Volume	5	454	5	464	2	0	1	3	1	469	11	481	1	0	3	4	952
Percent	1.1	97.8	1.1		66.7	0.0	33.3		0.2	97.5	2.3		25.0	0.0	75.0		
05:00 Volume	1	115	1	117	0	0	0	0	0	132	2	134	0	0	0	0	251
Peak Factor																	0.948
High Int.	05:45 PM				05:45 PM				05:00 PM				05:30 PM				
Volume	1	120	1	122	1	0	1	2	0	132	2	134	1	0	1	2	
Peak Factor				0.951				0.375				0.897				0.500	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
By Approach	05:00 PM				05:00 PM				05:00 PM				05:00 PM				
Volume	5	454	5	464	2	0	1	3	1	469	11	481	1	0	3	4	
Percent	1.1	97.8	1.1		66.7	0.0	33.3		0.2	97.5	2.3		25.0	0.0	75.0		
High Int.	05:45 PM				05:45 PM				05:00 PM				05:30 PM				
Volume	1	120	1	122	1	0	1	2	0	132	2	134	1	0	1	2	
Peak Factor				0.951				0.375				0.897				0.500	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

File Name : vestaviahills02
Site Code : 00000000
Start Date : 10/03/2016

	CROSSHAVEN DR Southbound				VALLEY PARK DR Westbound				CROSSHAVEN DR Northbound				CANTERBURY PL Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Intersection	07:30 AM																
Volume	2	354	3	359	9	0	3	12	2	366	7	375	1	0	2	3	749
Percent	0.6	98.6	0.8		75.0	0.0	25.0		0.5	97.6	1.9		33.3	0.0	66.7		
07:30 Volume	0	96	0	96	5	0	1	6	0	93	1	94	0	0	1	1	197
Peak Factor																	0.951
High Int.	07:45 AM				07:30 AM				08:15 AM				08:15 AM				
Volume	2	95	1	98	5	0	1	6	1	95	1	97	1	0	1	2	
Peak Factor				0.916				0.500				0.966				0.375	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
By Approach	07:30 AM				07:15 AM				07:30 AM				07:45 AM				
Volume	2	354	3	359	10	0	4	14	2	366	7	375	1	0	3	4	
Percent	0.6	98.6	0.8		71.4	0.0	28.6		0.5	97.6	1.9		25.0	0.0	75.0		
High Int.	07:45 AM				07:30 AM				08:15 AM				08:15 AM				
Volume	2	95	1	98	5	0	1	6	1	95	1	97	1	0	1	2	
Peak Factor				0.916				0.583				0.966				0.500	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Vestavia Hills, AL

File Name : vestaviahills05
Site Code : 00000000
Start Date : 05/02/2017
Page No : 1

Groups Printed- Unshifted

	CROSSHAVEN DR Southbound				GREEN VALLEY RD Westbound				CROSSHAVEN DR Northbound				GREEN VALLEY RD Eastbound				
Start Time	Left	Thru	Right	SV Dr	Left	Thru	Right	SV Dr	Left	Thru	Right	SV Dr	Left	Thru	Right	SV Dr	Int. Total
07:00 AM	6	34	0	1	8	5	5	0	1	51	25	0	4	44	10	1	195
07:15 AM	15	43	0	2	15	5	6	0	2	65	42	3	0	79	19	0	296
07:30 AM	21	40	0	0	12	9	8	0	4	72	58	2	5	133	26	0	390
07:45 AM	21	62	0	2	17	13	2	0	6	75	24	1	4	101	22	1	351
Total	63	179	0	5	52	32	21	0	13	263	149	6	13	357	77	2	1232
08:00 AM	18	51	2	0	23	8	15	0	13	80	22	2	2	77	21	0	334
08:15 AM	20	52	0	0	24	5	8	0	5	80	24	4	3	75	12	1	313
08:30 AM	13	46	3	1	17	11	11	0	10	60	29	4	1	35	10	0	251
08:45 AM	9	37	5	1	17	6	8	0	4	56	13	3	4	18	11	1	193
Total	60	186	10	2	81	30	42	0	32	276	88	13	10	205	54	2	1091
04:00 PM	11	94	4	0	55	16	19	0	10	73	20	8	4	13	17	2	346
04:15 PM	18	91	2	0	51	21	15	0	3	65	31	5	4	19	17	0	342
04:30 PM	13	74	6	1	36	27	22	0	6	84	23	4	2	31	36	0	365
04:45 PM	8	78	3	2	32	19	20	0	5	70	20	4	6	18	12	1	298
Total	50	337	15	3	174	83	76	0	24	292	94	21	16	81	82	3	1351
05:00 PM	9	99	4	1	60	27	24	2	3	72	26	4	7	23	21	0	382
05:15 PM	17	92	2	1	58	30	26	0	6	74	22	2	4	33	23	0	392
05:30 PM	18	76	3	0	46	30	21	0	12	87	29	5	0	31	24	2	384
05:45 PM	10	94	5	1	51	24	12	0	7	85	25	5	3	17	27	0	366
Total	54	361	14	3	215	111	85	2	28	318	102	16	14	104	95	2	1524
Grand Total	227	1063	39	13	522	256	224	2	97	1149	433	56	53	747	308	9	5198
Apprch %	16.9	79.2	2.9	1.0	52.0	25.5	22.3	0.2	5.6	66.2	25.0	3.2	4.7	66.9	27.6	0.8	
Total %	4.4	20.5	0.8	0.3	10.0	4.9	4.3	0.0	1.9	22.1	8.3	1.1	1.0	14.4	5.9	0.2	

	CROSSHAVEN DR Southbound					GREEN VALLEY RD Westbound					CROSSHAVEN DR Northbound					GREEN VALLEY RD Eastbound					
Start Time	Left	Thru	Right	SV Dr	App. Total	Left	Thru	Right	SV Dr	App. Total	Left	Thru	Right	SV Dr	App. Total	Left	Thru	Right	SV Dr	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Intersection	07:30 AM																				
Volume	80	205	2	2	289	76	35	33	0	144	28	307	128	9	472	14	386	81	2	483	1388
Percent	27.7	70.9	0.7	0.7		52.8	24.3	22.9	0.0		5.9	65.0	27.1	1.9		2.9	79.9	16.8	0.4		
07:30 Volume	21	40	0	0	61	12	9	8	0	29	4	72	58	2	136	5	133	26	0	164	390
Peak Factor																					0.890
High Int.	07:45 AM					08:00 AM					07:30 AM					07:30 AM					
Volume	21	62	0	2	85	23	8	15	0	46	4	72	58	2	136	5	133	26	0	164	
Peak Factor					0.850					0.783					0.868					0.736	

TRAFFIC DATA, LLC
1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

File Name : vestaviahills05
Site Code : 00000000
Start Date : 05/02/2017

	CROSSHAVEN DR Southbound					GREEN VALLEY RD Westbound					CROSSHAVEN DR Northbound					GREEN VALLEY RD Eastbound					
Start Time	Left	Thru	Right	SV Dr	App. Total	Left	Thru	Right	SV Dr	App. Total	Left	Thru	Right	SV Dr	App. Total	Left	Thru	Right	SV Dr	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
By Approach	07:45 AM					07:45 AM					07:30 AM					07:15 AM					
Volume	72	211	5	3	291	81	37	36	0	154	28	307	128	9	472	11	390	88	1	490	
Percent	24.7	72.6	1.7	1.0		52.6	24.0	23.4	0.0		5.9	65.0	27.1	1.9		2.2	79.6	18.0	0.2		
High Int.	07:45 AM					08:00 AM					07:30 AM					07:30 AM					
Volume	21	62	0	2	85	23	8	15	0	46	4	72	58	2	136	5	133	26	0	164	
Peak Factor					0.856					0.837					0.868					0.747	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Intersection	05:00 PM																				
Volume	54	361	14	3	432	215	111	85	2	413	28	318	102	16	464	14	104	95	2	215	1524
Percent	12.5	83.6	3.2	0.7		52.1	26.9	20.6	0.5		6.0	68.5	22.0	3.4		6.5	48.4	44.2	0.9		
05:15 Volume	17	92	2	1	112	58	30	28	0	116	6	74	22	2	104	4	33	23	0	60	392
Peak Factor																					0.972
High Int.	05:00 PM					05:15 PM					05:30 PM					05:15 PM					
Volume	9	99	4	1	113	58	30	28	0	116	12	87	29	5	133	4	33	23	0	60	
Peak Factor					0.956					0.890					0.872					0.896	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
By Approach	05:00 PM					05:00 PM					05:00 PM					04:30 PM					
Volume	54	361	14	3	432	215	111	85	2	413	28	318	102	16	464	19	105	92	1	217	
Percent	12.5	83.6	3.2	0.7		52.1	26.9	20.6	0.5		6.0	68.5	22.0	3.4		8.8	48.4	42.4	0.5		
High Int.	05:00 PM					05:15 PM					05:30 PM					04:30 PM					
Volume	9	99	4	1	113	58	30	28	0	116	12	87	29	5	133	2	31	36	0	69	
Peak Factor					0.956					0.890					0.872					0.786	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Vestavia Hills, AL

File Name : vestaviahills05
Site Code : 00000000
Start Date : 05/02/2017
Page No : 1

Groups Printed- Bank 1

	SUNVIEW DR Westbound				
Start Time	Left	R/left	R/thru	R/rt	Int. Total
07:00 AM	1	0	2	0	3
07:30 AM	1	0	2	0	3
07:45 AM	1	1	2	0	4
Total	3	1	6	0	10
08:15 AM	1	0	0	1	2
08:30 AM	1	0	2	0	3
08:45 AM	1	0	3	0	4
Total	3	0	5	1	9
04:00 PM	4	1	3	0	8
04:15 PM	4	1	7	0	12
04:30 PM	3	0	1	0	4
04:45 PM	0	1	5	0	6
Total	11	3	16	0	30
05:00 PM	1	2	1	0	4
05:15 PM	5	3	2	0	10
05:30 PM	2	0	2	1	5
05:45 PM	2	0	3	1	6
Total	10	5	8	2	25
Grand Total	27	9	35	3	74
Apprch %	36.5	12.2	47.3	4.1	
Total %	36.5	12.2	47.3	4.1	

		SUNVIEW DR Westbound							
Start Time	App. Total	Left	R/left	R/thru	R/rt	App. Total	App. Total	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1									
Intersection	07:00 AM								
Volume	0	3	1	6	0	10	0	0	10
Percent		30.0	10.0	60.0	0.0				
07:45 Volume	0	1	1	2	0	4	0	0	4
Peak Factor									0.625
High Int.	6:45:00 AM	07:45 AM					6:45:00 AM	6:45:00 AM	
Volume	0	1	1	2	0	4			
Peak Factor						0.625			
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1									
By Approach	07:00 AM	07:00 AM					07:00 AM	07:00 AM	
Volume	0	3	1	6	0	10	0	0	
Percent		30.0	10.0	60.0	0.0				
High Int.	-	07:45 AM					-	-	
Volume	-	1	1	2	0	4	-	-	
Peak Factor	-					0.625	-	-	

TRAFFIC DATA, LLC
1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

File Name : vestaviahills05
Site Code : 00000000
Start Date : 05/02/2017
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		SUNVIEW DR Westbound							
Start Time	App. Total	Left	R/left	R/thru	R/rt	App. Total	App. Total	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1									
Intersection	04:00 PM								
Volume	0	11	3	16	0	30	0	0	30
Percent		36.7	10.0	53.3	0.0				
04:15 Volume	0	4	1	7	0	12	0	0	12
Peak Factor									0.625
High Int.		04:15 PM							
Volume	0	4	1	7	0	12			
Peak Factor						0.625			
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1									
By Approach	04:00 PM	04:00 PM					04:00 PM	04:00 PM	
Volume	0	11	3	16	0	30	0	0	
Percent		36.7	10.0	53.3	0.0				
High Int.	-	04:15 PM					-	-	
Volume	-	4	1	7	0	12	-	-	
Peak Factor	-					0.625	-	-	

TRAFFIC DATA, LLC

1409 Turnham Lane
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Vestavia Hills, AL

File Name : vestaviahills04
Site Code : 00000000
Start Date : 05/03/2017
Page No : 1

Groups Printed- Unshifted

	CROSSHAVEN DR Southbound			BEARDEN CT Westbound			CROSSHAVEN DR Northbound			BUSINESS ACCESS Eastbound			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	0	80	0	5	0	4	0	52	0	0	0	0	141
07:15 AM	0	100	0	5	0	1	0	62	1	0	0	0	169
07:30 AM	0	130	0	2	0	10	0	94	1	0	0	0	237
07:45 AM	1	110	0	5	0	4	0	94	0	0	0	0	214
Total	1	420	0	17	0	19	0	302	2	0	0	0	761
08:00 AM	1	111	0	5	0	2	0	81	1	0	0	0	201
08:15 AM	0	80	0	6	0	2	0	72	1	0	0	0	161
08:30 AM	1	93	0	7	0	2	0	58	2	0	0	0	163
08:45 AM	5	89	0	7	0	1	0	78	1	0	0	1	182
Total	7	373	0	25	0	7	0	289	5	0	0	1	707
04:00 PM	3	116	1	8	0	7	2	142	12	1	0	2	294
04:15 PM	8	91	0	5	0	9	0	150	10	0	0	0	273
04:30 PM	8	99	0	12	0	11	1	192	8	0	0	3	334
04:45 PM	7	116	1	6	0	5	1	176	2	0	0	0	314
Total	26	422	2	31	0	32	4	660	32	1	0	5	1215
05:00 PM	11	125	0	1	0	10	1	193	18	0	0	0	359
05:15 PM	7	104	0	8	0	5	0	201	7	0	0	0	332
05:30 PM	5	109	0	8	0	12	0	199	6	1	0	0	340
05:45 PM	8	123	0	5	0	9	0	151	8	0	0	1	305
Total	31	461	0	22	0	36	1	744	39	1	0	1	1336
Grand Total	65	1676	2	95	0	94	5	1995	78	2	0	7	4019
Apprch %	3.7	96.2	0.1	50.3	0.0	49.7	0.2	96.0	3.8	22.2	0.0	77.8	
Total %	1.6	41.7	0.0	2.4	0.0	2.3	0.1	49.6	1.9	0.0	0.0	0.2	

	CROSSHAVEN DR Southbound				BEARDEN CT Westbound				CROSSHAVEN DR Northbound				BUSINESS ACCESS Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	2	451	0	453	17	0	17	34	0	331	3	334	0	0	0	0	821
Percent	0.4	99.6	0.0		50.0	0.0	50.0		0.0	99.1	0.9		0.0	0.0	0.0		
07:30 Volume	0	130	0	130	2	0	10	12	0	94	1	95	0	0	0	0	237
Peak Factor																	0.866
High Int.	07:30 AM				07:30 AM				07:30 AM				6:45:00 AM				
Volume	0	130	0	130	2	0	10	12	0	94	1	95					
Peak Factor				0.871				0.708				0.879					
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
By Approach	07:15 AM				07:00 AM				07:30 AM				08:00 AM				
Volume	2	451	0	453	17	0	19	36	0	341	3	344	0	0	1	1	
Percent	0.4	99.6	0.0		47.2	0.0	52.8		0.0	99.1	0.9		0.0	0.0	100.0		
High Int.	07:30 AM				07:30 AM				07:30 AM				08:45 AM				
Volume	0	130	0	130	2	0	10	12	0	94	1	95	0	0	1	1	
Peak Factor				0.871				0.750				0.905				0.250	

TRAFFIC DATA, LLC

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File Name : vestaviahills04
Site Code : 00000000
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	CROSSHAVEN DR Southbound				BEARDEN CT Westbound				CROSSHAVEN DR Northbound				BUSINESS ACCESS Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:45 PM																
Volume	30	454	1	485	23	0	32	55	2	769	33	804	1	0	0	1	1345
Percent	6.2	93.6	0.2		41.8	0.0	58.2		0.2	95.6	4.1		100.0	0.0	0.0		
05:00 Volume	11	125	0	136	1	0	10	11	1	193	18	212	0	0	0	0	359
Peak Factor																	0.937
High Int.	05:00 PM				05:30 PM				05:00 PM				05:30 PM				
Volume	11	125	0	136	8	0	12	20	1	193	18	212	1	0	0	1	
Peak Factor				0.892				0.688				0.948				0.250	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
By Approach	05:00 PM				04:00 PM				04:45 PM				04:00 PM				
Volume	31	461	0	492	31	0	32	63	2	769	33	804	1	0	5	6	
Percent	6.3	93.7	0.0		49.2	0.0	50.8		0.2	95.6	4.1		16.7	0.0	83.3		
High Int.	05:00 PM				04:30 PM				05:00 PM				04:00 PM				
Volume	11	125	0	136	12	0	11	23	1	193	18	212	1	0	2	3	
Peak Factor				0.904				0.685				0.948				0.500	

TRAFFIC DATA, LLC

1409 Turnham Lane
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Vestavia Hills, AL

File Name : vestaviahills03
Site Code : 00000000
Start Date : 05/04/2017
Page No : 1

Groups Printed- Unshifted

	CROSSHAVEN DR Southbound		GREENDALE RD Westbound		CROSSHAVEN DR Northbound		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	5	70	13	16	37	0	141
07:15 AM	1	63	33	31	69	7	204
07:30 AM	10	92	31	28	89	9	259
07:45 AM	9	91	20	26	87	9	242
Total	25	316	97	101	282	25	846
08:00 AM	12	100	13	14	71	6	216
08:15 AM	7	85	18	24	65	6	205
08:30 AM	6	77	11	15	58	7	174
08:45 AM	8	90	16	10	63	5	192
Total	33	352	58	63	257	24	787
04:00 PM	8	71	8	9	139	17	252
04:15 PM	13	99	10	18	124	14	278
04:30 PM	12	88	9	7	116	15	247
04:45 PM	10	89	10	8	130	18	265
Total	43	347	37	42	509	64	1042
05:00 PM	13	116	14	6	146	16	311
05:15 PM	16	104	17	7	140	24	308
05:30 PM	7	121	12	0	159	23	322
05:45 PM	14	101	14	8	130	23	290
Total	50	442	57	21	575	86	1231
Grand Total	151	1457	249	227	1623	199	3906
Apprch %	9.4	90.6	52.3	47.7	89.1	10.9	
Total %	3.9	37.3	6.4	5.8	41.6	5.1	

	CROSSHAVEN DR Southbound			GREENDALE RD Westbound			CROSSHAVEN DR Northbound				
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1											
Intersection	07:30 AM										
Volume	38	368	406	82	92	174	312	30	342	0	922
Percent	9.4	90.6		47.1	52.9		91.2	8.8			
07:30 Volume	10	92	102	31	28	59	89	9	98	0	259
Peak Factor											0.890
High Int.	08:00 AM			07:30 AM			07:30 AM			6:45:00 AM	
Volume	12	100	112	31	28	59	89	9	98		
Peak Factor			0.906			0.737			0.872		
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1											
By Approach	07:30 AM			07:00 AM			07:15 AM			07:00 AM	
Volume	38	368	406	97	101	198	316	31	347	0	
Percent	9.4	90.6		49.0	51.0		91.1	8.9			
High Int.	08:00 AM			07:15 AM			07:30 AM			-	
Volume	12	100	112	33	31	64	89	9	98	-	
Peak Factor			0.906			0.773			0.885	-	

TRAFFIC DATA, LLC

1409 Turnham Lane
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File Name : vestaviahills03
Site Code : 00000000
Start Date : 05/04/2017

	CROSSHAVEN DR Southbound			GREENDALE RD Westbound			CROSSHAVEN DR Northbound				
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1											
Intersection	05:00 PM										
Volume	50	442	492	57	21	78	575	86	661	0	1231
Percent	10.2	89.8		73.1	26.9		87.0	13.0			
05:30 Volume	7	121	128	12	0	12	159	23	182	0	322
Peak Factor											0.956
High Int.	05:00 PM			05:15 PM			05:30 PM				
Volume	13	116	129	17	7	24	159	23	182		
Peak Factor			0.953			0.813			0.908		
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1											
By Approach	05:00 PM			04:15 PM			05:00 PM			04:00 PM	
Volume	50	442	492	43	39	82	575	86	661	0	
Percent	10.2	89.8		52.4	47.6		87.0	13.0			
High Int.	05:00 PM			04:15 PM			05:30 PM			-	
Volume	13	116	129	10	18	28	159	23	182	-	
Peak Factor			0.953			0.732			0.908	-	

TRAFFIC DATA, LLC

1409 Turnham Lane
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Vestavia Hills, AL

File Name : vestaviahills01
Site Code : 00000000
Start Date : 05/04/2017
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Groups Printed- Unshifted

	CROSSHAVEN DR Southbound			OVERTON RD Westbound			CROSSHAVEN DR Northbound			OVERTON RD Eastbound			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	0	1	0	57	112	0	25	0	30	0	41	17	283
07:15 AM	3	1	0	49	156	1	49	3	46	1	65	10	384
07:30 AM	3	3	0	70	191	0	74	1	40	0	85	18	485
07:45 AM	0	2	1	73	166	4	75	5	36	1	55	23	441
Total	6	7	1	249	625	5	223	9	152	2	246	68	1593
08:00 AM	3	6	3	73	154	5	49	5	36	3	48	30	415
08:15 AM	0	5	1	48	116	2	52	4	38	2	48	29	345
08:30 AM	1	3	4	56	105	2	38	7	29	4	42	21	312
08:45 AM	0	5	0	59	111	11	34	13	34	12	44	31	354
Total	4	19	8	236	486	20	173	29	137	21	182	111	1426
04:00 PM	2	3	0	45	63	5	37	6	100	1	93	35	390
04:15 PM	1	6	1	77	87	3	36	1	111	1	97	27	448
04:30 PM	1	2	1	54	76	3	31	4	101	1	98	36	408
04:45 PM	4	3	3	55	80	1	41	2	96	0	114	33	432
Total	8	14	5	231	306	12	145	13	408	3	402	131	1678
05:00 PM	3	3	1	77	94	1	40	4	102	2	103	52	482
05:15 PM	0	2	0	79	84	1	34	2	111	1	90	42	446
05:30 PM	3	4	2	88	102	1	35	3	111	1	98	40	488
05:45 PM	0	4	4	67	75	2	33	4	108	0	89	36	422
Total	6	13	7	311	355	5	142	13	432	4	380	170	1838
Grand Total	24	53	21	1027	1772	42	683	64	1129	30	1210	480	6535
Apprch %	24.5	54.1	21.4	36.1	62.4	1.5	36.4	3.4	60.2	1.7	70.3	27.9	
Total %	0.4	0.8	0.3	15.7	27.1	0.6	10.5	1.0	17.3	0.5	18.5	7.3	

	CROSSHAVEN DR Southbound				OVERTON RD Westbound				CROSSHAVEN DR Northbound				OVERTON RD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	9	12	4	25	265	667	10	942	247	14	158	419	5	253	81	339	1725
Percent	36.0	48.0	16.0		28.1	70.8	1.1		58.9	3.3	37.7		1.5	74.6	23.9		
07:30 Volume	3	3	0	6	70	191	0	261	74	1	40	115	0	85	18	103	485
Peak Factor																	0.889
High Int.	08:00 AM				07:30 AM				07:45 AM				07:30 AM				
Volume	3	6	3	12	70	191	0	261	75	5	36	116	0	85	18	103	
Peak Factor				0.521				0.902				0.903				0.823	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																	
By Approach	08:00 AM				07:15 AM				07:15 AM				07:30 AM				
Volume	4	19	8	31	265	667	10	942	247	14	158	419	6	236	100	342	
Percent	12.9	61.3	25.8		28.1	70.8	1.1		58.9	3.3	37.7		1.8	69.0	29.2		
High Int.	08:00 AM				07:30 AM				07:45 AM				07:30 AM				
Volume	3	6	3	12	70	191	0	261	75	5	36	116	0	85	18	103	
Peak Factor				0.646				0.902				0.903				0.830	

TRAFFIC DATA, LLC
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File Name : vestaviahills01
Site Code : 00000000
Start Date : 05/04/2017
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	CROSSHAVEN DR Southbound				OVERTON RD Westbound				CROSSHAVEN DR Northbound				OVERTON RD Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:45 PM																
Volume	10	12	6	28	299	360	4	663	150	11	420	581	4	405	167	576	1848
Percent	35.7	42.9	21.4		45.1	54.3	0.6		25.8	1.9	72.3		0.7	70.3	29.0		
05:30 Volume	3	4	2	9	88	102	1	191	35	3	111	149	1	98	40	139	488
Peak Factor																	0.947
High Int.	04:45 PM				05:30 PM				05:30 PM				05:00 PM				
Volume	4	3	3	10	88	102	1	191	35	3	111	149	2	103	52	157	
Peak Factor				0.700				0.868				0.975				0.917	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
By Approach	04:15 PM				05:00 PM				05:00 PM				04:45 PM				
Volume	9	14	6	29	311	355	5	671	142	13	432	587	4	405	167	576	
Percent	31.0	48.3	20.7		46.3	52.9	0.7		24.2	2.2	73.6		0.7	70.3	29.0		
High Int.	04:45 PM				05:30 PM				05:30 PM				05:00 PM				
Volume	4	3	3	10	88	102	1	191	35	3	111	149	2	103	52	157	
Peak Factor				0.725				0.878				0.985				0.917	

Appendix B

Existing Machine Traffic Counts

TRAFFIC DATA, LLC
1409 Turnham Lane, Birmingham, AL 35216
205-824-0125

Location:: CROSSHAVE DR north of CROWN RIDGE DR
City, State:: VESTAVIA HILLS, AL
Speed Limit: : 25 mph

Date: 5/2/2017 Tuesday

24 Hour Volume

Begin	SB		NB		Combined		Begin	SB		NB		Combined	
9:00 AM	91	322	63	244	154	566	9:00 PM	22	91	74	185	96	276
9:15 AM	75		60		135		9:15 PM	35		53		88	
9:30 AM	75		59		134		9:30 PM	20		34		54	
9:45 AM	81		62		143		9:45 PM	14		24		38	
10:00 AM	83	319	51	255	134	574	10:00 PM	12	29	22	67	34	96
10:15 AM	73		57		130		10:15 PM	10		19		29	
10:30 AM	83		70		153		10:30 PM	4		21		25	
10:45 AM	80		77		157		10:45 PM	3		5		8	
11:00 AM	103	430	86	352	189	782	11:00 PM	6	16	17	27	23	43
11:15 AM	95		76		171		11:15 PM	4		5		9	
11:30 AM	119		89		208		11:30 PM	6		1		7	
11:45 AM	113		101		214		11:45 PM	0		4		4	
12:00 PM	94	396	106	422	200	818	5/3/2017 12:00 AM	4	16	8	19	12	35
12:15 PM	95		99		194		12:15 AM	4		6		10	
12:30 PM	93		95		188		12:30 AM	2		3		5	
12:45 PM	114		122		236		12:45 AM	6		2		8	
1:00 PM	119	357	110	428	229	785	1:00 AM	1	7	1	6	2	13
1:15 PM	84		109		193		1:15 AM	3		3		6	
1:30 PM	77		103		180		1:30 AM	1		1		2	
1:45 PM	77		106		183		1:45 AM	2		1		3	
2:00 PM	78	341	105	397	183	738	2:00 AM	2	3	4	7	6	10
2:15 PM	82		84		166		2:15 AM	0		2		2	
2:30 PM	96		97		193		2:30 AM	1		1		2	
2:45 PM	85		111		196		2:45 AM	0		0		0	
3:00 PM	105	406	114	439	219	845	3:00 AM	2	6	0	8	2	14
3:15 PM	96		113		209		3:15 AM	2		2		4	
3:30 PM	117		103		220		3:30 AM	2		2		4	
3:45 PM	88		109		197		3:45 AM	0		4		4	
4:00 PM	106	435	121	523	227	958	4:00 AM	1	16	1	16	2	32
4:15 PM	94		146		240		4:15 AM	2		3		5	
4:30 PM	119		129		248		4:30 AM	6		6		12	
4:45 PM	116		127		243		4:45 AM	7		6		13	
5:00 PM	106	484	155	558	261	1042	5:00 AM	4	68	7	37	11	105
5:15 PM	125		151		276		5:15 AM	14		7		21	
5:30 PM	147		133		280		5:30 AM	17		10		27	
5:45 PM	106		119		225		5:45 AM	33		13		46	
6:00 PM	128	440	98	450	226	890	6:00 AM	19	128	14	104	33	232
6:15 PM	102		124		226		6:15 AM	24		16		40	
6:30 PM	109		119		228		6:30 AM	36		28		64	
6:45 PM	101		109		210		6:45 AM	49		46		95	
7:00 PM	83	253	119	392	202	645	7:00 AM	66	316	60	377	126	693
7:15 PM	60		112		172		7:15 AM	63		89		152	
7:30 PM	50		89		139		7:30 AM	94		114		208	
7:45 PM	60		72		132		7:45 AM	93		114		207	
8:00 PM	40	147	80	266	120	413	8:00 AM	84	318	86	323	170	641
8:15 PM	41		62		103		8:15 AM	75		95		170	
8:30 PM	26		55		81		8:30 AM	75		63		138	
8:45 PM	40		69		109		8:45 AM	84		79		163	

	SB	NB	Combined
24 Hour Volume	5344 (47.5%)	5902 (52.5%)	11246

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	SB	NB	Combined	SB	NB	Combined
Count	1949	1748	3697	3395	4154	7549
	52.7 %	47.3 %		45.0 %	55.0 %	
Peak Hour	11:00 AM	7:30 AM	11:00 AM	5:15 PM	4:45 PM	4:45 PM
Volume	430	409	782	506	566	1060
Factor	0.90	0.90	0.91	0.86	0.91	0.95

TRAFFIC DATA, LLC
1409 Turnham Lane, Birmingham, AL 35216
205-824-0125

Location:: CROSSHAVE DR north of CROWN RIDGE DR
City, State:: VESTAVIA HILLS, AL
Speed Limit:: 25 mph

Date: 5/2/2017
Tuesday

24 Hour Speed
Combined Channels

mph	Total	0 - < 15	15 - < 20	20 - < 25	25 - < 30	30 - < 35	35 - < 40	40 - < 45	45 - < 50	50 - < 55	55 - < 60	60 - < 65	65 - < 70	70 - < 200
9:00 AM	566	7	5	40	169	246	86	12	0	0	1	0	0	0
10:00 AM	574	5	6	21	165	272	95	8	2	0	0	0	0	0
11:00 AM	782	14	15	54	250	340	98	7	0	1	0	1	0	2
12:00 PM	818	20	11	41	269	368	98	9	2	0	0	0	0	0
1:00 PM	785	11	13	45	289	326	87	10	1	1	0	2	0	0
2:00 PM	738	13	5	30	237	341	101	7	1	2	0	0	0	1
3:00 PM	845	11	12	39	289	379	103	12	0	0	0	0	0	0
4:00 PM	958	43	20	72	343	364	100	11	4	0	0	0	1	0
5:00 PM	1042	42	26	102	335	432	90	10	2	0	2	0	0	1
6:00 PM	890	30	14	41	327	375	91	8	2	0	0	0	0	2
7:00 PM	645	9	4	21	243	284	73	8	0	0	1	0	0	2
8:00 PM	413	1	1	21	143	204	41	1	1	0	0	0	0	0
9:00 PM	276	1	3	7	82	130	45	8	0	0	0	0	0	0
10:00 PM	96	0	0	3	20	50	20	1	1	0	1	0	0	0
11:00 PM	43	0	0	0	15	16	10	1	1	0	0	0	0	0
5/3/2017														
12:00 AM	35	0	0	1	6	20	8	0	0	0	0	0	0	0
1:00 AM	13	0	0	3	5	4	0	1	0	0	0	0	0	0
2:00 AM	10	0	0	0	1	7	1	1	0	0	0	0	0	0
3:00 AM	14	0	0	1	2	6	5	0	0	0	0	0	0	0
4:00 AM	32	0	0	3	10	13	5	1	0	0	0	0	0	0
5:00 AM	105	0	0	3	38	47	13	4	0	0	0	0	0	0
6:00 AM	232	2	1	9	58	111	41	9	1	0	0	0	0	0
7:00 AM	693	9	5	41	214	325	82	13	1	0	2	0	0	1
8:00 AM	641	1	1	17	185	295	120	19	0	0	1	1	1	0
Total	11246	219	142	615	3695	4955	1413	161	19	4	8	4	2	9
%		1.9	1.3	5.5	32.9	44.1	12.6	1.4	0.2	0.0	0.1	0.0	0.0	0.1

Percentile Speeds	10 %	15 %	50 %	85 %	90 %
(mph)	25.7	26.6	31.0	34.6	36.3

10 mph Pace Speed 25.7 - 35.7
Number in Pace 9015 (80.2 %)

Average 30.6 mph
Minimum 5.0 mph
Maximum 87.6 mph

Speeds Exceeded	15 mph	25 mph	35 mph
	98.1 %	91.3 %	14.4 %
Count	11027	10270	1620

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Speed Limit:: 25 mph

Date: 5/2/2017
Tuesday

24 Hour Vehicle Classification
Combined Channels

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
9:00 AM	566	1	401	113	13	28	3	0	6	1	0	0	0	0
10:00 AM	574	1	423	111	6	24	1	0	7	1	0	0	0	0
11:00 AM	782	0	585	148	15	24	1	0	7	2	0	0	0	0
12:00 PM	818	4	603	156	10	28	2	1	11	1	0	1	0	1
1:00 PM	785	3	596	135	11	27	1	0	10	2	0	0	0	0
2:00 PM	738	4	582	113	8	23	1	0	7	0	0	0	0	0
3:00 PM	845	3	650	151	12	22	1	0	6	0	0	0	0	0
4:00 PM	958	4	743	151	23	28	0	0	5	1	0	1	0	2
5:00 PM	1042	9	795	180	20	23	0	0	12	0	0	2	0	1
6:00 PM	890	3	712	138	20	14	0	0	3	0	0	0	0	0
7:00 PM	645	3	513	108	7	7	0	0	7	0	0	0	0	0
8:00 PM	413	0	355	51	0	7	0	0	0	0	0	0	0	0
9:00 PM	276	2	226	41	1	6	0	0	0	0	0	0	0	0
10:00 PM	96	1	84	9	0	2	0	0	0	0	0	0	0	0
11:00 PM	43	1	31	10	0	1	0	0	0	0	0	0	0	0
5/3/2017														
12:00 AM	35	0	27	7	0	0	0	0	0	1	0	0	0	0
1:00 AM	13	0	8	3	0	1	0	0	0	1	0	0	0	0
2:00 AM	10	0	8	1	0	1	0	0	0	0	0	0	0	0
3:00 AM	14	0	12	2	0	0	0	0	0	0	0	0	0	0
4:00 AM	32	0	22	8	0	1	1	0	0	0	0	0	0	0
5:00 AM	105	0	73	25	0	5	2	0	0	0	0	0	0	0
6:00 AM	232	1	177	38	1	11	1	0	3	0	0	0	0	0
7:00 AM	693	2	523	120	9	27	0	0	11	1	0	0	0	0
8:00 AM	641	1	498	108	1	28	0	0	4	1	0	0	0	0
Total	11246	43	8647	1927	157	338	14	1	99	12	0	4	0	4
%		0.4	76.9	17.1	1.4	3.0	0.1	0.0	0.9	0.1	0.0	0.0	0.0	0.0

TRAFFIC DATA, LLC
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Location:: CROSSHAVEN DR north of CANTERBURY PL
City, State:: VESTAVIA HILLS, AL
Speed Limit:: 25 mph

Date: 5/2/2017
Tuesday

24 Hour Volume

Begin	SB		NB		Combined		Begin	SB		NB		Combined	
9:00 AM	93	351	60	231	153	582	9:00 PM	25	88	47	151	72	239
9:15 AM	91		61		152		9:15 PM	32		50		82	
9:30 AM	81		53		134		9:30 PM	13		30		43	
9:45 AM	86		57		143		9:45 PM	18		24		42	
10:00 AM	88	348	61	258	149	606	10:00 PM	18	45	26	60	44	105
10:15 AM	91		50		141		10:15 PM	11		15		26	
10:30 AM	83		68		151		10:30 PM	11		12		23	
10:45 AM	86		79		165		10:45 PM	5		7		12	
11:00 AM	107	450	85	366	192	816	11:00 PM	11	22	14	31	25	53
11:15 AM	98		80		178		11:15 PM	9		4		13	
11:30 AM	116		93		209		11:30 PM	2		7		9	
11:45 AM	129		108		237		11:45 PM	0		6		6	
12:00 PM	100	453	109	404	209	857	5/3/2017 12:00 AM	2	9	4	12	6	21
12:15 PM	123		103		226		12:15 AM	5		3		8	
12:30 PM	113		85		198		12:30 AM	0		3		3	
12:45 PM	117		107		224		12:45 AM	2		2		4	
1:00 PM	116	406	104	405	220	811	1:00 AM	1	6	2	6	3	12
1:15 PM	97		104		201		1:15 AM	4		4		8	
1:30 PM	95		102		197		1:30 AM	1		0		1	
1:45 PM	98		95		193		1:45 AM	0		0		0	
2:00 PM	93	395	100	380	193	775	2:00 AM	1	4	5	10	6	14
2:15 PM	102		94		196		2:15 AM	1		2		3	
2:30 PM	100		90		190		2:30 AM	1		3		4	
2:45 PM	100		96		196		2:45 AM	1		0		1	
3:00 PM	116	427	107	405	223	832	3:00 AM	3	8	0	9	3	17
3:15 PM	98		91		189		3:15 AM	2		3		5	
3:30 PM	102		99		201		3:30 AM	1		2		3	
3:45 PM	111		108		219		3:45 AM	2		4		6	
4:00 PM	86	405	112	412	198	817	4:00 AM	0	11	0	10	0	21
4:15 PM	95		110		205		4:15 AM	2		3		5	
4:30 PM	111		100		211		4:30 AM	5		3		8	
4:45 PM	113		90		203		4:45 AM	4		4		8	
5:00 PM	96	405	115	440	211	845	5:00 AM	3	48	2	23	5	71
5:15 PM	107		111		218		5:15 AM	11		4		15	
5:30 PM	101		112		213		5:30 AM	16		7		23	
5:45 PM	101		102		203		5:45 AM	18		10		28	
6:00 PM	92	370	81	337	173	707	6:00 AM	27	136	12	81	39	217
6:15 PM	95		91		186		6:15 AM	22		15		37	
6:30 PM	103		76		179		6:30 AM	41		23		64	
6:45 PM	80		89		169		6:45 AM	46		31		77	
7:00 PM	92	273	89	300	181	573	7:00 AM	58	292	43	244	101	536
7:15 PM	73		86		159		7:15 AM	62		43		105	
7:30 PM	55		58		113		7:30 AM	80		71		151	
7:45 PM	53		67		120		7:45 AM	92		87		179	
8:00 PM	56	158	80	244	136	402	8:00 AM	70	303	86	268	156	571
8:15 PM	36		51		87		8:15 AM	78		62		140	
8:30 PM	24		52		76		8:30 AM	76		54		130	
8:45 PM	42		61		103		8:45 AM	79		66		145	

	SB	NB	Combined
24 Hour Volume	5413 (51.6%)	5087 (48.4%)	10500

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	SB	NB	Combined	SB	NB	Combined
Count	1966	1518	3484	3447	3569	7016
	56.4 %	43.6 %		49.1 %	50.9 %	
Peak Hour	11:00 AM	11:00 AM	11:00 AM	12:15 PM	5:00 PM	12:15 PM
Volume	450	366	816	469	440	868
Factor	0.87	0.85	0.86	0.95	0.96	0.96

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Speed Limit: : 25 mph

Date: 5/2/2017
Tuesday

24 Hour Speed
Combined Channels

mph	Total	0 - < 15	15 - < 20	20 - < 25	25 - < 30	30 - < 35	35 - < 40	40 - < 45	45 - < 50	50 - < 55	55 - < 60	60 - < 65	65 - < 70	70 - < 200
9:00 AM	582	2	1	17	102	270	155	32	3	0	0	0	0	0
10:00 AM	606	5	9	10	97	287	158	37	1	1	0	1	0	0
11:00 AM	816	10	5	25	180	370	189	31	6	0	0	0	0	0
12:00 PM	857	8	2	24	171	419	207	20	3	0	0	1	0	2
1:00 PM	811	17	10	19	157	390	186	28	1	1	0	0	1	1
2:00 PM	775	9	2	15	150	358	201	35	3	1	0	0	0	1
3:00 PM	832	7	5	15	167	424	187	25	2	0	0	0	0	0
4:00 PM	817	11	5	35	164	366	195	35	2	0	1	1	0	2
5:00 PM	845	13	11	27	146	403	208	34	2	1	0	0	0	0
6:00 PM	707	8	1	11	96	366	199	23	2	0	0	0	0	1
7:00 PM	573	3	1	10	123	294	127	11	3	1	0	0	0	0
8:00 PM	402	0	1	5	96	197	88	14	1	0	0	0	0	0
9:00 PM	239	0	3	6	53	122	46	9	0	0	0	0	0	0
10:00 PM	105	1	1	3	14	56	26	4	0	0	0	0	0	0
11:00 PM	53	0	0	0	9	24	11	8	1	0	0	0	0	0
5/3/2017														
12:00 AM	21	0	1	0	6	6	4	4	0	0	0	0	0	0
1:00 AM	12	0	0	3	3	3	2	1	0	0	0	0	0	0
2:00 AM	14	0	0	0	0	8	6	0	0	0	0	0	0	0
3:00 AM	17	1	0	1	2	4	6	3	0	0	0	0	0	0
4:00 AM	21	0	0	0	6	7	4	4	0	0	0	0	0	0
5:00 AM	71	0	0	3	13	24	26	5	0	0	0	0	0	0
6:00 AM	217	0	1	4	31	81	73	27	0	0	0	0	0	0
7:00 AM	536	11	0	11	51	236	169	50	6	1	0	0	0	1
8:00 AM	571	6	6	11	70	231	202	40	5	0	0	0	0	0
Total	10500	112	65	255	1907	4946	2675	480	41	6	1	3	1	8
%		1.1	0.6	2.4	18.2	47.1	25.5	4.6	0.4	0.1	0.0	0.0	0.0	0.1

Percentile Speeds	10 %	15 %	50 %	85 %	90 %
(mph)	27.6	28.6	33.1	37.2	38.2

10 mph Pace Speed 29.2 - 39.2
Number in Pace 8324 (79.3 %)

Average 32.9 mph
Minimum 5.0 mph
Maximum 99.3 mph

Speeds Exceeded	15 mph	25 mph	35 mph
	98.9 %	95.9 %	30.6 %
Count	10388	10068	3215

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Date: 5/2/2017
Tuesday

24 Hour Vehicle Classification
Combined Channels

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
9:00 AM	582	0	432	115	4	27	0	0	2	2	0	0	0	0
10:00 AM	606	1	451	119	7	22	1	0	2	3	0	0	0	0
11:00 AM	816	0	604	169	12	23	1	0	4	2	0	0	0	1
12:00 PM	857	3	644	166	13	24	2	0	5	0	0	0	0	0
1:00 PM	811	0	616	139	19	27	1	0	7	2	0	0	0	0
2:00 PM	775	1	621	117	8	25	0	0	2	1	0	0	0	0
3:00 PM	832	1	656	144	5	21	0	0	4	1	0	0	0	0
4:00 PM	817	2	637	138	15	22	1	0	2	0	0	0	0	0
5:00 PM	845	5	667	135	13	22	0	0	3	0	0	0	0	0
6:00 PM	707	0	582	105	8	11	0	0	1	0	0	0	0	0
7:00 PM	573	3	461	94	0	14	0	0	1	0	0	0	0	0
8:00 PM	402	0	340	50	0	12	0	0	0	0	0	0	0	0
9:00 PM	239	1	200	37	0	1	0	0	0	0	0	0	0	0
10:00 PM	105	0	92	12	0	1	0	0	0	0	0	0	0	0
11:00 PM	53	0	45	7	0	1	0	0	0	0	0	0	0	0
5/3/2017														
12:00 AM	21	0	13	7	0	0	0	0	0	1	0	0	0	0
1:00 AM	12	0	9	1	0	1	0	0	0	1	0	0	0	0
2:00 AM	14	0	12	1	0	1	0	0	0	0	0	0	0	0
3:00 AM	17	0	11	2	0	4	0	0	0	0	0	0	0	0
4:00 AM	21	0	15	5	0	0	1	0	0	0	0	0	0	0
5:00 AM	71	0	47	17	0	4	1	0	1	1	0	0	0	0
6:00 AM	217	2	165	42	0	4	2	0	2	0	0	0	0	0
7:00 AM	536	0	402	92	12	21	1	0	6	1	0	1	0	0
8:00 AM	571	2	436	93	8	28	0	0	3	1	0	0	0	0
Total	10500	21	8158	1807	124	316	11	0	45	16	0	1	0	1
%		0.2	77.7	17.2	1.2	3.0	0.1	0.0	0.4	0.2	0.0	0.0	0.0	0.0

Appendix C

Existing Intersection Capacity Analysis Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.96		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1662	1671		1662	1708		1662	1677		1662	1676	
Flt Permitted	0.15	1.00		0.49	1.00		0.26	1.00		0.58	1.00	
Satd. Flow (perm)	261	1671		865	1708		454	1677		1009	1676	
Volume (vph)	61	161	68	58	436	80	242	169	65	103	186	71
Peak-hour factor, PHF	0.84	0.84	0.84	0.88	0.88	0.88	0.78	0.78	0.78	0.83	0.83	0.83
Adj. Flow (vph)	73	192	81	66	495	91	310	217	83	124	224	86
RTOR Reduction (vph)	0	17	0	0	7	0	0	15	0	0	15	0
Lane Group Flow (vph)	73	256	0	66	579	0	310	285	0	124	295	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	33.6	29.2		33.6	29.2		33.6	25.5		23.1	18.0	
Effective Green, g (s)	34.1	30.7		34.1	30.7		35.1	27.0		23.6	19.5	
Actuated g/C Ratio	0.42	0.38		0.42	0.38		0.43	0.33		0.29	0.24	
Clearance Time (s)	3.0	5.5		3.0	5.5		3.0	5.5		3.0	5.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	168	632		397	646		369	558		326	402	
v/s Ratio Prot	c0.02	0.15		0.01	c0.34		c0.12	0.17		0.02	0.18	
v/s Ratio Perm	0.16			0.06			c0.24			0.09		
v/c Ratio	0.43	0.40		0.17	0.90		0.84	0.51		0.38	0.73	
Uniform Delay, d1	17.1	18.5		14.4	23.7		17.6	21.8		22.1	28.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.8	0.4		0.2	14.9		15.7	0.8		0.7	6.8	
Delay (s)	18.9	19.0		14.6	38.7		33.2	22.6		22.8	35.2	
Level of Service	B	B		B	D		C	C		C	D	
Approach Delay (s)		19.0			36.2			28.0			31.7	
Approach LOS		B			D			C			C	

Intersection Summary			
HCM Average Control Delay	29.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	81.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	1	2	6	4	4	6	363	6	8	360	5
Peak Hour Factor	0.25	0.25	0.25	0.44	0.44	0.44	0.93	0.93	0.93	0.91	0.91	0.91
Hourly flow rate (vph)	0	4	8	14	9	9	6	390	6	9	396	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								473				
pX, platoon unblocked	0.96	0.96		0.96	0.96	0.96				0.96		
vC, conflicting volume	836	826	398	832	825	394	401			397		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	828	818	398	825	817	366	401			369		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	99	95	97	99	99			99		
cM capacity (veh/h)	261	290	645	267	290	643	1141			1121		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	12	32	403	410
Volume Left	0	14	6	9
Volume Right	8	9	6	5
cSH	458	329	1141	1121
Volume to Capacity	0.03	0.10	0.01	0.01
Queue Length 95th (ft)	2	8	0	1
Control Delay (s)	13.1	17.1	0.2	0.3
Lane LOS	B	C	A	A
Approach Delay (s)	13.1	17.1	0.2	0.3
Approach LOS	B	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	1	0	2	9	0	3	2	366	7	2	354	3
Peak Hour Factor	0.38	0.38	0.38	0.50	0.50	0.50	0.97	0.97	0.97	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	5	18	0	6	2	377	7	2	385	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								1041			1139	
pX, platoon unblocked												
vC, conflicting volume	782	779	386	781	777	381	388			385		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	782	779	386	781	777	381	388			385		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	99	94	100	99	100			100		
cM capacity (veh/h)	305	322	655	305	323	660	1154			1158		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	24	387	390
Volume Left	3	18	2	2
Volume Right	5	6	7	3
cSH	473	353	1154	1158
Volume to Capacity	0.02	0.07	0.00	0.00
Queue Length 95th (ft)	1	5	0	0
Control Delay (s)	12.7	16.0	0.1	0.1
Lane LOS	B	C	A	A
Approach Delay (s)	12.7	16.0	0.1	0.1
Approach LOS	B	C		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	31.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR	SBL
Lane Configurations		↕			↕					↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0					4.0		
Lane Util. Factor		1.00			1.00					1.00		
Frt		0.97			0.98					0.96		
Flt Protected		0.97			1.00					1.00		
Satd. Flow (prot)		1651			1706					1679		
Flt Permitted		0.58			0.99					0.95		
Satd. Flow (perm)		987			1690					1604		
Volume (vph)	76	35	33	14	386	2	81	28	9	307	128	80
Peak-hour factor, PHF	0.74	0.74	0.74	0.78	0.78	0.78	0.78	0.87	0.87	0.87	0.87	0.85
Adj. Flow (vph)	103	47	45	18	495	3	104	32	10	353	147	94
RTOR Reduction (vph)	0	24	0	0	16	0	0	0	0	30	0	0
Lane Group Flow (vph)	0	171	0	0	604	0	0	0	0	512	0	0
Turn Type	Perm			Perm				Perm	Perm			Perm
Protected Phases		1			1					2!		
Permitted Phases	1			1				2	2!			2!
Actuated Green, G (s)		16.8			16.8					15.6		
Effective Green, g (s)		17.8			17.8					16.6		
Actuated g/C Ratio		0.42			0.42					0.39		
Clearance Time (s)		5.0			5.0					5.0		
Vehicle Extension (s)		3.0			3.0					3.0		
Lane Grp Cap (vph)		414			709					628		
v/s Ratio Prot												
v/s Ratio Perm		0.17			c0.36					c0.32		
v/c Ratio		0.41			0.85					0.81		
Uniform Delay, d1		8.6			11.1					11.5		
Progression Factor		1.00			1.00					1.00		
Incremental Delay, d2		0.7			9.7					8.0		
Delay (s)		9.3			20.8					19.5		
Level of Service		A			C					B		
Approach Delay (s)		9.3			20.8					19.5		
Approach LOS		A			C					B		

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	42.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	SBT	SBR	SBR2	SEL2	SEL	SER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0				4.0	
Lane Util. Factor	1.00				1.00	
Frt	1.00				0.92	
Flt Protected	0.99				0.98	
Satd. Flow (prot)	1723				1578	
Flt Permitted	0.75				0.98	
Satd. Flow (perm)	1302				1578	
Volume (vph)	205	2	2	3	1	6
Peak-hour factor, PHF	0.85	0.85	0.85	0.63	0.63	0.63
Adj. Flow (vph)	241	2	2	5	2	10
RTOR Reduction (vph)	1	0	0	0	0	0
Lane Group Flow (vph)	338	0	0	0	17	0
Turn Type				custom		
Protected Phases	2!				2!	
Permitted Phases				1		
Actuated Green, G (s)	15.6				15.6	
Effective Green, g (s)	16.6				16.6	
Actuated g/C Ratio	0.39				0.39	
Clearance Time (s)	5.0				5.0	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	510				618	
v/s Ratio Prot						
v/s Ratio Perm	0.26				0.01	
v/c Ratio	0.66				0.03	
Uniform Delay, d1	10.6				7.9	
Progression Factor	1.00				1.00	
Incremental Delay, d2	3.2				0.0	
Delay (s)	13.8				8.0	
Level of Service	B				A	
Approach Delay (s)	13.8				8.0	
Approach LOS	B				A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	0	0	17	0	17	0	331	3	2	451	0
Peak Hour Factor	1.00	1.00	1.00	0.71	0.71	0.71	0.88	0.88	0.88	0.87	0.87	0.87
Hourly flow rate (vph)	0	0	0	24	0	24	0	376	3	2	518	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								720			680	
pX, platoon unblocked												
vC, conflicting volume	925	903	518	901	901	378	518			380		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	925	903	518	901	901	378	518			380		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	91	100	96	100			100		
cM capacity (veh/h)	237	274	551	256	274	662	1032			1163		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	48	380	521
Volume Left	0	24	0	2
Volume Right	0	24	3	0
cSH	1700	369	1032	1163
Volume to Capacity	0.00	0.13	0.00	0.00
Queue Length 95th (ft)	0	11	0	0
Control Delay (s)	0.0	16.2	0.0	0.1
Lane LOS	A	C		A
Approach Delay (s)	0.0	16.2	0.0	0.1
Approach LOS	A	C		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		1.00			1.00
Frt	0.93		0.99			1.00
Flt Protected	0.98		1.00			1.00
Satd. Flow (prot)	1587		1729			1741
Flt Permitted	0.98		1.00			0.95
Satd. Flow (perm)	1587		1729			1653
Volume (vph)	82	92	312	30	38	368
Peak-hour factor, PHF	0.74	0.74	0.87	0.87	0.91	0.91
Adj. Flow (vph)	111	124	359	34	42	404
RTOR Reduction (vph)	101	0	7	0	0	0
Lane Group Flow (vph)	134	0	386	0	0	446
Turn Type					Perm	
Protected Phases	4		2			2
Permitted Phases					2	
Actuated Green, G (s)	8.1		22.3			22.3
Effective Green, g (s)	7.1		23.3			23.3
Actuated g/C Ratio	0.18		0.61			0.61
Clearance Time (s)	3.0		5.0			5.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	293		1049			1003
v/s Ratio Prot	c0.08		0.22			
v/s Ratio Perm						c0.27
v/c Ratio	0.46		0.37			0.44
Uniform Delay, d1	13.9		3.8			4.1
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	1.1		0.2			0.3
Delay (s)	15.1		4.0			4.4
Level of Service	B		A			A
Approach Delay (s)	15.1		4.0			4.4
Approach LOS	B		A			A

Intersection Summary			
HCM Average Control Delay	6.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	38.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	1.00			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1662	1686		1662	1745			1670	1487		1680	
Flt Permitted	0.38	1.00		0.26	1.00			0.70	1.00		0.86	
Satd. Flow (perm)	656	1686		447	1745			1229	1487		1478	
Volume (vph)	5	253	81	265	667	10	247	14	158	9	12	4
Peak-hour factor, PHF	0.82	0.82	0.82	0.90	0.90	0.90	0.90	0.90	0.90	0.52	0.52	0.52
Adj. Flow (vph)	6	309	99	294	741	11	274	16	176	17	23	8
RTOR Reduction (vph)	0	15	0	0	1	0	0	0	122	0	6	0
Lane Group Flow (vph)	6	393	0	294	751	0	0	290	54	0	42	0
Turn Type	Perm			pm+pt			Perm		Perm	Perm		
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)	19.9	19.9		36.0	36.0			19.0	19.0		19.0	
Effective Green, g (s)	21.5	21.5		37.6	37.6			20.4	20.4		20.4	
Actuated g/C Ratio	0.33	0.33		0.57	0.57			0.31	0.31		0.31	
Clearance Time (s)	5.6	5.6		5.3	5.6			5.4	5.4		5.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	214	549		477	994			380	460		457	
v/s Ratio Prot		0.23		0.11	c0.43							
v/s Ratio Perm	0.01			0.24				c0.24	0.04		0.03	
v/c Ratio	0.03	0.72		0.62	0.76			0.76	0.12		0.09	
Uniform Delay, d1	15.1	19.6		9.3	10.7			20.6	16.4		16.2	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.1	4.4		2.4	3.3			8.8	0.1		0.1	
Delay (s)	15.2	24.0		11.7	14.0			29.4	16.5		16.3	
Level of Service	B	C		B	B			C	B		B	
Approach Delay (s)		23.9			13.4			24.5			16.3	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	66.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.94		1.00	0.97		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1662	1638		1662	1642		1662	1692		1662	1696	
Flt Permitted	0.28	1.00		0.21	1.00		0.24	1.00		0.28	1.00	
Satd. Flow (perm)	484	1638		373	1642		426	1692		496	1696	
Volume (vph)	134	276	202	143	237	163	168	312	87	158	307	77
Peak-hour factor, PHF	0.93	0.93	0.93	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92
Adj. Flow (vph)	144	297	217	170	282	194	173	322	90	172	334	84
RTOR Reduction (vph)	0	30	0	0	29	0	0	11	0	0	10	0
Lane Group Flow (vph)	144	484	0	170	447	0	173	401	0	172	408	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	30.7	26.5		32.1	27.2		28.2	22.5		26.6	21.7	
Effective Green, g (s)	31.2	28.0		32.6	28.7		28.7	24.0		27.1	23.2	
Actuated g/C Ratio	0.41	0.37		0.43	0.38		0.38	0.32		0.36	0.31	
Clearance Time (s)	3.0	5.5		3.0	5.5		3.0	5.5		3.0	5.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	249	605		227	622		238	536		237	519	
v/s Ratio Prot	0.02	c0.30		c0.04	0.27		c0.05	0.24		0.04	c0.24	
v/s Ratio Perm	0.21			0.28			0.23			0.22		
v/c Ratio	0.58	0.80		0.75	0.72		0.73	0.75		0.73	0.79	
Uniform Delay, d1	17.7	21.4		18.2	20.1		19.1	23.2		21.1	24.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	7.3		12.7	4.0		10.5	5.7		10.5	7.7	
Delay (s)	21.0	28.7		30.9	24.1		29.6	28.9		31.6	31.8	
Level of Service	C	C		C	C		C	C		C	C	
Approach Delay (s)		27.0			25.9			29.1			31.7	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	75.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	2	1	14	0	1	0	0	492	6	4	490	10
Peak Hour Factor	0.71	0.71	0.71	0.25	0.25	0.25	0.94	0.94	0.94	0.89	0.89	0.89
Hourly flow rate (vph)	3	1	20	0	4	0	0	523	6	4	551	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								473				
pX, platoon unblocked	0.97	0.97		0.97	0.97	0.97				0.97		
vC, conflicting volume	1094	1095	556	1112	1097	527	562			530		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1097	1098	556	1116	1100	512	562			516		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	99	96	100	98	100	100			100		
cM capacity (veh/h)	179	203	525	169	202	539	995			1004		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	24	4	530	566
Volume Left	3	0	0	4
Volume Right	20	0	6	11
cSH	398	202	995	1004
Volume to Capacity	0.06	0.02	0.00	0.00
Queue Length 95th (ft)	5	2	0	0
Control Delay (s)	14.6	23.1	0.0	0.1
Lane LOS	B	C		A
Approach Delay (s)	14.6	23.1	0.0	0.1
Approach LOS	B	C		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	1	0	3	2	0	1	1	469	11	5	454	5
Peak Hour Factor	0.50	0.50	0.50	0.38	0.38	0.38	0.90	0.90	0.90	0.95	0.95	0.95
Hourly flow rate (vph)	2	0	6	5	0	3	1	521	12	5	478	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								1041			1139	
pX, platoon unblocked												
vC, conflicting volume	1023	1027	481	1026	1023	527	483			533		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1023	1027	481	1026	1023	527	483			533		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	99	97	100	100	100			99		
cM capacity (veh/h)	209	230	579	207	231	545	1064			1019		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	8	534	488
Volume Left	2	5	1	5
Volume Right	6	3	12	5
cSH	402	261	1064	1019
Volume to Capacity	0.02	0.03	0.00	0.01
Queue Length 95th (ft)	2	2	0	0
Control Delay (s)	14.1	19.2	0.0	0.2
Lane LOS	B	C	A	A
Approach Delay (s)	14.1	19.2	0.0	0.2
Approach LOS	B	C		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL2	EBL	EBT	EBR	WBL	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR
Lane Configurations			✣			✣					✣	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0			4.0					4.0	
Lane Util. Factor			1.00			1.00					1.00	
Frt			0.97			0.94					0.97	
Flt Protected			0.97			1.00					1.00	
Satd. Flow (prot)			1657			1637					1689	
Flt Permitted			0.74			0.96					0.94	
Satd. Flow (perm)			1261			1579					1593	
Volume (vph)	2	215	111	85	14	104	2	95	28	16	318	102
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.89	0.89	0.89	0.89	0.87	0.87	0.87	0.87
Adj. Flow (vph)	2	239	123	94	16	117	2	107	32	18	366	117
RTOR Reduction (vph)	0	0	21	0	0	62	0	0	0	0	23	0
Lane Group Flow (vph)	0	0	437	0	0	180	0	0	0	0	510	0
Turn Type	Perm	Perm			Perm				Perm	Perm		
Protected Phases			1			1					2!	
Permitted Phases	1!	1			1				2	2!		
Actuated Green, G (s)			16.6			16.6					15.6	
Effective Green, g (s)			17.6			17.6					16.6	
Actuated g/C Ratio			0.42			0.42					0.39	
Clearance Time (s)			5.0			5.0					5.0	
Vehicle Extension (s)			3.0			3.0					3.0	
Lane Grp Cap (vph)			526			659					627	
v/s Ratio Prot												
v/s Ratio Perm			c0.35			0.11					c0.32	
v/c Ratio			0.83			0.27					0.81	
Uniform Delay, d1			11.0			8.1					11.4	
Progression Factor			1.00			1.00					1.00	
Incremental Delay, d2			10.7			0.2					8.0	
Delay (s)			21.7			8.3					19.4	
Level of Service			C			A					B	
Approach Delay (s)			21.7			8.3					19.4	
Approach LOS			C			A					B	

Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	42.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.0%	ICU Level of Service	E
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	SBL	SBT	SBR	SBR2	SEL2	SEL	SER
Lane Configurations							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0				4.0	
Lane Util. Factor		1.00				1.00	
Frt		0.99				0.93	
Flt Protected		0.99				0.98	
Satd. Flow (prot)		1729				1586	
Flt Permitted		0.90				0.98	
Satd. Flow (perm)		1570				1586	
Volume (vph)	54	361	14	3	11	3	16
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.63	0.63	0.63
Adj. Flow (vph)	56	376	15	3	17	5	25
RTOR Reduction (vph)	0	1	0	0	0	0	0
Lane Group Flow (vph)	0	449	0	0	0	47	0
Turn Type	Perm				custom		
Protected Phases		2!				2!	
Permitted Phases	2!				1!		
Actuated Green, G (s)		15.6				15.6	
Effective Green, g (s)		16.6				16.6	
Actuated g/C Ratio		0.39				0.39	
Clearance Time (s)		5.0				5.0	
Vehicle Extension (s)		3.0				3.0	
Lane Grp Cap (vph)		618				624	
v/s Ratio Prot							
v/s Ratio Perm		0.29				0.03	
v/c Ratio		0.73				0.08	
Uniform Delay, d1		10.9				8.0	
Progression Factor		1.00				1.00	
Incremental Delay, d2		4.3				0.1	
Delay (s)		15.1				8.1	
Level of Service		B				A	
Approach Delay (s)		15.1				8.1	
Approach LOS		B				A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	1	0	0	23	0	32	0	769	33	30	454	1
Peak Hour Factor	0.25	0.25	0.25	0.69	0.69	0.69	0.95	0.95	0.95	0.89	0.89	0.89
Hourly flow rate (vph)	4	0	0	33	0	46	0	809	35	34	510	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								720			680	
pX, platoon unblocked												
vC, conflicting volume	1451	1422	511	1405	1405	827	511			844		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1451	1422	511	1405	1405	827	511			844		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	100	100	70	100	87	100			96		
cM capacity (veh/h)	90	128	557	111	131	367	1039			779		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	4	80	844	545
Volume Left	4	33	0	34
Volume Right	0	46	35	1
cSH	90	187	1039	779
Volume to Capacity	0.04	0.43	0.00	0.04
Queue Length 95th (ft)	3	49	0	3
Control Delay (s)	46.7	37.8	0.0	1.2
Lane LOS	E	E		A
Approach Delay (s)	46.7	37.8	0.0	1.2
Approach LOS	E	E		

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		1.00			1.00
Frt	0.96		0.98			1.00
Flt Protected	0.96		1.00			0.99
Satd. Flow (prot)	1626		1718			1740
Flt Permitted	0.96		1.00			0.90
Satd. Flow (perm)	1626		1718			1566
Volume (vph)	57	21	575	86	50	442
Peak-hour factor, PHF	0.81	0.81	0.91	0.91	0.95	0.95
Adj. Flow (vph)	70	26	632	95	53	465
RTOR Reduction (vph)	24	0	7	0	0	0
Lane Group Flow (vph)	72	0	720	0	0	518
Turn Type					Perm	
Protected Phases	4		2			2
Permitted Phases					2	
Actuated Green, G (s)	6.8		49.9			49.9
Effective Green, g (s)	5.8		50.9			50.9
Actuated g/C Ratio	0.09		0.79			0.79
Clearance Time (s)	3.0		5.0			5.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	146		1352			1232
v/s Ratio Prot	c0.04		c0.42			
v/s Ratio Perm						0.33
v/c Ratio	0.50		0.53			0.42
Uniform Delay, d1	28.1		2.5			2.2
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	2.6		0.4			0.2
Delay (s)	30.7		2.9			2.4
Level of Service	C		A			A
Approach Delay (s)	30.7		2.9			2.4
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	4.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	64.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	1.00			1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1662	1672		1662	1746			1671	1487		1667	
Flt Permitted	0.52	1.00		0.17	1.00			0.71	1.00		0.88	
Satd. Flow (perm)	905	1672		294	1746			1244	1487		1488	
Volume (vph)	4	405	167	299	360	4	150	11	420	10	12	6
Peak-hour factor, PHF	0.92	0.92	0.92	0.87	0.87	0.87	0.98	0.98	0.98	0.70	0.70	0.70
Adj. Flow (vph)	4	440	182	344	414	5	153	11	429	14	17	9
RTOR Reduction (vph)	0	20	0	0	1	0	0	0	342	0	7	0
Lane Group Flow (vph)	4	602	0	344	418	0	0	164	87	0	33	0
Turn Type	Perm			pm+pt			Perm		Perm	Perm		
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)	27.6	27.6		44.2	44.2			12.2	12.2		12.2	
Effective Green, g (s)	29.2	29.2		45.8	45.8			13.6	13.6		13.6	
Actuated g/C Ratio	0.43	0.43		0.68	0.68			0.20	0.20		0.20	
Clearance Time (s)	5.6	5.6		5.3	5.6			5.4	5.4		5.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	392	724		456	1186			251	300		300	
v/s Ratio Prot		c0.36		c0.14	0.24							
v/s Ratio Perm	0.00			0.37				c0.13	0.06		0.02	
v/c Ratio	0.01	0.83		0.75	0.35			0.65	0.29		0.11	
Uniform Delay, d1	10.9	16.9		11.8	4.6			24.7	22.8		22.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	8.1		7.0	0.2			6.0	0.5		0.2	
Delay (s)	10.9	25.0		18.7	4.7			30.7	23.3		22.1	
Level of Service	B	C		B	A			C	C		C	
Approach Delay (s)		24.9			11.0			25.4			22.1	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	67.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Appendix D

Existing Queue Calculation Worksheets

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	73	273	66	586	310	300	124	310
v/c Ratio	0.35	0.41	0.16	0.88	0.84	0.52	0.40	0.77
Control Delay	16.5	18.6	12.8	33.1	42.4	27.0	21.8	36.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	18.6	12.8	33.1	42.4	27.0	21.8	36.6
Queue Length 50th (ft)	21	96	19	291	125	133	44	152
Queue Length 95th (ft)	40	147	39	#465	#178	178	74	220
Internal Link Dist (ft)		920		920		920		393
Turn Bay Length (ft)	100		75				220	
Base Capacity (vph)	211	730	415	738	370	597	315	467
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.37	0.16	0.79	0.84	0.50	0.39	0.66

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	WBT	NBT	SBT	SEL
Lane Group Flow (vph)	195	620	542	339	17
v/c Ratio	0.45	0.86	0.82	0.66	0.03
Control Delay	11.0	23.8	22.2	17.9	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	11.0	23.8	22.2	17.9	8.5
Queue Length 50th (ft)	25	128	105	67	3
Queue Length 95th (ft)	48	#226	#241	125	7
Internal Link Dist (ft)	920	920	1059	640	510
Turn Bay Length (ft)					
Base Capacity (vph)	451	754	690	538	650
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.82	0.79	0.63	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	235	393	446
v/c Ratio	0.55	0.36	0.43
Control Delay	9.0	5.7	6.6
Queue Delay	0.0	0.0	0.0
Total Delay	9.0	5.7	6.6
Queue Length 50th (ft)	14	28	36
Queue Length 95th (ft)	42	83	110
Internal Link Dist (ft)	920	600	1020
Turn Bay Length (ft)			
Base Capacity (vph)	522	1136	1077
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.45	0.35	0.41

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	6	408	294	752	290	176	48
v/c Ratio	0.03	0.74	0.61	0.76	0.77	0.30	0.10
Control Delay	18.4	25.3	13.6	16.6	29.4	4.6	16.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.4	25.3	13.6	16.6	29.4	4.6	16.0
Queue Length 50th (ft)	2	152	64	236	113	0	12
Queue Length 95th (ft)	9	232	119	419	#235	40	19
Internal Link Dist (ft)		920		920	1020		920
Turn Bay Length (ft)	110		340			370	
Base Capacity (vph)	224	656	504	1071	463	669	565
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.62	0.58	0.70	0.63	0.26	0.08

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	144	514	170	476	173	412	172	418
v/c Ratio	0.51	0.80	0.64	0.73	0.69	0.75	0.69	0.78
Control Delay	20.3	27.1	25.4	24.1	33.3	32.2	34.7	34.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.3	27.1	25.4	24.1	33.3	32.2	34.7	34.4
Queue Length 50th (ft)	43	228	51	199	59	196	59	204
Queue Length 95th (ft)	77	#369	82	281	#125	#355	#137	#376
Internal Link Dist (ft)		920		920		920		393
Turn Bay Length (ft)	100		75				220	
Base Capacity (vph)	285	747	270	764	256	621	252	603
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.69	0.63	0.62	0.68	0.66	0.68	0.69

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	WBT	NBT	SBT	SEL
Lane Group Flow (vph)	458	242	533	450	47
v/c Ratio	0.85	0.34	0.82	0.73	0.08
Control Delay	26.1	6.5	22.4	19.0	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	26.1	6.5	22.4	19.0	8.8
Queue Length 50th (ft)	90	21	106	92	7
Queue Length 95th (ft)	#238	54	#241	#213	14
Internal Link Dist (ft)	920	920	1059	640	510
Turn Bay Length (ft)					
Base Capacity (vph)	566	750	681	651	656
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.81	0.32	0.78	0.69	0.07

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	96	727	518
v/c Ratio	0.45	0.52	0.41
Control Delay	16.3	5.1	4.3
Queue Delay	0.0	0.0	0.0
Total Delay	16.3	5.1	4.3
Queue Length 50th (ft)	21	65	43
Queue Length 95th (ft)	36	161	105
Internal Link Dist (ft)	920	600	1020
Turn Bay Length (ft)			
Base Capacity (vph)	231	1386	1258
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.42	0.52	0.41

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	4	622	344	419	164	429	40
v/c Ratio	0.01	0.85	0.73	0.36	0.65	0.67	0.13
Control Delay	11.8	23.3	16.4	5.5	37.3	8.1	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.8	23.3	16.4	5.5	37.3	8.1	22.3
Queue Length 50th (ft)	1	230	58	69	71	0	12
Queue Length 95th (ft)	6	#397	141	103	#159	80	29
Internal Link Dist (ft)		920		920	1020		920
Turn Bay Length (ft)	110		340			370	
Base Capacity (vph)	446	843	508	1260	292	677	358
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.74	0.68	0.33	0.56	0.63	0.11

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Appendix E

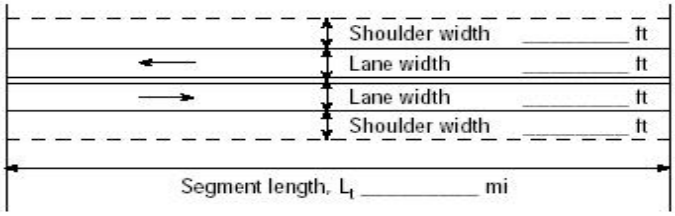
Existing Roadway Segment Capacity Analysis Worksheets

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Cahaba Heights to Green Valley*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*AM Peak*	Analysis Year	*Existing 2017*

Project Description: *Croisshaven APPLE*

Input Data



Analysis direction vol., V_d *450*veh/h

Opposing direction vol., V_o *366*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.4*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *100*%

% Trucks and Buses , P_T *5* %

% Recreational vehicles, P_R *0*%

Access points *mi* *40*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*2.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.962*	*0.952*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.95*	*0.91*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*566*	*486*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*37*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.3 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*43.6 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.1 mi/h*
		Percent free flow speed, PFFS	*76.0* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.2*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.990*	*0.980*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.96*	*0.91*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*544*	*472*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*53.8*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*38.1*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*74.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*76.0*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*517.2*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.23*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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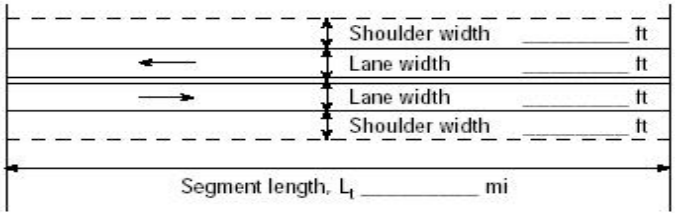
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Green Valley to Overton Rd*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*AM Peak*	Analysis Year	*Existing 2017*

Project Description: *Croisshaven APPLE*

Input Data



Analysis direction vol., V_d *430*veh/h

Opposing direction vol., V_o *352*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

Show North Arrow

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *100*%

% Trucks and Buses , P_T *5* %

% Recreational vehicles, P_R *0*%

Access points *mi* *25*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*2.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.962*	*0.952*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.94*	*0.89*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*528*	*462*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*35*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.4 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*41.3 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*31.2 mi/h*
		Percent free flow speed, PFFS	*75.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.980*	*0.971*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.95*	*0.90*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*513*	*448*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*51.9*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*39.7*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*73.1*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*75.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*477.8*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.17*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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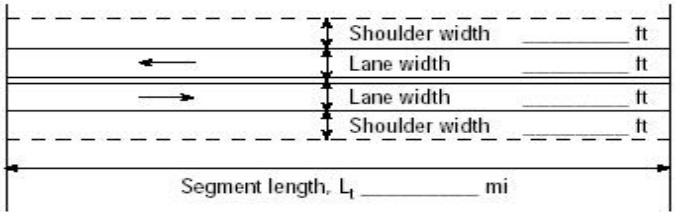
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Cahaba Heights to Green Valley*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*PM Peak*	Analysis Year	*Existing 2017*

Project Description: *Croisshaven APPLE*

Input Data



Show North Arrow

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.95*

No-passing zone *100*%

Analysis direction vol., V_d *469*veh/h

Opposing direction vol., V_o *399*veh/h

% Trucks and Buses , P_T *5* %

% Recreational vehicles, P_R *0*%

Access points *mi* *40*/mi

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.4*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*2.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.962*	*0.952*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.95*	*0.91*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*540*	*485*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*37*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.3 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*43.6 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.3 mi/h*
		Percent free flow speed, PFFS	*76.4* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.4*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.980*	*0.980*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.96*	*0.91*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*525*	*471*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*52.7*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*39.1*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*73.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*76.4*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*493.7*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.26*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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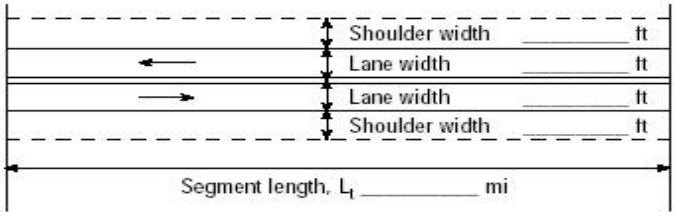
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Green Valley to Overton Rd*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*PM Peak*	Analysis Year	*Existing 2017*

Project Description: *Croisshaven APPLE*

Input Data



Show North Arrow

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.91*

No-passing zone *100%*

% Trucks and Buses , P_T *5 %*

% Recreational vehicles, P_R *0%*

Access points *mi* *25*/mi

Analysis direction vol., V_d *566*veh/h

Opposing direction vol., V_o *494*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.7*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.966*	*0.962*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.97*	*0.96*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*664*	*588*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*35*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.9 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*43.5 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*31.9 mi/h*
		Percent free flow speed, PFFS	*73.4 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.990*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.97*	*0.96*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*641*	*571*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*59.5*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*33.4*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*77.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*73.4*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*622.0*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.33*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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Appendix F

Daily Volume and Level of Service Table

Level of Service Chart
By Roadway Type and Cross-Section
(based on ALDOT approved capacities)

Functional Classification	*Number of Lanes*	*Maximum Daily Flow Rate Related to Level of Service*					
		A	*B*	*C*	*D*	*E*	*F*
Freeway	4	23,800	34,000	42,160	51,000	68,000	>68,000
	6	35,700	51,000	63,240	76,500	102,000	>102,000
	8	47,600	68,000	84,320	102,000	136,000	>136,000
	10	59,500	85,000	105,400	127,500	170,000	>170,000
Expressway	4	17,500	25,000	31,000	37,500	50,000	>50,000
	6	26,250	37,500	46,500	56,250	75,000	>75,000
	8	35,000	50,000	62,000	75,000	100,000	>100,000
Arterial (Divided)	2	7,700	11,000	13,640	16,500	22,000	>22,000
	4	11,865	16,950	21,018	25,425	33,900	>33,900
	6	17,500	25,000	31,000	37,500	50,000	>50,000
	8	25,760	36,800	45,632	55,200	73,600	>73,600
Arterial (Undivided)	2	6,230	8,900	11,036	13,350	17,800	>17,800
	4	10,850	15,500	19,220	23,250	31,000	>31,000
	6	16,030	22,900	28,396	34,350	45,800	>45,800
	8	22,085	31,550	39,122	47,325	63,100	>63,100
Collector (Divided)	2	7,280	10,400	12,896	15,600	20,800	>20,800
	4	9,975	14,250	17,670	21,375	28,500	>28,500
	6	14,700	21,000	26,040	31,500	42,000	>42,000
Collector (Undivided)	2	5,810	8,300	10,292	12,450	16,600	>16,600
	4	9,170	13,100	16,244	19,650	26,200	>26,200
	6	13,545	19,350	23,994	29,025	38,700	>38,700

Appendix G

Future Intersection Capacity Analysis Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.96		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1662	1671		1662	1709		1662	1676		1662	1677	
Flt Permitted	0.11	1.00		0.41	1.00		0.15	1.00		0.33	1.00	
Satd. Flow (perm)	194	1671		718	1709		269	1676		579	1677	
Volume (vph)	61	161	68	58	436	80	242	169	65	103	186	71
Peak-hour factor, PHF	0.84	0.84	0.84	0.88	0.88	0.88	0.78	0.78	0.78	0.83	0.83	0.83
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	95	251	106	86	649	119	406	284	109	163	294	112
RTOR Reduction (vph)	0	17	0	0	7	0	0	15	0	0	15	0
Lane Group Flow (vph)	95	340	0	86	761	0	406	378	0	163	391	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	39.3	34.6		39.3	34.6		35.5	25.5		27.5	20.5	
Effective Green, g (s)	39.8	36.1		39.8	36.1		37.0	27.0		28.0	22.0	
Actuated g/C Ratio	0.45	0.41		0.45	0.41		0.42	0.30		0.32	0.25	
Clearance Time (s)	3.0	5.5		3.0	5.5		3.0	5.5		3.0	5.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	148	679		361	695		285	510		256	415	
v/s Ratio Prot	c0.03	0.20		0.01	c0.45		c0.18	0.23		0.04	0.23	
v/s Ratio Perm	0.26			0.10			c0.42			0.16		
v/c Ratio	0.64	0.50		0.24	1.09		1.42	0.74		0.64	0.94	
Uniform Delay, d1	21.4	19.6		14.8	26.3		22.2	27.8		24.2	32.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.2	0.6		0.3	62.9		210.3	5.7		5.1	29.8	
Delay (s)	30.6	20.2		15.1	89.3		232.5	33.5		29.3	62.5	
Level of Service	C	C		B	F		F	C		C	E	
Approach Delay (s)		22.4			81.8			134.6			53.0	
Approach LOS		C			F			F			D	

Intersection Summary			
HCM Average Control Delay	81.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	88.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	1	2	6	4	4	6	363	6	8	360	5
Peak Hour Factor	0.25	0.25	0.25	0.44	0.44	0.44	0.93	0.93	0.93	0.91	0.91	0.91
Hourly flow rate (vph)	0	5	10	18	12	12	8	511	8	12	518	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								473				
pX, platoon unblocked	0.87	0.87		0.87	0.87	0.87				0.87		
vC, conflicting volume	1095	1082	522	1090	1081	516	525			520		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1109	1093	522	1104	1093	445	525			450		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	97	98	88	93	98	99			99		
cM capacity (veh/h)	147	181	549	153	181	530	1026			956		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	16	42	528	537
Volume Left	0	18	8	12
Volume Right	10	12	8	7
cSH	327	204	1026	956
Volume to Capacity	0.05	0.20	0.01	0.01
Queue Length 95th (ft)	4	19	1	1
Control Delay (s)	16.6	27.2	0.2	0.3
Lane LOS	C	D	A	A
Approach Delay (s)	16.6	27.2	0.2	0.3
Approach LOS	C	D		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	1	0	2	9	0	3	2	366	7	2	354	3
Peak Hour Factor	0.38	0.38	0.38	0.50	0.50	0.50	0.97	0.97	0.97	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	7	24	0	8	3	494	9	3	504	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								1041			1139	
pX, platoon unblocked												
vC, conflicting volume	1024	1021	506	1023	1018	499	508			504		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1024	1021	506	1023	1018	499	508			504		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	89	100	99	100			100		
cM capacity (veh/h)	207	232	560	208	233	566	1041			1045		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	10	31	506	511
Volume Left	3	24	3	3
Volume Right	7	8	9	4
cSH	357	247	1041	1045
Volume to Capacity	0.03	0.13	0.00	0.00
Queue Length 95th (ft)	2	11	0	0
Control Delay (s)	15.4	21.7	0.1	0.1
Lane LOS	C	C	A	A
Approach Delay (s)	15.4	21.7	0.1	0.1
Approach LOS	C	C		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR	SBL
Lane Configurations		↕			↕					↕		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0					4.0		
Lane Util. Factor		1.00			1.00					1.00		
Frt		0.97			0.98					0.96		
Flt Protected		0.97			1.00					1.00		
Satd. Flow (prot)		1652			1706					1678		
Flt Permitted		0.43			0.99					0.95		
Satd. Flow (perm)		724			1686					1594		
Volume (vph)	76	35	33	14	386	2	81	28	9	307	128	80
Peak-hour factor, PHF	0.74	0.74	0.74	0.78	0.78	0.78	0.78	0.87	0.87	0.87	0.87	0.85
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	135	62	58	24	648	3	136	42	14	462	193	123
RTOR Reduction (vph)	0	24	0	0	16	0	0	0	0	30	0	0
Lane Group Flow (vph)	0	231	0	0	795	0	0	0	0	681	0	0
Turn Type	Perm			Perm				Perm	Perm			Perm
Protected Phases		1			1					2!		
Permitted Phases	1			1				2	2!			2!
Actuated Green, G (s)		18.0			18.0					17.0		
Effective Green, g (s)		19.0			19.0					18.0		
Actuated g/C Ratio		0.42			0.42					0.40		
Clearance Time (s)		5.0			5.0					5.0		
Vehicle Extension (s)		3.0			3.0					3.0		
Lane Grp Cap (vph)		306			712					638		
v/s Ratio Prot												
v/s Ratio Perm		0.32			c0.47					c0.43		
v/c Ratio		0.76			1.12					1.07		
Uniform Delay, d1		11.0			13.0					13.5		
Progression Factor		1.00			1.00					1.00		
Incremental Delay, d2		10.2			70.4					55.0		
Delay (s)		21.2			83.4					68.5		
Level of Service		C			F					E		
Approach Delay (s)		21.2			83.4					68.5		
Approach LOS		C			F					E		

Intersection Summary			
HCM Average Control Delay	66.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	113.5%	ICU Level of Service	H
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	SBT	SBR	SBR2	SEL2	SEL	SER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0				4.0	
Lane Util. Factor	1.00				1.00	
Frt	1.00				0.92	
Flt Protected	0.99				0.98	
Satd. Flow (prot)	1722				1576	
Flt Permitted	0.62				0.98	
Satd. Flow (perm)	1086				1576	
Volume (vph)	205	2	2	3	1	6
Peak-hour factor, PHF	0.85	0.85	0.85	0.63	0.63	0.63
Growth Factor (vph)	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	316	3	3	6	2	12
RTOR Reduction (vph)	1	0	0	0	0	0
Lane Group Flow (vph)	444	0	0	0	20	0
Turn Type				custom		
Protected Phases	2!				2!	
Permitted Phases				1		
Actuated Green, G (s)	17.0				17.0	
Effective Green, g (s)	18.0				18.0	
Actuated g/C Ratio	0.40				0.40	
Clearance Time (s)	5.0				5.0	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	434				630	
v/s Ratio Prot						
v/s Ratio Perm	0.41				0.01	
v/c Ratio	1.02				0.03	
Uniform Delay, d1	13.5				8.2	
Progression Factor	1.00				1.00	
Incremental Delay, d2	49.4				0.0	
Delay (s)	62.9				8.2	
Level of Service	E				A	
Approach Delay (s)	62.9				8.2	
Approach LOS	E				A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	0	0	17	0	17	0	331	3	2	451	0
Peak Hour Factor	1.00	1.00	1.00	0.71	0.71	0.71	0.88	0.88	0.88	0.87	0.87	0.87
Hourly flow rate (vph)	0	0	0	31	0	31	0	493	4	3	679	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								720			680	
pX, platoon unblocked	0.93	0.93	0.93	0.93	0.93		0.93					
vC, conflicting volume	1211	1182	679	1180	1180	495	679			497		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1227	1196	656	1193	1193	495	656			497		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	79	100	94	100			100		
cM capacity (veh/h)	134	171	429	150	171	569	855			1051		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	63	497	682
Volume Left	0	31	0	3
Volume Right	0	31	4	0
cSH	1700	237	855	1051
Volume to Capacity	0.00	0.26	0.00	0.00
Queue Length 95th (ft)	0	26	0	0
Control Delay (s)	0.0	25.5	0.0	0.1
Lane LOS	A	D		A
Approach Delay (s)	0.0	25.5	0.0	0.1
Approach LOS	A	D		

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		1.00			1.00
Frt	0.93		0.99			1.00
Flt Protected	0.98		1.00			1.00
Satd. Flow (prot)	1587		1729			1741
Flt Permitted	0.98		1.00			0.93
Satd. Flow (perm)	1587		1729			1618
Volume (vph)	82	92	312	30	38	368
Peak-hour factor, PHF	0.74	0.74	0.87	0.87	0.91	0.91
Growth Factor (vph)	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	145	163	470	45	55	530
RTOR Reduction (vph)	108	0	8	0	0	0
Lane Group Flow (vph)	200	0	507	0	0	585
Turn Type					Perm	
Protected Phases	4		2			2
Permitted Phases					2	
Actuated Green, G (s)	9.5		19.9			19.9
Effective Green, g (s)	8.5		20.9			20.9
Actuated g/C Ratio	0.23		0.56			0.56
Clearance Time (s)	3.0		5.0			5.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	361		966			904
v/s Ratio Prot	c0.13		0.29			
v/s Ratio Perm						c0.36
v/c Ratio	0.55		0.52			0.65
Uniform Delay, d1	12.8		5.2			5.7
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	1.8		0.5			1.6
Delay (s)	14.6		5.7			7.3
Level of Service	B		A			A
Approach Delay (s)	14.6		5.7			7.3
Approach LOS	B		A			A

Intersection Summary			
HCM Average Control Delay	8.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	37.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	1.00			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1662	1686		1662	1745			1670	1487		1681	
Flt Permitted	0.15	1.00		0.14	1.00			0.73	1.00		0.83	
Satd. Flow (perm)	259	1686		241	1745			1274	1487		1414	
Volume (vph)	5	253	81	265	667	10	247	14	158	9	12	4
Peak-hour factor, PHF	0.82	0.82	0.82	0.90	0.90	0.90	0.90	0.90	0.90	0.52	0.52	0.52
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	8	404	129	386	971	15	360	20	230	23	30	10
RTOR Reduction (vph)	0	14	0	0	1	0	0	0	154	0	7	0
Lane Group Flow (vph)	8	519	0	386	985	0	0	380	76	0	56	0
Turn Type	Perm			pm+pt			Perm		Perm	Perm		
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)	25.4	25.4		43.4	43.4			24.5	24.5		24.5	
Effective Green, g (s)	27.0	27.0		45.0	45.0			25.9	25.9		25.9	
Actuated g/C Ratio	0.34	0.34		0.57	0.57			0.33	0.33		0.33	
Clearance Time (s)	5.6	5.6		5.3	5.6			5.4	5.4		5.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	89	577		390	995			418	488		464	
v/s Ratio Prot		0.31		0.18	c0.56							
v/s Ratio Perm	0.03			c0.39				c0.30	0.05		0.04	
v/c Ratio	0.09	0.90		0.99	0.99			0.91	0.15		0.12	
Uniform Delay, d1	17.6	24.7		21.2	16.7			25.4	18.8		18.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.4	16.7		42.4	26.0			23.1	0.1		0.1	
Delay (s)	18.1	41.3		63.6	42.8			48.5	18.9		18.7	
Level of Service	B	D		E	D			D	B		B	
Approach Delay (s)		41.0			48.6			37.3			18.7	
Approach LOS		D			D			D			B	

Intersection Summary			
HCM Average Control Delay	43.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	78.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.94		1.00	0.97		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1662	1638		1662	1642		1662	1692		1662	1696	
Flt Permitted	0.14	1.00		0.11	1.00		0.15	1.00		0.15	1.00	
Satd. Flow (perm)	243	1638		194	1642		259	1692		269	1696	
Volume (vph)	134	276	202	143	237	163	168	312	87	158	307	77
Peak-hour factor, PHF	0.93	0.93	0.93	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	189	389	285	223	370	254	227	421	117	225	437	110
RTOR Reduction (vph)	0	29	0	0	28	0	0	11	0	0	10	0
Lane Group Flow (vph)	189	645	0	223	596	0	227	527	0	225	537	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6			2			4			8		
Actuated Green, G (s)	39.5	33.5		41.5	34.5		33.5	25.5		31.5	24.5	
Effective Green, g (s)	40.0	35.0		42.0	36.0		34.0	27.0		32.0	26.0	
Actuated g/C Ratio	0.44	0.39		0.47	0.40		0.38	0.30		0.36	0.29	
Clearance Time (s)	3.0	5.5		3.0	5.5		3.0	5.5		3.0	5.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	187	637		188	657		207	508		189	490	
v/s Ratio Prot	0.06	0.39		c0.08	0.36		c0.09	0.31		0.08	0.32	
v/s Ratio Perm	0.39			c0.47			0.33			c0.34		
v/c Ratio	1.01	1.01		1.19	0.91		1.10	1.04		1.19	1.10	
Uniform Delay, d1	23.6	27.5		20.8	25.4		25.6	31.5		27.1	32.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	68.6	38.7		124.7	16.3		90.8	49.8		126.2	69.3	
Delay (s)	92.2	66.2		145.5	41.7		116.3	81.3		153.3	101.3	
Level of Service	F	E		F	D		F	F		F	F	
Approach Delay (s)		71.9			69.0			91.7			116.5	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	86.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	2	1	14	0	1	0	0	492	6	4	490	10
Peak Hour Factor	0.71	0.71	0.71	0.25	0.25	0.25	0.94	0.94	0.94	0.89	0.89	0.89
Hourly flow rate (vph)	4	2	26	0	5	0	0	686	8	6	721	15
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								473				
pX, platoon unblocked	0.82	0.82		0.82	0.82	0.82				0.82		
vC, conflicting volume	1433	1434	729	1457	1438	690	736			694		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1531	1533	729	1561	1537	620	736			625		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	98	94	100	94	100	100			99		
cM capacity (veh/h)	73	93	418	67	92	394	856			768		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	31	5	694	742
Volume Left	4	0	0	6
Volume Right	26	0	8	15
cSH	237	92	856	768
Volume to Capacity	0.13	0.06	0.00	0.01
Queue Length 95th (ft)	11	4	0	1
Control Delay (s)	22.5	46.3	0.0	0.2
Lane LOS	C	E		A
Approach Delay (s)	22.5	46.3	0.0	0.2
Approach LOS	C	E		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	1	0	3	2	0	1	1	469	11	5	454	5
Peak Hour Factor	0.50	0.50	0.50	0.38	0.38	0.38	0.90	0.90	0.90	0.95	0.95	0.95
Hourly flow rate (vph)	3	0	8	7	0	3	1	683	16	7	626	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								1041			1139	
pX, platoon unblocked	0.96	0.96		0.96	0.96	0.96				0.96		
vC, conflicting volume	1340	1345	629	1345	1340	691	633			699		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1353	1358	629	1357	1353	679	633			688		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	98	94	100	99	100			99		
cM capacity (veh/h)	119	140	477	117	141	430	936			861		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	10	10	700	640
Volume Left	3	7	1	7
Volume Right	8	3	16	7
cSH	272	154	936	861
Volume to Capacity	0.04	0.07	0.00	0.01
Queue Length 95th (ft)	3	5	0	1
Control Delay (s)	18.8	30.0	0.0	0.2
Lane LOS	C	D	A	A
Approach Delay (s)	18.8	30.0	0.0	0.2
Approach LOS	C	D		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL2	EBL	EBT	EBR	WBL	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0			4.0					4.0	
Lane Util. Factor			1.00			1.00					1.00	
Frt			0.97			0.94					0.97	
Flt Protected			0.97			1.00					1.00	
Satd. Flow (prot)			1657			1637					1689	
Flt Permitted			0.68			0.95					0.91	
Satd. Flow (perm)			1152			1563					1537	
Volume (vph)	2	215	111	85	14	104	2	95	28	16	318	102
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.89	0.89	0.89	0.89	0.87	0.87	0.87	0.87
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	3	313	162	124	21	153	3	140	42	24	479	154
RTOR Reduction (vph)	0	0	21	0	0	64	0	0	0	0	23	0
Lane Group Flow (vph)	0	0	581	0	0	253	0	0	0	0	676	0
Turn Type	Perm	Perm			Perm				Perm	Perm		
Protected Phases			1			1					2!	
Permitted Phases	1!	1			1				2	2!		
Actuated Green, G (s)			18.0			18.0					17.0	
Effective Green, g (s)			19.0			19.0					18.0	
Actuated g/C Ratio			0.42			0.42					0.40	
Clearance Time (s)			5.0			5.0					5.0	
Vehicle Extension (s)			3.0			3.0					3.0	
Lane Grp Cap (vph)			486			660					615	
v/s Ratio Prot												
v/s Ratio Perm			c0.50			0.16					c0.44	
v/c Ratio			1.20			0.38					1.10	
Uniform Delay, d1			13.0			9.0					13.5	
Progression Factor			1.00			1.00					1.00	
Incremental Delay, d2			106.8			0.4					66.5	
Delay (s)			119.8			9.3					80.0	
Level of Service			F			A					F	
Approach Delay (s)			119.8			9.3					80.0	
Approach LOS			F			A					F	

Intersection Summary			
HCM Average Control Delay	72.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	111.1%	ICU Level of Service	H
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	SBL	SBT	SBR	SBR2	SEL2	SEL	SER
Lane Configurations							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0				4.0	
Lane Util. Factor		1.00				1.00	
Frt		0.99				0.93	
Flt Protected		0.99				0.98	
Satd. Flow (prot)		1729				1586	
Flt Permitted		0.84				0.98	
Satd. Flow (perm)		1454				1586	
Volume (vph)	54	361	14	3	11	3	16
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.63	0.63	0.63
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	74	493	19	4	23	6	33
RTOR Reduction (vph)	0	1	0	0	0	0	0
Lane Group Flow (vph)	0	589	0	0	0	62	0
Turn Type	Perm				custom		
Protected Phases		2!				2!	
Permitted Phases	2!				1!		
Actuated Green, G (s)		17.0				17.0	
Effective Green, g (s)		18.0				18.0	
Actuated g/C Ratio		0.40				0.40	
Clearance Time (s)		5.0				5.0	
Vehicle Extension (s)		3.0				3.0	
Lane Grp Cap (vph)		582				634	
v/s Ratio Prot							
v/s Ratio Perm		0.41				0.04	
v/c Ratio		1.01				0.10	
Uniform Delay, d1		13.5				8.4	
Progression Factor		1.00				1.00	
Incremental Delay, d2		40.5				0.1	
Delay (s)		54.0				8.5	
Level of Service		D				A	
Approach Delay (s)		54.0				8.5	
Approach LOS		D				A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	1	0	0	23	0	32	0	769	33	30	454	1
Peak Hour Factor	0.25	0.25	0.25	0.69	0.69	0.69	0.95	0.95	0.95	0.89	0.89	0.89
Hourly flow rate (vph)	5	0	0	44	0	61	0	1060	46	44	668	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								720			680	
pX, platoon unblocked	0.91	0.91	0.94	0.91	0.91	0.88	0.94			0.88		
vC, conflicting volume	1901	1863	669	1840	1841	1083	670			1106		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1887	1845	648	1820	1821	1094	648			1120		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	84	100	100	13	100	73	100			92		
cM capacity (veh/h)	33	62	437	50	64	227	867			542		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	104	1106	714
Volume Left	5	44	0	44
Volume Right	0	61	46	1
cSH	33	92	867	542
Volume to Capacity	0.16	1.14	0.00	0.08
Queue Length 95th (ft)	12	177	0	7
Control Delay (s)	133.4	219.1	0.0	2.3
Lane LOS	F	F		A
Approach Delay (s)	133.4	219.1	0.0	2.3
Approach LOS	F	F		

Intersection Summary			
Average Delay	13.1		
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		1.00			1.00
Frt	0.96		0.98			1.00
Flt Protected	0.96		1.00			0.99
Satd. Flow (prot)	1626		1718			1740
Flt Permitted	0.96		1.00			0.85
Satd. Flow (perm)	1626		1718			1494
Volume (vph)	57	21	575	86	50	442
Peak-hour factor, PHF	0.81	0.81	0.91	0.91	0.95	0.95
Growth Factor (vph)	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	92	34	828	124	69	609
RTOR Reduction (vph)	31	0	8	0	0	0
Lane Group Flow (vph)	95	0	944	0	0	678
Turn Type					Perm	
Protected Phases	4		2			2
Permitted Phases					2	
Actuated Green, G (s)	7.0		45.6			45.6
Effective Green, g (s)	6.0		46.6			46.6
Actuated g/C Ratio	0.10		0.77			0.77
Clearance Time (s)	3.0		5.0			5.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	161		1321			1149
v/s Ratio Prot	c0.06		c0.55			
v/s Ratio Perm						0.45
v/c Ratio	0.59		0.71			0.59
Uniform Delay, d1	26.1		3.6			3.0
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	5.7		1.9			0.8
Delay (s)	31.9		5.5			3.8
Level of Service	C		A			A
Approach Delay (s)	31.9		5.5			3.8
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	1.00			1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1662	1673		1662	1746			1671	1487		1669	
Flt Permitted	0.46	1.00		0.10	1.00			0.77	1.00		0.84	
Satd. Flow (perm)	803	1673		171	1746			1353	1487		1428	
Volume (vph)	4	405	167	299	360	4	150	11	420	10	12	6
Peak-hour factor, PHF	0.92	0.92	0.92	0.87	0.87	0.87	0.98	0.98	0.98	0.70	0.70	0.70
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	6	577	238	450	542	6	201	15	561	19	22	11
RTOR Reduction (vph)	0	19	0	0	1	0	0	0	369	0	9	0
Lane Group Flow (vph)	6	796	0	450	547	0	0	216	192	0	43	0
Turn Type	Perm			pm+pt			Perm		Perm	Perm		
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8		8	4		
Actuated Green, G (s)	35.4	35.4		54.4	54.4			14.0	14.0		14.0	
Effective Green, g (s)	37.0	37.0		56.0	56.0			15.4	15.4		15.4	
Actuated g/C Ratio	0.47	0.47		0.71	0.71			0.19	0.19		0.19	
Clearance Time (s)	5.6	5.6		5.3	5.6			5.4	5.4		5.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	374	780		402	1231			262	288		277	
v/s Ratio Prot		0.48		c0.21	0.31							
v/s Ratio Perm	0.01			c0.58				c0.16	0.13		0.03	
v/c Ratio	0.02	1.02		1.12	0.44			0.82	0.67		0.16	
Uniform Delay, d1	11.4	21.2		24.8	5.0			30.7	29.6		26.6	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	37.6		81.4	0.3			18.6	5.7		0.3	
Delay (s)	11.4	58.8		106.2	5.3			49.3	35.3		26.9	
Level of Service	B	E		F	A			D	D		C	
Approach Delay (s)		58.5			50.8			39.2			26.9	
Approach LOS		E			D			D			C	

Intersection Summary			
HCM Average Control Delay	49.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	79.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Appendix H

Future Queue Calculation Worksheets

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	95	357	86	768	406	393	163	406
v/c Ratio	0.57	0.51	0.23	1.09	1.41	0.74	0.64	0.94
Control Delay	26.3	21.5	13.8	87.5	228.4	36.6	32.7	63.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.3	21.5	13.8	87.5	228.4	36.6	32.7	63.1
Queue Length 50th (ft)	27	138	25	~503	~272	191	59	218
Queue Length 95th (ft)	50	200	48	#700	#363	243	94	#350
Internal Link Dist (ft)		920		920		920		393
Turn Bay Length (ft)	100		75				220	
Base Capacity (vph)	168	700	368	707	287	529	254	434
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.51	0.23	1.09	1.41	0.74	0.64	0.94

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	WBT	NBT	SBT	SEL
Lane Group Flow (vph)	255	811	711	445	20
v/c Ratio	0.78	1.11	1.06	1.02	0.03
Control Delay	30.3	87.5	71.5	69.3	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	30.3	87.5	71.5	69.3	8.5
Queue Length 50th (ft)	43	~252	~207	~115	3
Queue Length 95th (ft)	#107	#340	#356	#248	8
Internal Link Dist (ft)	920	920	1059	640	510
Turn Bay Length (ft)					
Base Capacity (vph)	329	728	668	435	630
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.78	1.11	1.06	1.02	0.03

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	308	515	585
v/c Ratio	0.66	0.53	0.65
Control Delay	11.8	7.9	10.8
Queue Delay	0.0	0.0	0.0
Total Delay	11.8	7.9	10.8
Queue Length 50th (ft)	30	51	66
Queue Length 95th (ft)	57	119	#180
Internal Link Dist (ft)	920	600	1020
Turn Bay Length (ft)			
Base Capacity (vph)	544	996	924
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.57	0.52	0.63

Intersection Summary

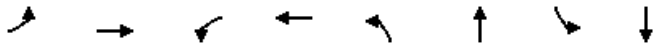
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	8	533	386	986	380	230	63
v/c Ratio	0.09	0.90	1.00	0.99	0.91	0.36	0.13
Control Delay	21.4	45.2	69.0	45.2	50.6	4.6	16.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.4	45.2	69.0	45.2	50.6	4.6	16.9
Queue Length 50th (ft)	3	242	~150	~460	177	0	18
Queue Length 95th (ft)	12	#368	#328	#754	#340	45	24
Internal Link Dist (ft)		920		920	1020		920
Turn Bay Length (ft)	110		340			370	
Base Capacity (vph)	88	592	386	997	428	654	488
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.90	1.00	0.99	0.89	0.35	0.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	189	674	223	624	227	538	225	547
v/c Ratio	1.01	1.01	1.19	0.91	1.10	1.04	1.19	1.09
Control Delay	90.6	64.9	146.2	43.6	115.3	81.4	150.7	100.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	90.6	64.9	146.2	43.6	115.3	81.4	150.7	100.1
Queue Length 50th (ft)	~59	~367	~106	308	~99	~327	~107	~350
Queue Length 95th (ft)	#173	#604	#223	#463	#245	#526	#253	#550
Internal Link Dist (ft)		920		920		920		393
Turn Bay Length (ft)	100		75				220	
Base Capacity (vph)	187	667	188	685	207	519	189	500
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.01	1.01	1.19	0.91	1.10	1.04	1.19	1.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	WBT	NBT	SBT	SEL
Lane Group Flow (vph)	602	317	699	590	62
v/c Ratio	1.19	0.44	1.10	1.01	0.10
Control Delay	121.7	8.2	83.2	59.5	9.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	121.7	8.2	83.2	59.5	9.0
Queue Length 50th (ft)	~195	33	~211	~149	9
Queue Length 95th (ft)	#353	77	#360	#327	18
Internal Link Dist (ft)	920	920	1059	640	510
Turn Bay Length (ft)					
Base Capacity (vph)	507	724	638	583	634
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.19	0.44	1.10	1.01	0.10

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	126	952	678
v/c Ratio	0.53	0.70	0.75
Control Delay	18.0	10.4	15.9
Queue Delay	0.0	0.0	0.0
Total Delay	18.0	10.4	15.9
Queue Length 50th (ft)	24	119	98
Queue Length 95th (ft)	44	#382	#312
Internal Link Dist (ft)	920	600	1020
Turn Bay Length (ft)			
Base Capacity (vph)	254	1361	908
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.50	0.70	0.75

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	6	815	450	548	216	561	52
v/c Ratio	0.02	1.02	1.12	0.44	0.82	0.85	0.18
Control Delay	12.0	60.3	105.3	6.5	54.3	20.3	23.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.0	60.3	105.3	6.5	54.3	20.3	23.9
Queue Length 50th (ft)	2	~433	~217	100	104	45	17
Queue Length 95th (ft)	8	#652	#374	146	#217	#230	35
Internal Link Dist (ft)		920		920	1020		920
Turn Bay Length (ft)	110		340			370	
Base Capacity (vph)	374	798	402	1232	270	664	299
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	1.02	1.12	0.44	0.80	0.84	0.17

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Appendix I

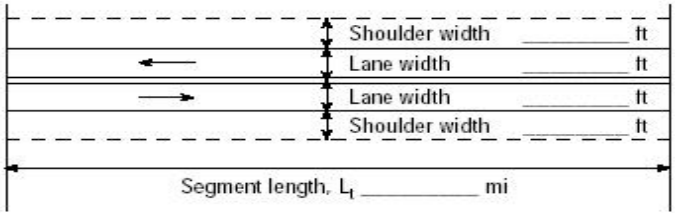
Future Roadway Segment Capacity Analysis Worksheets

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Cahaba Heights to Green Valley*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*AM Peak*	Analysis Year	*Future 2027*

Project Description: *Croisshaven APPLE*

Input Data



Show North Arrow

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *100%*

% Trucks and Buses , P_T *5 %*

% Recreational vehicles, P_R *0%*

Access points *mi* *40*/mi

Analysis direction vol., V_d *590*veh/h

Opposing direction vol., V_o *479*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.4*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.6*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.971*	*0.966*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.98*	*0.96*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*713*	*594*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*37*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.8 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*43.5 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*31.6 mi/h*
		Percent free flow speed, PFFS	*72.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.990*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.99*	*0.97*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*685*	*573*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*62.5*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*31.7*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*79.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*72.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*678.2*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.37*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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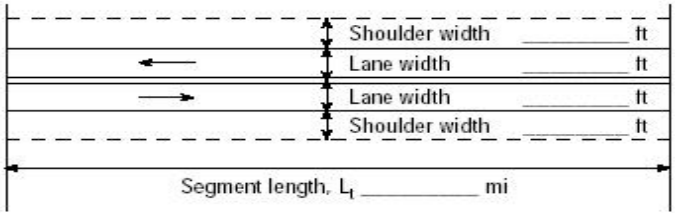
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Cahaba Heights to Green Valley*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*PM Peak*	Analysis Year	*Future 2027*

Project Description: *Croisshaven APPLE*

Input Data



Analysis direction vol., V_d *614*veh/h

Opposing direction vol., V_o *523*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.4*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.95*

No-passing zone *100*%

% Trucks and Buses , P_T *5* %

% Recreational vehicles, P_R *0*%

Access points *mi* *40*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.966*	*0.966*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.97*	*0.96*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*690*	*594*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*37*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.8 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*43.6 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*31.8 mi/h*
		Percent free flow speed, PFFS	*72.9 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.990*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.98*	*0.97*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*660*	*573*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*61.3*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*32.6*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*78.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*72.9*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*646.3*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.35*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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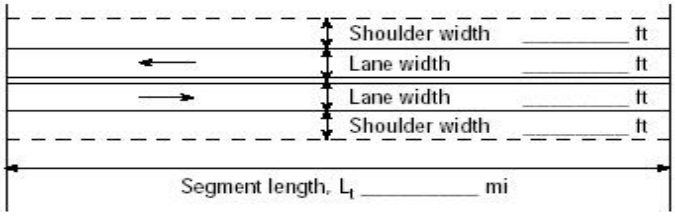
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Green Valley to Overton Rd*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*AM Peak*	Analysis Year	*Future 2027*

Project Description: *Croisshaven APPLE*

Input Data



Show North Arrow

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *100*%

% Trucks and Buses , P_T *5* %

% Recreational vehicles, P_R *0*%

Access points *mi* *25*/mi

Analysis direction vol., V_d *563*veh/h

Opposing direction vol., V_o *461*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.7*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.966*	*0.962*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.97*	*0.95*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*668*	*560*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*35*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.0 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*41.3 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*29.8 mi/h*
		Percent free flow speed, PFFS	*72.1* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.990*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.98*	*0.96*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*638*	*539*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*60.0*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*33.9*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*78.4*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*72.1*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*625.6*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.33*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	

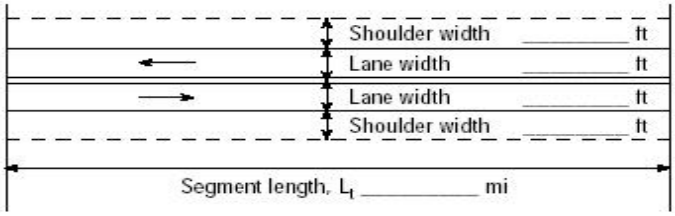
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Green Valley to Overton Rd*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*PM Peak*	Analysis Year	*Future 2027*

Project Description: *Croisshaven APPLE*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.91*

No-passing zone *100%*

% Trucks and Buses , P_T *5 %*

% Recreational vehicles, P_R *0%*

Access points *mi* *25*/mi

Show North Arrow

Analysis direction vol., V_d *741*veh/h

Opposing direction vol., V_o *647*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.4*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.980*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.99*	*0.98*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*839*	*747*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*35*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.4 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*43.4 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*29.7 mi/h*
		Percent free flow speed, PFFS	*68.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*0.99*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*814*	*718*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*69.1*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*26.0*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*82.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*68.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*814.3*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.47*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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Appendix J

Future Intersection Capacity Analysis Worksheets with Improvements

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1749	1487	1662	1749	1487	1662	1676		1662	1749	1487
Flt Permitted	0.12	1.00	1.00	0.50	1.00	1.00	0.20	1.00		0.43	1.00	1.00
Satd. Flow (perm)	211	1749	1487	878	1749	1487	354	1676		757	1749	1487
Volume (vph)	61	161	68	58	436	80	242	169	65	103	186	71
Peak-hour factor, PHF	0.84	0.84	0.84	0.88	0.88	0.88	0.78	0.78	0.78	0.83	0.83	0.83
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	95	251	106	86	649	119	406	284	109	163	294	112
RTOR Reduction (vph)	0	0	66	0	0	73	0	15	0	0	0	90
Lane Group Flow (vph)	95	251	40	86	649	46	406	378	0	163	294	22
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6		6	2		2	4			8		8
Actuated Green, G (s)	35.6	31.7	31.7	37.2	32.5	32.5	37.9	25.7		25.0	15.8	15.8
Effective Green, g (s)	36.1	33.2	33.2	37.7	34.0	34.0	39.4	27.2		25.5	17.3	17.3
Actuated g/C Ratio	0.41	0.38	0.38	0.43	0.39	0.39	0.45	0.31		0.29	0.20	0.20
Clearance Time (s)	3.0	5.5	5.5	3.0	5.5	5.5	3.0	5.5		3.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	134	658	559	408	673	573	426	516		303	343	291
v/s Ratio Prot	c0.02	0.14		0.01	c0.37		c0.20	0.23		0.05	0.17	
v/s Ratio Perm	0.27		0.03	0.08		0.03	c0.23			0.11		0.01
v/c Ratio	0.71	0.38	0.07	0.21	0.96	0.08	0.95	0.73		0.54	0.86	0.08
Uniform Delay, d1	22.0	20.1	17.7	15.5	26.6	17.2	21.7	27.3		24.8	34.3	29.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	15.8	0.4	0.1	0.3	25.9	0.1	31.6	5.3		1.8	18.6	0.1
Delay (s)	37.8	20.4	17.7	15.8	52.5	17.3	53.3	32.6		26.7	52.9	29.1
Level of Service	D	C	B	B	D	B	D	C		C	D	C
Approach Delay (s)		23.4			43.9			43.1			40.7	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM Average Control Delay	39.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	88.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	1	2	6	4	4	6	363	6	8	360	5
Peak Hour Factor	0.25	0.25	0.25	0.44	0.44	0.44	0.93	0.93	0.93	0.91	0.91	0.91
Hourly flow rate (vph)	0	5	10	18	12	12	8	511	8	12	518	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								473				
pX, platoon unblocked	0.88	0.88		0.88	0.88	0.88				0.88		
vC, conflicting volume	1091	1082	522	1087	1081	516	525			520		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1103	1093	522	1099	1092	450	525			455		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	97	98	89	93	98	99			99		
cM capacity (veh/h)	150	183	549	156	183	531	1026			960		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	16	42	8	520	12	525
Volume Left	0	18	8	0	12	0
Volume Right	10	12	0	8	0	7
cSH	329	206	1026	1700	960	1700
Volume to Capacity	0.05	0.20	0.01	0.31	0.01	0.31
Queue Length 95th (ft)	4	18	1	0	1	0
Control Delay (s)	16.5	26.8	8.5	0.0	8.8	0.0
Lane LOS	C	D	A		A	
Approach Delay (s)	16.5	26.8	0.1		0.2	
Approach LOS	C	D				

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	39.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	1	0	2	9	0	3	2	366	7	2	354	3
Peak Hour Factor	0.38	0.38	0.38	0.50	0.50	0.50	0.97	0.97	0.97	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	7	24	0	8	3	494	9	3	504	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								1041			1139	
pX, platoon unblocked												
vC, conflicting volume	1019	1021	506	1021	1018	499	508			504		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1019	1021	506	1021	1018	499	508			504		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	89	100	99	100			100		
cM capacity (veh/h)	209	232	560	208	233	566	1041			1045		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	31	3	504	3	508
Volume Left	3	24	3	0	3	0
Volume Right	7	8	0	9	0	4
cSH	359	248	1041	1700	1045	1700
Volume to Capacity	0.03	0.13	0.00	0.30	0.00	0.30
Queue Length 95th (ft)	2	11	0	0	0	0
Control Delay (s)	15.3	21.6	8.5	0.0	8.5	0.0
Lane LOS	C	C	A		A	
Approach Delay (s)	15.3	21.6	0.0		0.0	
Approach LOS	C	C				

Intersection Summary				
Average Delay	0.8			
Intersection Capacity Utilization	35.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR	SBL
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0				4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00				1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.98				1.00	1.00	0.85	1.00
Flt Protected	0.95	1.00	1.00		1.00				0.95	1.00	1.00	0.95
Satd. Flow (prot)	1662	1749	1487		1706				1662	1749	1487	1662
Flt Permitted	0.27	1.00	1.00		0.99				0.49	1.00	1.00	0.32
Satd. Flow (perm)	479	1749	1487		1696				856	1749	1487	554
Volume (vph)	76	35	33	14	386	2	81	28	9	307	128	80
Peak-hour factor, PHF	0.74	0.74	0.74	0.78	0.78	0.78	0.78	0.87	0.87	0.87	0.87	0.85
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	135	62	58	24	648	3	136	42	14	462	193	123
RTOR Reduction (vph)	0	0	31	0	16	0	0	0	0	0	124	0
Lane Group Flow (vph)	135	62	27	0	795	0	0	0	56	462	69	123
Turn Type	Perm		Perm	Perm				Perm	Perm		Perm	Perm
Protected Phases		1			1					2!		
Permitted Phases	1		1	1				2	2!		2	2!
Actuated Green, G (s)	19.1	19.1	19.1		19.1				14.7	14.7	14.7	14.7
Effective Green, g (s)	20.1	20.1	20.1		20.1				15.7	15.7	15.7	15.7
Actuated g/C Ratio	0.46	0.46	0.46		0.46				0.36	0.36	0.36	0.36
Clearance Time (s)	5.0	5.0	5.0		5.0				5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0				3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	220	803	682		778				307	627	533	199
v/s Ratio Prot		0.04								c0.26		
v/s Ratio Perm	0.28		0.02		c0.47				0.07		0.05	0.22
v/c Ratio	0.61	0.08	0.04		1.02				0.18	0.74	0.13	0.62
Uniform Delay, d1	8.9	6.6	6.5		11.8				9.6	12.2	9.5	11.6
Progression Factor	1.00	1.00	1.00		1.00				1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	0.0	0.0		38.0				0.3	4.5	0.1	5.6
Delay (s)	13.9	6.7	6.6		49.9				9.9	16.8	9.6	17.2
Level of Service	B	A	A		D				A	B	A	B
Approach Delay (s)		10.5			49.9					14.3		
Approach LOS		B			D					B		

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	43.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	SBT	SBR	SBR2	SEL2	SEL	SER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0				4.0	
Lane Util. Factor	1.00				1.00	
Frt	1.00				0.92	
Flt Protected	1.00				0.98	
Satd. Flow (prot)	1744				1576	
Flt Permitted	1.00				0.98	
Satd. Flow (perm)	1744				1576	
Volume (vph)	205	2	2	3	1	6
Peak-hour factor, PHF	0.85	0.85	0.85	0.63	0.63	0.63
Growth Factor (vph)	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	316	3	3	6	2	12
RTOR Reduction (vph)	1	0	0	0	0	0
Lane Group Flow (vph)	321	0	0	0	20	0
Turn Type				custom		
Protected Phases	2!				2!	
Permitted Phases				1		
Actuated Green, G (s)	14.7				14.7	
Effective Green, g (s)	15.7				15.7	
Actuated g/C Ratio	0.36				0.36	
Clearance Time (s)	5.0				5.0	
Vehicle Extension (s)	3.0				3.0	
Lane Grp Cap (vph)	625				565	
v/s Ratio Prot	0.18					
v/s Ratio Perm					0.01	
v/c Ratio	0.51				0.04	
Uniform Delay, d1	11.1				9.1	
Progression Factor	1.00				1.00	
Incremental Delay, d2	0.7				0.0	
Delay (s)	11.8				9.2	
Level of Service	B				A	
Approach Delay (s)	13.3				9.2	
Approach LOS	B				A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0			4.0		4.0	4.0	
Lane Util. Factor					1.00			1.00		1.00	1.00	
Frt					0.93			1.00		1.00	1.00	
Flt Protected					0.98			1.00		0.95	1.00	
Satd. Flow (prot)					1591			1747		1662	1749	
Flt Permitted					0.84			1.00		0.47	1.00	
Satd. Flow (perm)					1373			1747		823	1749	
Volume (vph)	0	0	0	17	0	17	0	331	3	2	451	0
Peak-hour factor, PHF	1.00	1.00	1.00	0.71	0.71	0.71	0.88	0.88	0.88	0.87	0.87	0.87
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	0	0	0	31	0	31	0	493	4	3	679	0
RTOR Reduction (vph)	0	0	0	0	29	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	33	0	0	497	0	3	679	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)					5.3			64.3		64.3	64.3	
Effective Green, g (s)					6.3			65.3		65.3	65.3	
Actuated g/C Ratio					0.08			0.82		0.82	0.82	
Clearance Time (s)					5.0			5.0		5.0	5.0	
Vehicle Extension (s)					3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)					109			1433		675	1435	
v/s Ratio Prot								0.28			c0.39	
v/s Ratio Perm					c0.02					0.00		
v/c Ratio					0.31			0.35		0.00	0.47	
Uniform Delay, d1					34.6			1.8		1.3	2.1	
Progression Factor					1.00			1.00		1.00	1.00	
Incremental Delay, d2					1.6			0.1		0.0	0.2	
Delay (s)					36.2			1.9		1.3	2.3	
Level of Service					D			A		A	A	
Approach Delay (s)		0.0			36.2			1.9			2.3	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	3.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	79.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.93		1.00	0.85	1.00	1.00
Flt Protected	0.98		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1587		1749	1487	1662	1749
Flt Permitted	0.98		1.00	1.00	0.45	1.00
Satd. Flow (perm)	1587		1749	1487	785	1749
Volume (vph)	82	92	312	30	38	368
Peak-hour factor, PHF	0.74	0.74	0.87	0.87	0.91	0.91
Growth Factor (vph)	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	145	163	470	45	55	530
RTOR Reduction (vph)	107	0	0	20	0	0
Lane Group Flow (vph)	201	0	470	25	55	530
Turn Type				Perm	Perm	
Protected Phases	4		2			2
Permitted Phases				2	2	
Actuated Green, G (s)	9.4		18.7	18.7	18.7	18.7
Effective Green, g (s)	8.4		19.7	19.7	19.7	19.7
Actuated g/C Ratio	0.23		0.55	0.55	0.55	0.55
Clearance Time (s)	3.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	369		954	811	428	954
v/s Ratio Prot	c0.13		0.27			c0.30
v/s Ratio Perm				0.02	0.07	
v/c Ratio	0.54		0.49	0.03	0.13	0.56
Uniform Delay, d1	12.2		5.1	3.8	4.0	5.3
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6		0.4	0.0	0.1	0.7
Delay (s)	13.8		5.5	3.8	4.1	6.1
Level of Service	B		A	A	A	A
Approach Delay (s)	13.8		5.3			5.9
Approach LOS	B		A			A

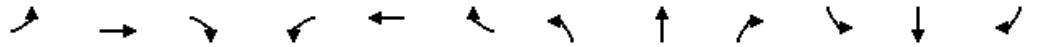
Intersection Summary			
HCM Average Control Delay	7.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	36.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)	1662	1749	1487	1662	1745			1670	1487		1681	
Flt Permitted	0.15	1.00	1.00	0.28	1.00			0.73	1.00		0.83	
Satd. Flow (perm)	255	1749	1487	481	1745			1275	1487		1413	
Volume (vph)	5	253	81	265	667	10	247	14	158	9	12	4
Peak-hour factor, PHF	0.82	0.82	0.82	0.90	0.90	0.90	0.90	0.90	0.90	0.52	0.52	0.52
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	8	404	129	386	971	15	360	20	230	23	30	10
RTOR Reduction (vph)	0	0	84	0	1	0	0	0	155	0	7	0
Lane Group Flow (vph)	8	404	45	386	985	0	0	380	75	0	56	0
Turn Type	Perm		Perm	pm+pt			Perm		Perm	Perm		
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6			8		8	4		
Actuated Green, G (s)	25.8	25.8	25.8	43.5	43.5			24.5	24.5		24.5	
Effective Green, g (s)	27.4	27.4	27.4	45.1	45.1			25.9	25.9		25.9	
Actuated g/C Ratio	0.35	0.35	0.35	0.57	0.57			0.33	0.33		0.33	
Clearance Time (s)	5.6	5.6	5.6	5.3	5.6			5.4	5.4		5.4	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	88	607	516	479	996			418	488		463	
v/s Ratio Prot		0.23		0.14	c0.56							
v/s Ratio Perm	0.03		0.03	0.32				c0.30	0.05		0.04	
v/c Ratio	0.09	0.67	0.09	0.81	0.99			0.91	0.15		0.12	
Uniform Delay, d1	17.4	21.9	17.4	11.9	16.7			25.4	18.8		18.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.4	2.8	0.1	9.6	25.6			23.1	0.1		0.1	
Delay (s)	17.8	24.7	17.4	21.5	42.3			48.5	18.9		18.7	
Level of Service	B	C	B	C	D			D	B		B	
Approach Delay (s)		22.8			36.4			37.4			18.7	
Approach LOS		C			D			D			B	

Intersection Summary			
HCM Average Control Delay	33.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	79.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1749	1487	1662	1749	1487	1662	1692		1662	1749	1487
Flt Permitted	0.33	1.00	1.00	0.27	1.00	1.00	0.25	1.00		0.15	1.00	1.00
Satd. Flow (perm)	584	1749	1487	470	1749	1487	433	1692		267	1749	1487
Volume (vph)	134	276	202	143	237	163	168	312	87	158	307	77
Peak-hour factor, PHF	0.93	0.93	0.93	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	189	389	285	223	370	254	227	421	117	225	437	110
RTOR Reduction (vph)	0	0	199	0	0	174	0	11	0	0	0	74
Lane Group Flow (vph)	189	389	86	223	370	80	227	527	0	225	437	36
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6		6	2		2	4			8		8
Actuated Green, G (s)	28.8	22.8	22.8	30.8	23.8	23.8	33.8	24.7		33.8	24.7	24.7
Effective Green, g (s)	29.3	24.3	24.3	31.3	25.3	25.3	34.3	26.2		34.3	26.2	26.2
Actuated g/C Ratio	0.36	0.30	0.30	0.39	0.31	0.31	0.43	0.33		0.43	0.33	0.33
Clearance Time (s)	3.0	5.5	5.5	3.0	5.5	5.5	3.0	5.5		3.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	279	527	448	271	549	467	308	550		254	569	483
v/s Ratio Prot	0.04	0.22		c0.06	0.21		0.07	c0.31		c0.09	0.25	
v/s Ratio Perm	0.20		0.06	c0.26		0.05	0.24			0.29		0.02
v/c Ratio	0.68	0.74	0.19	0.82	0.67	0.17	0.74	0.96		0.89	0.77	0.07
Uniform Delay, d1	21.0	25.3	20.9	21.0	24.1	20.0	16.9	26.7		18.3	24.5	18.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.4	5.4	0.2	17.9	3.3	0.2	8.9	27.9		28.6	6.2	0.1
Delay (s)	27.4	30.7	21.1	38.9	27.3	20.2	25.8	54.6		46.9	30.6	18.9
Level of Service	C	C	C	D	C	C	C	D		D	C	B
Approach Delay (s)		26.8			28.2			46.0			33.7	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	33.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	2	1	14	0	1	0	0	492	6	4	490	10
Peak Hour Factor	0.71	0.71	0.71	0.25	0.25	0.25	0.94	0.94	0.94	0.89	0.89	0.89
Hourly flow rate (vph)	4	2	26	0	5	0	0	686	8	6	721	15
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								473				
pX, platoon unblocked	0.85	0.85		0.85	0.85	0.85				0.85		
vC, conflicting volume	1429	1434	729	1450	1438	690	736			694		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1502	1509	729	1527	1513	637	736			641		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	98	94	100	95	100	100			99		
cM capacity (veh/h)	80	101	418	74	100	403	856			793		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	31	5	0	694	6	736
Volume Left	4	0	0	0	6	0
Volume Right	26	0	0	8	0	15
cSH	249	100	1700	1700	793	1700
Volume to Capacity	0.13	0.05	0.00	0.41	0.01	0.43
Queue Length 95th (ft)	11	4	0	0	1	0
Control Delay (s)	21.6	43.0	0.0	0.0	9.6	0.0
Lane LOS	C	E			A	
Approach Delay (s)	21.6	43.0	0.0		0.1	
Approach LOS	C	E				

Intersection Summary				
Average Delay	0.7			
Intersection Capacity Utilization	44.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	1	0	3	2	0	1	1	469	11	5	454	5
Peak Hour Factor	0.50	0.50	0.50	0.38	0.38	0.38	0.90	0.90	0.90	0.95	0.95	0.95
Hourly flow rate (vph)	3	0	8	7	0	3	1	683	16	7	626	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								1041			1139	
pX, platoon unblocked												
vC, conflicting volume	1332	1345	629	1341	1340	691	633			699		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1332	1345	629	1341	1340	691	633			699		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	98	94	100	99	100			99		
cM capacity (veh/h)	127	148	477	124	149	440	936			884		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	10	1	699	7	633
Volume Left	3	7	1	0	7	0
Volume Right	8	3	0	16	0	7
cSH	283	164	936	1700	884	1700
Volume to Capacity	0.04	0.06	0.00	0.41	0.01	0.37
Queue Length 95th (ft)	3	5	0	0	1	0
Control Delay (s)	18.2	28.5	8.9	0.0	9.1	0.0
Lane LOS	C	D	A		A	
Approach Delay (s)	18.2	28.5	0.0		0.1	
Approach LOS	C	D				

Intersection Summary				
Average Delay	0.4			
Intersection Capacity Utilization	43.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL2	EBL	EBT	EBR	WBL	WBT	WBR	WBR2	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0		4.0				4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	1.00		1.00				1.00	1.00	1.00
Frt		1.00	1.00	0.85		0.94				1.00	1.00	0.85
Flt Protected		0.95	1.00	1.00		1.00				0.95	1.00	1.00
Satd. Flow (prot)		1662	1749	1487		1637				1662	1749	1487
Flt Permitted		0.57	1.00	1.00		0.98				0.30	1.00	1.00
Satd. Flow (perm)		996	1749	1487		1605				524	1749	1487
Volume (vph)	2	215	111	85	14	104	2	95	28	16	318	102
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.89	0.89	0.89	0.89	0.87	0.87	0.87	0.87
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	3	313	162	124	21	153	3	140	42	24	479	154
RTOR Reduction (vph)	0	0	0	73	0	65	0	0	0	0	0	93
Lane Group Flow (vph)	0	316	162	51	0	252	0	0	0	66	479	61
Turn Type	Perm	Perm		Perm	Perm				Perm	Perm		Perm
Protected Phases			1			1					2!	
Permitted Phases	1!	1		1	1				2	2!		2
Actuated Green, G (s)		16.0	16.0	16.0		16.0				15.5	15.5	15.5
Effective Green, g (s)		17.0	17.0	17.0		17.0				16.5	16.5	16.5
Actuated g/C Ratio		0.41	0.41	0.41		0.41				0.40	0.40	0.40
Clearance Time (s)		5.0	5.0	5.0		5.0				5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0	3.0		3.0				3.0	3.0	3.0
Lane Grp Cap (vph)		408	716	609		657				208	695	591
v/s Ratio Prot			0.09								0.27	
v/s Ratio Perm		c0.32		0.03		0.16				0.13		0.04
v/c Ratio		0.77	0.23	0.08		0.38				0.32	0.69	0.10
Uniform Delay, d1		10.6	8.0	7.5		8.6				8.6	10.4	7.9
Progression Factor		1.00	1.00	1.00		1.00				1.00	1.00	1.00
Incremental Delay, d2		8.9	0.2	0.1		0.4				0.9	2.9	0.1
Delay (s)		19.5	8.1	7.5		9.0				9.5	13.2	7.9
Level of Service		B	A	A		A				A	B	A
Approach Delay (s)			14.0			9.0					11.7	
Approach LOS			B			A					B	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	41.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	SBL	SBT	SBR	SBR2	SEL2	SEL	SER
Lane Configurations							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0				4.0	
Lane Util. Factor	1.00	1.00				1.00	
Frt	1.00	0.99				0.93	
Flt Protected	0.95	1.00				0.98	
Satd. Flow (prot)	1662	1738				1586	
Flt Permitted	0.34	1.00				0.98	
Satd. Flow (perm)	593	1738				1586	
Volume (vph)	54	361	14	3	11	3	16
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.63	0.63	0.63
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	74	493	19	4	23	6	33
RTOR Reduction (vph)	0	1	0	0	0	0	0
Lane Group Flow (vph)	74	515	0	0	0	62	0
Turn Type	Perm				custom		
Protected Phases		2!				2!	
Permitted Phases	2!				1!		
Actuated Green, G (s)	15.5	15.5				15.5	
Effective Green, g (s)	16.5	16.5				16.5	
Actuated g/C Ratio	0.40	0.40				0.40	
Clearance Time (s)	5.0	5.0				5.0	
Vehicle Extension (s)	3.0	3.0				3.0	
Lane Grp Cap (vph)	236	691				631	
v/s Ratio Prot		c0.30					
v/s Ratio Perm	0.12					0.04	
v/c Ratio	0.31	0.75				0.10	
Uniform Delay, d1	8.6	10.7				7.8	
Progression Factor	1.00	1.00				1.00	
Incremental Delay, d2	0.8	4.4				0.1	
Delay (s)	9.4	15.1				7.9	
Level of Service	A	B				A	
Approach Delay (s)		14.4				7.9	
Approach LOS		B				A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00			1.00		1.00	1.00	
Frt		1.00			0.92			0.99		1.00	1.00	
Flt Protected		0.95			0.98			1.00		0.95	1.00	
Satd. Flow (prot)		1662			1579			1738		1662	1749	
Flt Permitted		0.72			0.86			1.00		0.15	1.00	
Satd. Flow (perm)		1267			1389			1738		254	1749	
Volume (vph)	1	0	0	23	0	32	0	769	33	30	454	1
Peak-hour factor, PHF	0.25	0.25	0.25	0.69	0.69	0.69	0.95	0.95	0.95	0.89	0.89	0.89
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	5	0	0	44	0	61	0	1060	46	44	668	1
RTOR Reduction (vph)	0	0	0	0	53	0	0	2	0	0	0	0
Lane Group Flow (vph)	0	5	0	0	52	0	0	1104	0	44	669	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		7.2			7.2			45.7		45.7	45.7	
Effective Green, g (s)		8.2			8.2			46.7		46.7	46.7	
Actuated g/C Ratio		0.13			0.13			0.74		0.74	0.74	
Clearance Time (s)		5.0			5.0			5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)		165			181			1290		189	1299	
v/s Ratio Prot								c0.64			0.38	
v/s Ratio Perm		0.00			c0.04					0.17		
v/c Ratio		0.03			0.29			0.86		0.23	0.52	
Uniform Delay, d1		23.9			24.7			5.7		2.5	3.4	
Progression Factor		1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2		0.1			0.9			5.8		0.6	0.3	
Delay (s)		24.0			25.6			11.5		3.2	3.7	
Level of Service		C			C			B		A	A	
Approach Delay (s)		24.0			25.6			11.5			3.7	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	9.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	62.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.96		1.00	0.85	1.00	1.00
Flt Protected	0.96		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1626		1749	1487	1662	1749
Flt Permitted	0.96		1.00	1.00	0.29	1.00
Satd. Flow (perm)	1626		1749	1487	514	1749
Volume (vph)	57	21	575	86	50	442
Peak-hour factor, PHF	0.81	0.81	0.91	0.91	0.95	0.95
Growth Factor (vph)	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	92	34	828	124	69	609
RTOR Reduction (vph)	31	0	0	29	0	0
Lane Group Flow (vph)	95	0	828	95	69	609
Turn Type				Perm	Perm	
Protected Phases	4		2			2
Permitted Phases				2	2	
Actuated Green, G (s)	7.0		45.6	45.6	45.6	45.6
Effective Green, g (s)	6.0		46.6	46.6	46.6	46.6
Actuated g/C Ratio	0.10		0.77	0.77	0.77	0.77
Clearance Time (s)	3.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	161		1345	1143	395	1345
v/s Ratio Prot	c0.06		c0.47			0.35
v/s Ratio Perm				0.06	0.13	
v/c Ratio	0.59		0.62	0.08	0.17	0.45
Uniform Delay, d1	26.1		3.1	1.7	1.9	2.5
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	5.7		0.8	0.0	0.2	0.2
Delay (s)	31.9		3.9	1.8	2.1	2.7
Level of Service	C		A	A	A	A
Approach Delay (s)	31.9		3.6			2.7
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	60.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1662	1749	1487	1662	1746			1671	1487		1669	
Flt Permitted	0.46	1.00	1.00	0.18	1.00			0.70	1.00		0.85	
Satd. Flow (perm)	803	1749	1487	318	1746			1230	1487		1450	
Volume (vph)	4	405	167	299	360	4	150	11	420	10	12	6
Peak-hour factor, PHF	0.92	0.92	0.92	0.87	0.87	0.87	0.98	0.98	0.98	0.70	0.70	0.70
Growth Factor (vph)	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%	131%
Adj. Flow (vph)	6	577	238	450	542	6	201	15	561	19	22	11
RTOR Reduction (vph)	0	0	140	0	1	0	0	0	362	0	9	0
Lane Group Flow (vph)	6	577	98	450	547	0	0	216	199	0	43	0
Turn Type	Perm		Perm	pm+pt			Perm		Perm	Perm		
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6			8		8	4		
Actuated Green, G (s)	27.3	27.3	27.3	45.9	45.9			13.4	13.4		13.4	
Effective Green, g (s)	28.9	28.9	28.9	47.5	47.5			14.8	14.8		14.8	
Actuated g/C Ratio	0.41	0.41	0.41	0.68	0.68			0.21	0.21		0.21	
Clearance Time (s)	5.6	5.6	5.6	5.3	5.6			5.4	5.4		5.4	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	330	719	611	494	1180			259	313		305	
v/s Ratio Prot		0.33		c0.19	0.31							
v/s Ratio Perm	0.01		0.07	c0.43				c0.18	0.13		0.03	
v/c Ratio	0.02	0.80	0.16	0.91	0.46			0.83	0.63		0.14	
Uniform Delay, d1	12.3	18.2	13.0	15.1	5.4			26.6	25.3		22.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	6.4	0.1	20.9	0.3			20.0	4.2		0.2	
Delay (s)	12.3	24.6	13.2	36.1	5.7			46.6	29.5		22.8	
Level of Service	B	C	B	D	A			D	C		C	
Approach Delay (s)		21.2			19.4			34.2			22.8	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	24.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	70.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Appendix K

Future Queue Calculation Worksheets with Improvements

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	95	251	106	86	649	119	406	393	163	294	112
v/c Ratio	0.62	0.38	0.17	0.21	0.96	0.18	0.94	0.73	0.56	0.85	0.29
Control Delay	35.1	22.7	4.8	15.1	53.7	4.5	53.9	36.0	23.8	54.8	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.1	22.7	4.8	15.1	53.7	4.5	53.9	36.0	23.8	54.8	8.5
Queue Length 50th (ft)	29	104	0	27	359	0	172	191	55	162	0
Queue Length 95th (ft)	#62	155	27	52	#566	31	#267	243	88	#260	35
Internal Link Dist (ft)		920			920			920		393	
Turn Bay Length (ft)	100			75					220		
Base Capacity (vph)	152	663	629	410	680	651	432	535	304	357	393
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.38	0.17	0.21	0.95	0.18	0.94	0.73	0.54	0.82	0.28

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SEL
Lane Group Flow (vph)	135	62	58	811	56	462	193	123	322	20
v/c Ratio	0.65	0.08	0.08	1.02	0.18	0.74	0.29	0.59	0.51	0.04
Control Delay	30.2	7.6	3.0	55.9	11.0	19.6	3.3	24.8	13.9	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.2	7.6	3.0	55.9	11.0	19.6	3.3	24.8	13.9	9.1
Queue Length 50th (ft)	25	9	0	~239	9	96	0	24	60	3
Queue Length 95th (ft)	#71	19	9	#328	26	#176	26	#76	106	9
Internal Link Dist (ft)		920		920		1059			640	510
Turn Bay Length (ft)										
Base Capacity (vph)	209	801	713	792	328	661	682	219	659	595
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.08	0.08	1.02	0.17	0.70	0.28	0.56	0.49	0.03

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	62	497	3	679
v/c Ratio	0.32	0.33	0.00	0.45
Control Delay	10.0	3.3	3.0	4.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	10.0	3.3	3.0	4.3
Queue Length 50th (ft)	10	0	0	0
Queue Length 95th (ft)	20	101	2	161
Internal Link Dist (ft)	920	640		600
Turn Bay Length (ft)				
Base Capacity (vph)	243	1496	610	1498
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.26	0.33	0.00	0.45

Intersection Summary

Lane Group	WBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	308	470	45	55	530
v/c Ratio	0.65	0.49	0.05	0.13	0.56
Control Delay	11.3	7.7	2.2	5.7	8.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	11.3	7.7	2.2	5.7	8.4
Queue Length 50th (ft)	28	46	0	4	54
Queue Length 95th (ft)	57	107	8	18	135
Internal Link Dist (ft)	920	600			1020
Turn Bay Length (ft)					
Base Capacity (vph)	557	994	865	426	994
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.55	0.47	0.05	0.13	0.53

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	8	404	129	386	986	380	230	63
v/c Ratio	0.09	0.67	0.21	0.82	0.99	0.91	0.36	0.13
Control Delay	21.3	28.8	4.8	26.1	45.2	50.6	4.6	16.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.3	28.8	4.8	26.1	45.2	50.6	4.6	16.9
Queue Length 50th (ft)	3	172	0	101	~460	177	0	18
Queue Length 95th (ft)	12	237	27	#227	#754	#340	45	24
Internal Link Dist (ft)		920			920	1020		920
Turn Bay Length (ft)	110			340			370	
Base Capacity (vph)	90	607	600	476	997	428	654	488
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.67	0.21	0.81	0.99	0.89	0.35	0.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	189	389	285	223	370	254	227	538	225	437	110
v/c Ratio	0.61	0.74	0.44	0.71	0.67	0.40	0.84	0.96	0.89	0.77	0.20
Control Delay	25.3	28.9	4.2	30.3	26.9	4.0	45.3	59.4	55.2	37.3	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.3	28.9	4.2	30.3	26.9	4.0	45.3	59.4	55.2	37.3	6.0
Queue Length 50th (ft)	59	174	0	72	160	0	68	260	67	199	0
Queue Length 95th (ft)	101	268	49	109	224	36	#213	#538	#230	#402	37
Internal Link Dist (ft)		920			920			920		393	
Turn Bay Length (ft)	100			75					220		
Base Capacity (vph)	311	661	739	313	680	734	271	559	253	567	557
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.59	0.39	0.71	0.54	0.35	0.84	0.96	0.89	0.77	0.20

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SEL
Lane Group Flow (vph)	316	162	124	317	66	479	154	74	516	62
v/c Ratio	0.79	0.23	0.18	0.44	0.33	0.69	0.23	0.32	0.75	0.10
Control Delay	25.6	9.3	2.9	7.9	14.2	16.6	3.0	13.6	18.9	8.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.6	9.3	2.9	7.9	14.2	16.6	3.0	13.6	18.9	8.9
Queue Length 50th (ft)	65	25	0	33	11	96	0	12	107	9
Queue Length 95th (ft)	#178	53	21	76	35	169	22	38	#240	18
Internal Link Dist (ft)		920		920		1059			640	510
Turn Bay Length (ft)										
Base Capacity (vph)	429	765	720	765	215	733	713	243	729	665
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.21	0.17	0.41	0.31	0.65	0.22	0.30	0.71	0.09

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	5	105	1106	44	669
v/c Ratio	0.03	0.38	0.83	0.17	0.50
Control Delay	11.0	9.0	19.2	6.7	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	11.0	9.0	19.2	6.7	7.2
Queue Length 50th (ft)	1	11	199	3	72
Queue Length 95th (ft)	2	21	#517	20	#208
Internal Link Dist (ft)	920	920	640		600
Turn Bay Length (ft)					
Base Capacity (vph)	230	321	1325	252	1330
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.02	0.33	0.83	0.17	0.50

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	126	828	124	69	609
v/c Ratio	0.53	0.60	0.10	0.23	0.44
Control Delay	17.9	7.6	1.1	5.6	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	17.9	7.6	1.1	5.6	4.6
Queue Length 50th (ft)	24	93	0	5	55
Queue Length 95th (ft)	44	#307	11	22	122
Internal Link Dist (ft)	920	600			1020
Turn Bay Length (ft)					
Base Capacity (vph)	254	1378	1198	305	1378
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.50	0.60	0.10	0.23	0.44

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	6	577	238	450	548	216	561	52
v/c Ratio	0.02	0.81	0.32	0.85	0.47	0.76	0.83	0.17
Control Delay	12.0	23.5	2.9	26.7	6.8	43.6	17.7	22.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.0	23.5	2.9	26.7	6.8	43.6	17.7	22.8
Queue Length 50th (ft)	2	221	0	96	100	93	40	15
Queue Length 95th (ft)	8	344	36	#247	146	#217	#229	35
Internal Link Dist (ft)		920			920	1020		920
Turn Bay Length (ft)	110			340			370	
Base Capacity (vph)	380	829	830	536	1242	306	693	338
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.70	0.29	0.84	0.44	0.71	0.81	0.15

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Appendix L

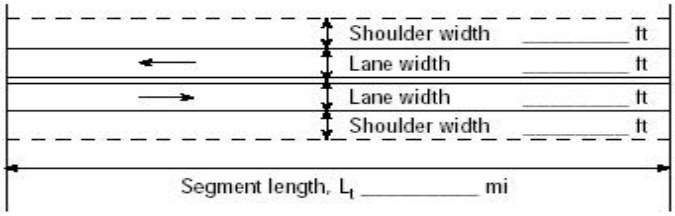
Future Roadway Segment Capacity Analysis Worksheets with Improvements

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Cahaba Heights to Green Valley*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*AM Peak*	Analysis Year	*Future 2027 w/imp*

Project Description: *Croisshaven APPLE*

Input Data



Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *0%*

Show North Arrow

Analysis direction vol., V_d *590*veh/h

Opposing direction vol., V_o *479*veh/h

% Trucks and Buses , P_T *5 %*

% Recreational vehicles, P_R *0%*

Access points *mi* *40*/mi

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.4*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.6*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.971*	*0.966*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.98*	*0.96*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*713*	*594*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*37*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.4 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*43.5 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*33.0 mi/h*
		Percent free flow speed, PFFS	*75.7 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.990*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.99*	*0.97*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*685*	*573*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*62.5*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.8*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*69.5*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*75.7*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*678.2*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.37*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	

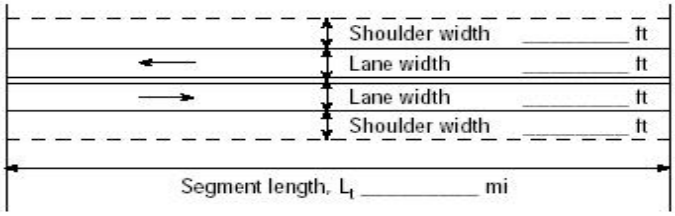
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Cahaba Heights to Green Valley*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*PM Peak*	Analysis Year	*Future 2027 w/imp*

Project Description: *Croisshaven APPLE*

Input Data



Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Show North Arrow

Analysis direction vol., V_d	*614*veh/h
Opposing direction vol., V_o	*523*veh/h
Shoulder width ft	*2.0*
Lane Width ft	*12.0*
Segment Length mi	*0.4*
Grade Length mi Up/down	
Peak-hour factor, PHF	*0.95*
No-passing zone	*0%*
% Trucks and Buses , P_T	*5 %*
% Recreational vehicles, P_R	*0%*
Access points *mi*	*40*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.966*	*0.966*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.97*	*0.96*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*690*	*594*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*37*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.4 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*43.6 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*33.2 mi/h*
		Percent free flow speed, PFFS	*76.2 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.990*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.98*	*0.97*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*660*	*573*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*61.3*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.1*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*68.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*76.2*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*646.3*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.35*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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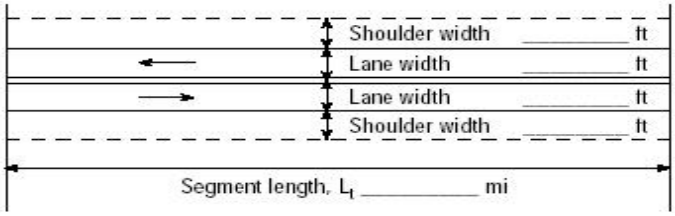
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Green Valley to Overton Rd*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*AM Peak*	Analysis Year	*Future 2027 w/imp*

Project Description: *Croisshaven APPLE*

Input Data



Show North Arrow

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.90*

No-passing zone *0%*

% Trucks and Buses , P_T *5 %*

% Recreational vehicles, P_R *0%*

Access points *mi* *25*/mi

Analysis direction vol., V_d *563*veh/h

Opposing direction vol., V_o *461*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.7*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.966*	*0.962*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.97*	*0.95*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*668*	*560*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*35*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.5 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*41.3 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*31.3 mi/h*
		Percent free flow speed, PFFS	*75.7 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.990*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*0.98*	*0.96*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*638*	*539*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*60.0*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*13.2*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*67.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*75.7*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*625.6*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.33*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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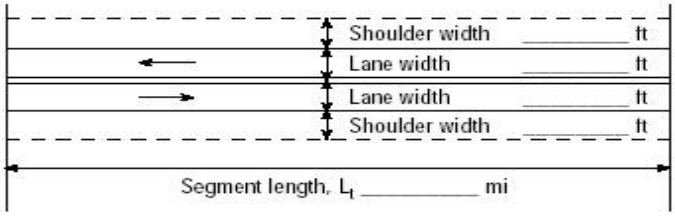
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*RLC*	Highway / Direction of Travel	*Crosshaven Drive*
Agency or Company	*Skipper Consulting*	From/To	*Green Valley to Overton Rd*
Date Performed	*5/22/2017*	Jurisdiction	*City of Vestavia Hills*
Analysis Time Period	*PM Peak*	Analysis Year	*Future 2027*

Project Description: *Croisshaven APPLE*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☐ Level ☑ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.91*

No-passing zone *0%*

Show North Arrow

% Trucks and Buses , P_T *5 %*

% Recreational vehicles, P_R *0%*

Access points *mi* *25*/mi

Analysis direction vol., V_d *741*veh/h

Opposing direction vol., V_o *647*veh/h

Shoulder width ft *2.0*

Lane Width ft *12.0*

Segment Length mi *0.5*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.4*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.1*	*1.1*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.980*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*0.99*	*0.98*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*839*	*747*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}	*35*	Base free-flow speed[4], BFFS	*mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.3 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*43.4 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*30.8 mi/h*
		Percent free flow speed, PFFS	*70.9 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*0.99*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*814*	*718*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*69.1*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*11.9*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*75.4*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.53*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1675*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*70.9*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*814.3*
Effective width, Wv (Eq. 15-29) ft	*14.00*
Effective speed factor, S_t (Eq. 15-30)	*2.61*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.47*
Bicycle level of service (Exhibit 15-4)	*D*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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APPENDIX B

Cost Estimates

UTILITY OWNER	CONCEPTUAL ESTIMATE	COMMENTS
AT&T	$48,000.00	ESTIMATE BASED ON $12,000 PER RELOCATED POLE. SOUTHERN COMPANY HAS STATED THAT THESE POLES ARE THEIRS AND NOT AT&T SO THIS SHOULD BE REDUCED GREATLY.
BIRMINGHAM WATER WORKS BOARD	$54,000.00	ESTIMATE BASED ON RELOCATING APPROXIMATELY 30 SERVICES AT $38,000 AND 4 FIRE HYDRANTS AT $16,000.
BRIGHT HOUSE	$20,407.21	
CHARTER	$24,170.21	LABOR COST $19,795.65 - MATERIALS $4,374.56
JEFFERSON COUNTY ENVIRONMENTAL SEREVICES	$155,155.00	COST BREAKDOWN IS IN FILE. ESTIMATE BASED ON WORST CASE SCENARIO FROM SITE VISIT.
SOUTHERN COMPANY	$0.00	ALABAMA POWER COMPANY WILL REQUIRE A 30 FT. RIGHT OF WAY (15 FT. ON EITHER SIDE) FOR THE RELOCATED POLES/LINES.
SPIRE ENERGY (ALAGASCO)	$77,354.64	
TOTAL	**$379,087.06**	

Table 1 – Estimated Utility Cost

SUMMARY OF ESTIMATED COST - NORTHERN PHASE

PROJECT NO.: CROSSHAVEN DRIVE
COUNTY: JEFFERSON
WORK DESCRIPTION: ROADWAY WIDENING, INTERSECTION IMPROVEMENTS & SIDEWALK

ITEM DESCRIPTION	Unit	Quantity	Unit Cost	Amount
ROADWAY:				
GRADE & DRAIN	SY	5,367	$48.08	$258,029
BORROW EXCAVATION	CY	2,000	$28.47	$56,932
STORM DRAINAGE				
NORTHERN PHASE	LF	2,300	$85.40	$196,417
BASE AND PAVEMENT				
NORTHERN PHASE	SY	3,833	$59.70	$228,843
PAVEMENT MILLING & ASPHALT OVERLAY	SY	5,367	$15.00	$80,500
SIDEWALK	SY	1,533	$48.00	$73,600
CURB & GUTTER	LF	4,600	$21.35	$98,210
ROADWAY SUBTOTAL				$992,532
CONTINGENCIES (15 PERCENT)			15%	$148,879.82
ROADWAY TOTAL				**$1,141,412**
PRELIMINARY ENGINEERING (15 %)				$171,212
ENGINEERING INSPECTION (15 %)				$171,212
RIGHT-OF-WAY COSTS (NORTHERN PHASE)	AC	0.73	$550,000	**$401,500**
UTILITY RELOCATION				**$650,000**
GRAND TOTAL :				**$2,535,336**

Table 2 – Cost Estimated for Northern Phase

SUMMARY OF ESTIMATED COST - SOUTHERN PHASE

PROJECT NO.: CROSSHAVEN DRIVE
COUNTY: JEFFERSON
WORK DESCRIPTION: ROADWAY WIDENING, INTERSECTION IMPROVEMENTS & SIDEWALK

ITEM DESCRIPTION	Unit	Quantity	Unit Cost	Amount
ROADWAY:				
GRADE & DRAIN	SY	4,878	$48.08	$234,524
BORROW EXCAVATION	CY	1,100	$28.50	$31,350
STORM DRAINAGE				
SOUTHERN PHASE	LF	1,750	$85.40	$149,448
BASE AND PAVEMENT				
SOUTHERN PHASE	SY	3,833	$59.70	$228,843
PAVEMENT MILLING & ASPHALT OVERLAY	SY	5,367	$15.00	$80,500
SIDEWALK	SY	1,167	$48.00	$56,000
CURB & GUTTER	LF	4,600	$21.35	$98,210
ROADWAY SUBTOTAL				$878,875
CONTINGENCIES (15 PERCENT)			15%	$131,831.19
ROADWAY TOTAL				**$1,010,706**
PRELIMINARY ENGINEERING (15 %)				$151,606
ENGINEERING INSPECTION (15 %)				$151,606
RIGHT-OF-WAY COSTS TOTAL	AC	0.75	$550,000	$412,500
UTILITY RELOCATION				**$350,000**
GRAND TOTAL :				**$2,076,418**

Table 3 – Cost Estimated for Southern Phase

APPENDIX C

Public Involvement

Crosshaven Drive Neighborhood Meeting

Held in the

New Merkle House

November 14, 2017

VESTAVIA HILLS

A LIFE ABOVE

AGENDA

- Introductions
- Project Overview
- Traffic Study
- Engineering Feasibility
- Questions and Answers

VESTAVIA HILLS

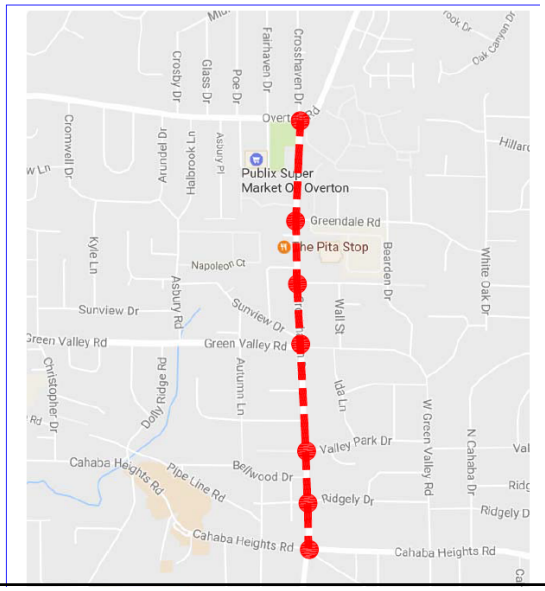
A LIFE ABOVE

TRAFFIC OPERATIONS STUDY

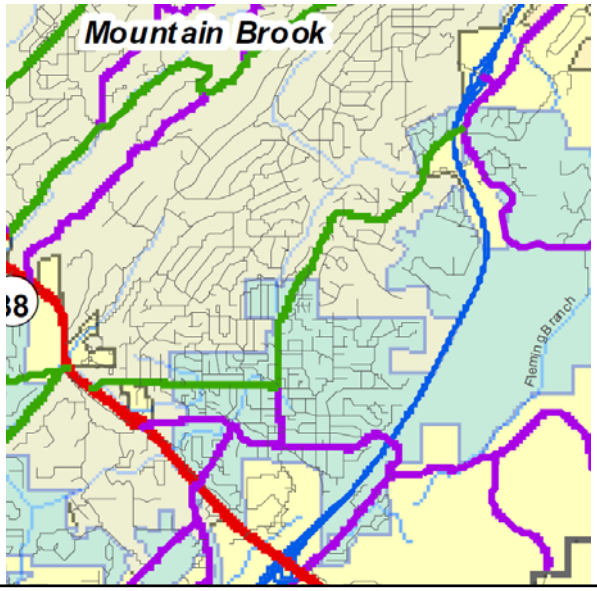
Crosshaven Drive
Vestavia Hills, Alabama

Advance Planning, Programming, and Logical Engineering (APPLE) Program

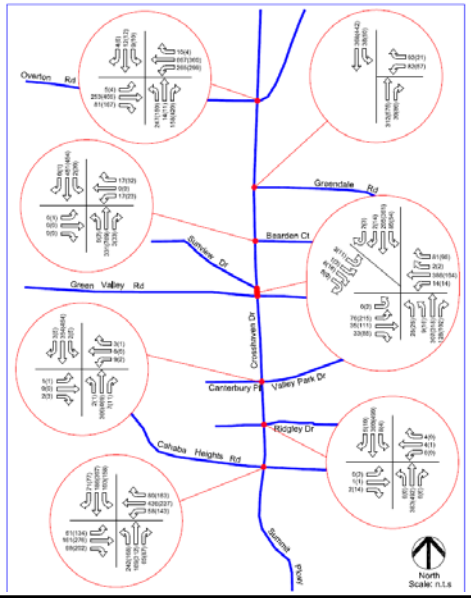
Study Area and Intersections



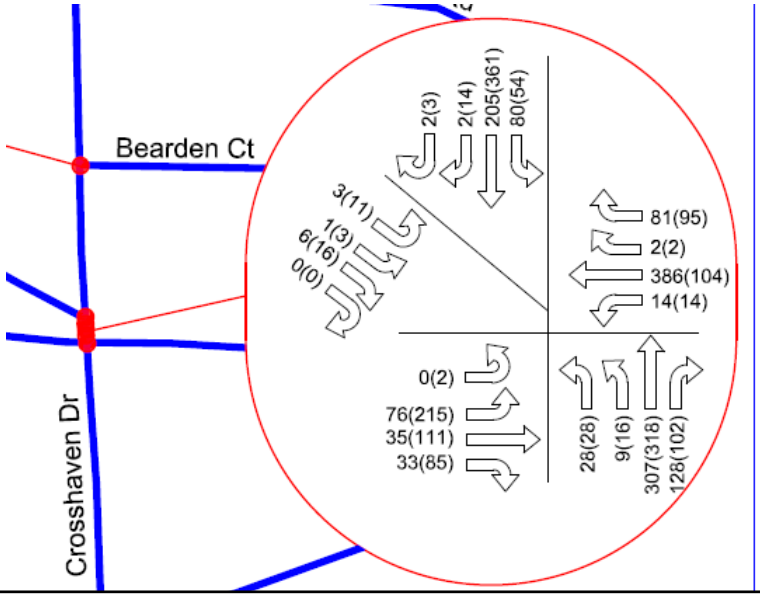
Functional Classification



Existing Traffic Counts



Existing Traffic Counts



Existing Traffic Counts

North of Crown Ridge Drive		
	Northbound	*Southbound*
Daily	5,902	5,344
AM Peak Hour	409	430
PM Peak Hour	566	506
North of Canterbury Place		
	Northbound	*Southbound*
Daily	5,087	5,413
AM Peak Hour	366	450
PM Peak Hour	440	469

Existing Speed Survey

North of Crown Ridge Drive					
Average – 31 mph					
85th Percentile – 35 mph					
0-25	26-30	31-35	36-40	41-45	46+
976	3,695	4,955	1,413	161	46
8.7%	32.8%	44.1%	12.6%	1.4%	0.4%
North of Canterbury Place					
Average – 33 mph					
85th Percentile – 37 mph					
0-25	26-30	31-35	36-40	41-45	46+
432	1,907	4,946	2,675	480	60
4.1%	18.1%	47.1%	25.5%	4.6%	0.6%

Existing Vehicle Classification

North of Crown Ridge Drive		
Motorcycle	43	0.4%
Passenger Vehicle	10,574	94.0%
Bus	157	1.4%
Light Truck	353	3.1%
Heavy Truck	119	1.1%
North of Canterbury Place		
Motorcycle	21	0.2%
Passenger Vehicle	9,965	94.9%
Bus	124	1.2%
Light Truck	327	3.1%
Heavy Truck	63	0.6%

Observations - AM

- Queues on Cahaba Heights Road westbound
- Queues on Overton Road westbound
- Queues on Crosshaven Drive southbound

Observations – Midday

- Stop-and-go traffic on Crosshaven Drive between Greendale Road and Green Valley Road
- Queue on Crosshaven Drive northbound and southbound at Green Valley Road
- Queue on Crosshaven Drive southbound at Cahaba Heights Road

Observations - Midday

Observations - Midday

Observations - Midday

Observations - PM

- Queue on Crosshaven Drive northbound and southbound at Green Valley Road
- Queue on Green Valley Road eastbound at Crosshaven Drive
- Queue on Green Valley Road southbound at Cahaba Heights Road
- Traffic exiting Sunview Drive causes signficant disruptions

Observations - PM

Observations - PM

Observations - PM

Observations - PM

Existing Intersection Capacity Analysis

Intersection	*Approach*	*Movement*	*Level of Service*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	B	C
		Through-Right	B	C
		Overall approach	*B*	*C*
	Cahaba Heights Road Westbound	Left	B	C
		Through-Right	D	C
		Overall approach	*D*	*C*
	Summit Parkway Northbound	Left	C	C
		Through-Right	C	C
		Overall approach	*C*	*C*
	Crosshaven Drive Southbound	Left	C	C
		Through-Right	D	C
		Overall approach	*C*	*C*
		Overall intersection	***C***	***C***

Existing Intersection Capacity Analysis

Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left-Through-Right	A	C
	Green Valley Road Westbound	Left-Through-Right	C	A
	Crosshaven Drive Northbound	Left-Through-Right	B	B
	Crosshaven Drive Southbound	Left-Through-Right	B	B
	Sunview Drive Southeastbound	Left-Through-Right	A	A
		Overall intersection	***B***	***B***

Existing Intersection Capacity Analysis

Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	B	B
		Through-Right	C	C
		Overall approach	*C*	*C*
	Overton Road Westbound	Left	B	B
		Through-Right	B	A
		Overall approach	*B*	*B*
	Crosshaven Drive Northbound	Left-Through	C	C
		Right	B	C
		Overall approach	*C*	*C*
	Crosshaven Drive Southbound	Left-Through-Right	B	C
		Overall intersection	***B***	***B***

Existing Queues

Intersection	*Approach*	*Movement*	*95th Percentile Queue*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	40′	77′
		Through-Right	147′	369′
	Cahaba Heights Road Westbound	Left	39′	82′
		Through-Right	465′	281′
	Summit Parkway Northbound	Left	178′	125′
		Through-Right	178′	355′
	Crosshaven Drive Southbound	Left	74′	137′
		Through-Right	220′	376′

Existing Queues

Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left-Through-Right	48′	238′
	Green Valley Road Westbound	Left-Through-Right	226′	54′
	Crosshaven Drive Northbound	Left-Through-Right	241′	241′
	Crosshaven Drive Southbound	Left-Through-Right	125′	213′
	Sunview Drive Southeastbound	Left-Through-Right	7′	14′

Existing Queues

Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	9′	6′
		Through-Right	232′	397′
	Overton Road Westbound	Left	119′	141′
		Through-Right	419′	103′
	Crosshaven Drive Northbound	Left-Through	235′	159′
		Right	40′	80′
	Crosshaven Drive Southbound	Left-Through-Right	19′	29′

Existing Roadway Segment Capacity Analysis

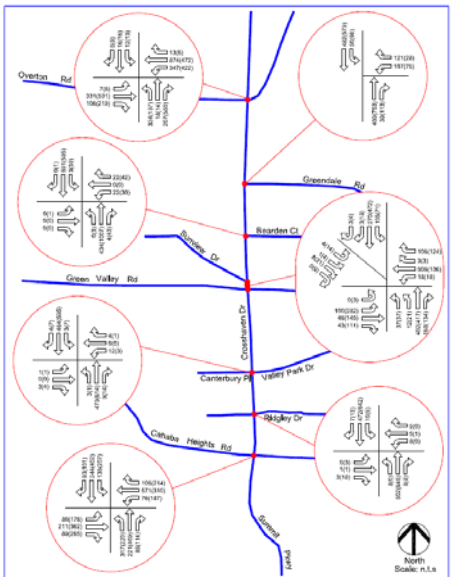
Segment	AM Peak				PM Peak			
	Traffic Volumes		Level of Service	v/c Ratio	Traffic Volumes		Level of Service	v/c Ratio
	Analysis Direction	Opposing Direction			Analysis Direction	Opposing Direction		
Cahaba Heights Rd to Green Valley Rd	450 vph	366 vph	C	0.53	469 vph	399 vph	C	0.53
Green Valley Rd to Overton Rd	430 vph	352 vph	C	0.53	566 vph	494 vph	D	0.53

Segment	Classification	Cross Section	Daily Volume	Capacity	v/c Ratio	Level of Service
Cahaba Heights Road to Green Valley Road	Collector	2 Lane Undivided	10,500 vpd	16,600 vpd	0.63	D
Green Valley Road to Overton Road	Minor Arterial	2 Lane Undivided	11,246 vpd	17,800 vpd	0.63	C

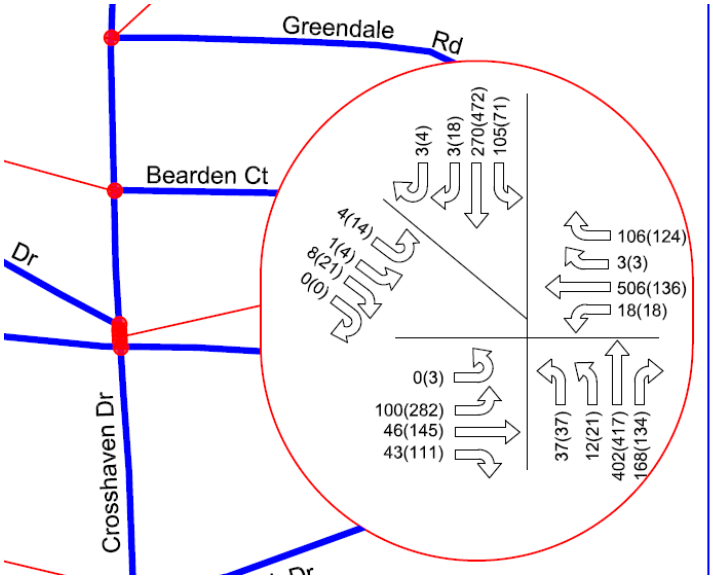
Traffic Growth

Year	Cahaba Heights Rd to Green Valley Rd		Green Valley Rd to Overton Rd	
	Count	Growth	Count	Growth
1988	5000		8300	
1989			7600	-8.4%
1990	5600	6.0%		
1993	7900	13.7%	8800	3.9%
1998	8310	1.0%	11330	5.8%
2000	10550	13.5%	13150	8.0%
2013	11580	0.8%	12500	-0.4%
2014	11670	0.8%	14650	17.2%
2015	10860	-6.9%	13650	-6.8%
Average		***4.3%***		***2.4%***

Future 2027 Traffic Volumes



Future 2027 Traffic Volumes



Future 2027 Intersection Capacity Analysis

Intersection	*Approach*	*Movement*	*Level of Service*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	C	F
		Through-Right	C	E
		Overall approach	*C*	*E*
	Cahaba Heights Road Westbound	Left	B	F
		Through-Right	F	D
		Overall approach	*F*	*E*
	Summit Parkway Northbound	Left	F	F
		Through-Right	C	F
		Overall approach	*F*	*F*
	Crosshaven Drive Southbound	Left	C	F
		Through-Right	E	F
		Overall approach	*D*	*F*
		Overall intersection	***F***	***F***

Future 2027 Intersection Capacity Analysis

Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left-Through-Right	C	F
	Green Valley Road Westbound	Left-Through-Right	F	A
	Crosshaven Drive Northbound	Left-Through-Right	E	F
	Crosshaven Drive Southbound	Left-Through-Right	E	D
	Sunview Drive Southeastbound	Left-Through-Right	A	A
		Overall intersection	***E***	***E***

Future 2027 Intersection Capacity Analysis

Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	B	B
		Through-Right	D	E
		Overall approach	*D*	*E*
	Overton Road Westbound	Left	E	F
		Through-Right	D	A
		Overall approach	*D*	*D*
	Crosshaven Drive Northbound	Left-Through	D	D
		Right	B	D
		Overall approach	*D*	*D*
	Crosshaven Drive Southbound	Left-Through-Right	B	C
		Overall intersection	***D***	***D***

Future 2027 Queue Analysis

Intersection	*Approach*	*Movement*	*95th Percentile Queue*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	50′	173′
		Through-Right	200′	604′
	Cahaba Heights Road Westbound	Left	48′	223′
		Through-Right	700′	463′
	Summit Parkway Northbound	Left	363′	245′
		Through-Right	243′	526′
	Crosshaven Drive Southbound	Left	94′	253′
		Through-Right	350′	550′

Future 2027 Queue Analysis

Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left-Through-Right	107′	353′
	Green Valley Road Westbound	Left-Through-Right	340′	77′
	Crosshaven Drive Northbound	Left-Through-Right	356′	360′
	Crosshaven Drive Southbound	Left-Through-Right	248′	327′
	Sunview Drive Southeastbound	Left-Through-Right	8′	18′

Future 2027 Queue Analysis

Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	12′	8′
		Through-Right	368′	652′
	Overton Road Westbound	Left	328′	374′
		Through-Right	754′	146′
	Crosshaven Drive Northbound	Left-Through	340′	217′
		Right	45′	320′
	Crosshaven Drive Southbound	Left-Through-Right	24′	35′

Future Roadway Segment Capacity Analysis

Segment	AM Peak				PM Peak			
	Traffic Volumes		Level of Service	v/c Ratio	Traffic Volumes		Level of Service	v/c Ratio
	Analysis Direction	Opposing Direction			Analysis Direction	Opposing Direction		
Cahaba Heights Rd to Green Valley Rd	590 vph	479 vph	D	0.53	614 vph	522 vph	D	0.53
Green Valley Rd to Overton Rd	563 vph	461 vph	D	0.53	741 vph	647 vph	D	0.53

Segment	Classification	Cross Section	Daily Volume	Capacity	v/c Ratio	Level of Service
Cahaba Heights Road to Green Valley Road	Collector	2 Lane Undivided	13,750 vpd	16,600 vpd	0.83	E
Green Valley Road to Overton Road	Minor Arterial	2 Lane Undivided	14,750 vpd	17,800 vpd	0.83	E

Recommended Improvements

Crosshaven Drive – entire roadway from Cahaba Heights Road to Overton Road

Widen to a continuous three lane cross section

Crosshaven Drive at Cahaba Heights Road

Construct a right turn lane on Cahaba Heights Road eastbound

Construct a right turn lane on Cahaba Heights Road westbound

Construct a right turn lane on Crosshaven Drive southbound

Recommended Improvements

Crosshaven Drive at Green Valley Road

Construct a left turn lane on Green Valley Road eastbound

Construct a right turn lane on Green Valley Road eastbound

Construct a right turn lane on Crosshaven Drive northbound

Construct a left turn lane on Crosshaven Drive southbound

Crosshaven Drive at Bearden Court

Construct a left turn lane on Crosshaven Drive southbound

Install a traffic signal when warranted

Recommended Improvements

Crosshaven Drive at Greendale Road

Construct a right turn lane on Crosshaven Drive northbound

Construct a left turn lane on Crosshaven Drive southbound

Crosshaven Drive at Overton Road

Construct a right turn lane on Overton Road eastbound

2027 Capacity Analysis with Recommended Improvements

Intersection	Approach	Movement	Level of Service	
			AM Peak	PM Peak
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	D	C
		Through	C	C
		Right	B	C
		Overall approach	*C*	*C*
	Cahaba Heights Road Westbound	Left	B	D
		Through	D	C
		Right	B	C
		Overall approach	*D*	*C*
	Summit Parkway Northbound	Left	D	C
		Through-Right	C	D
		Overall approach	*D*	*D*
	Crosshaven Drive Southbound	Left	C	D
		Through	D	C
		Right	C	B
		Overall approach	*D*	*C*
		Overall intersection	***D***	***C***

2027 Capacity Analysis with Recommended Improvements

Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left	B	B
		Through	A	A
		Right	A	A
		Overall approach	*B*	*B*
	Green Valley Road Westbound	Left-Through-Right	D	A
	Crosshaven Drive Northbound	Left	A	A
		Through	B	B
		Right	A	A
		Overall approach	*B*	*B*
	Crosshaven Drive Southbound	Left	B	A
		Through-Right	B	B
		Overall approach	*B*	*B*
	Sunview Drive Southeastbound	Left-Through-Right	A	A
		Overall intersection	***C***	***B***

2027 Capacity Analysis with Recommended Improvements

Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	B	B
		Through	C	C
		Right	B	B
		Overall approach	*C*	*C*
	Overton Road Westbound	Left	C	D
		Through-Right	D	A
		Overall approach	*D*	*B*
	Crosshaven Drive Northbound	Left-Through	D	D
		Right	B	C
		Overall approach	*D*	*C*
	Crosshaven Drive Southbound	Left-Through-Right	B	C
		Overall intersection	***C***	***C***

2027 Queue Analysis with Recommended Improvements

Intersection	*Approach*	*Movement*	*95th Percentile Queue*	
			AM Peak	*PM Peak*
Crosshaven Drive at Cahaba Heights Road	Cahaba Heights Road Eastbound	Left	62′	101′
		Through	155′	268′
		Right	27′	49
	Cahaba Heights Road Westbound	Left	52′	109′
		Through	566′	224′
		Right	31′	36′
	Summit Parkway Northbound	Left	267′	213′
		Through-Right	243′	538′
	Crosshaven Drive Southbound	Left	88′	230′
		Through	260′	402′
		Right	35′	37′

2027 Queue Analysis with Recommended Improvements

Crosshaven Drive at Green Valley Road/Sunview Drive	Green Valley Road Eastbound	Left	71′	178′
		Through	19′	53′
		Right	9′	21′
	Green Valley Road Westbound	Left-Through-Right	328′	76′
	Crosshaven Drive Northbound	Left	26′	35′
		Through	176′	169′
		Right	26′	22′
	Crosshaven Drive Southbound	Left	76′	38′
		Through-Right	106	240′
	Sunview Drive Southeastbound	Left-Through-Right	9′	18′

2027 Queue Analysis with Recommended Improvements

Crosshaven Drive at Overton Road	Overton Road Eastbound	Left	12′	8′
		Through	237′	344′
		Right	27′	36′
	Overton Road Westbound	Left	227′	247′
		Through-Right	754′	146′
	Crosshaven Drive Northbound	Left-Through	340′	217′
		Right	45′	229′
	Crosshaven Drive Southbound	Left-Through-Right	24′	35′

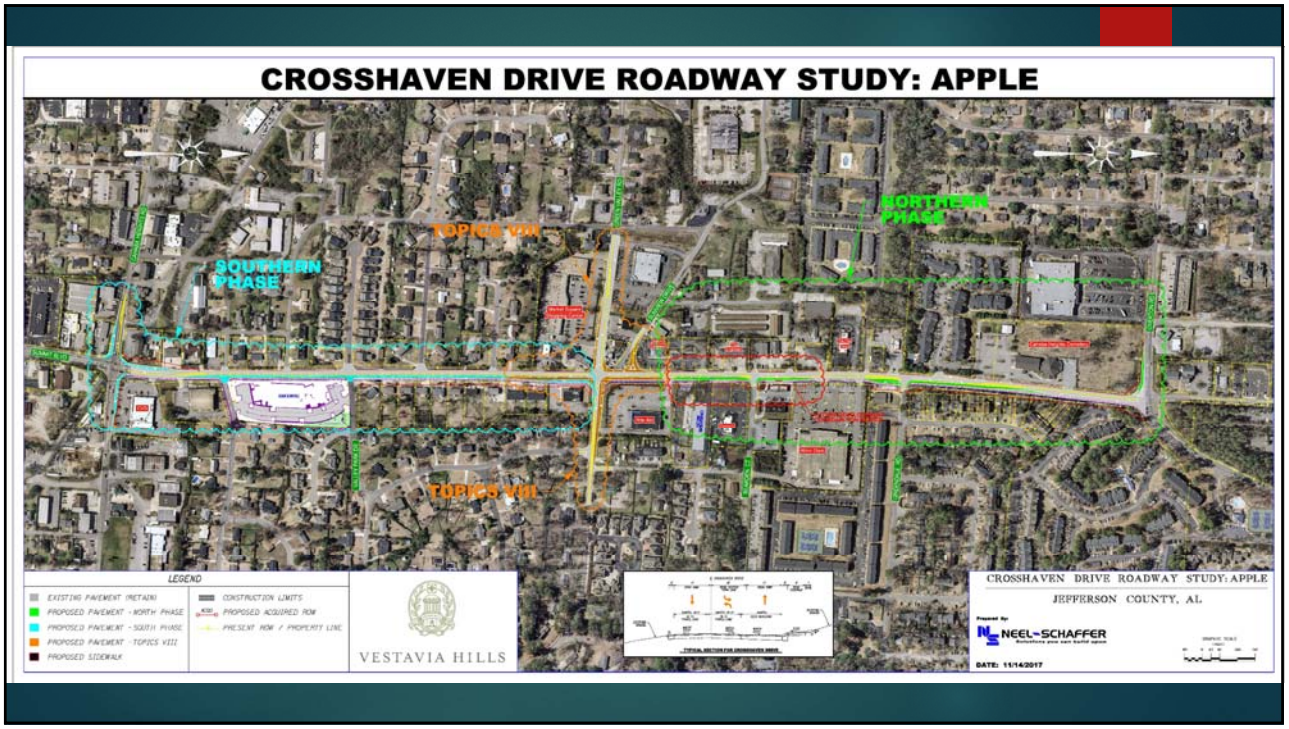
2027 Roadway Segment Capacity Analysis with Recommended Improvements

Segment	AM Peak				PM Peak			
	Traffic Volumes		Level of Service	v/c Ratio	Traffic Volumes		Level of Service	v/c Ratio
	Analysis Direction	Opposing Direction			Analysis Direction	Opposing Direction		
Cahaba Heights Rd to Green Valley Rd	590 vph	479 vph	C	0.53	614 vph	522 vph	C	0.53
Green Valley Rd to Overton Rd	563 vph	461 vph	C	0.53	741 vph	647 vph	D	0.53

Segment	Classification	Cross Section	Daily Volume	Capacity	v/c Ratio	Level of Service
Cahaba Heights Road to Green Valley Road	Collector	3 Lane	13,750 vpd	20,800 vpd	0.66	D
Green Valley Road to Overton Road	Minor Arterial	3 Lane	14,750 vpd	22,000 vpd	0.67	D

Engineering Feasibility

PHASING PLAN



TOPICS VIII

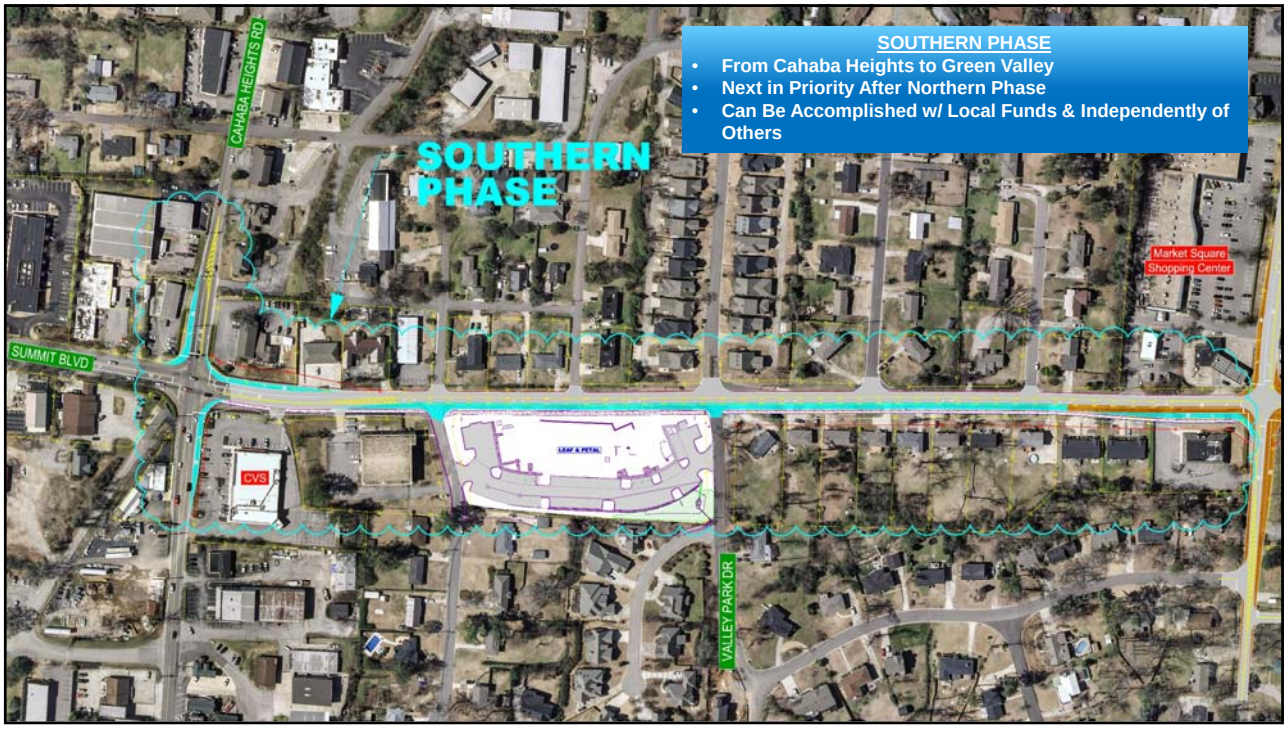
- Ongoing Jefferson Co. Project
- Federally Funded with 80/20 Split
- ROW Acquisition currently underway
- Project has a letting date of **January 2020**

According to Skipper's Traffic Study, this project addresses largest traffic congestion need, so is the highest priority among the 3 different Phases.

SUMMARY OF ESTIMATED COST - NORTHERN PHASE

PROJECT NO.: CROSSHAVEN DRIVE
COUNTY: JEFFERSON
WORK DESCRIPTION: ROADWAY WIDENING, INTERSECTION IMPROVEMENTS & SIDEWALK

ITEM DESCRIPTION	Unit	Quantity	Unit Cost	Amount
ROADWAY:				
GRADE & DRAIN	SY	5,367	$48.08	$258,029
BORROW EXCAVATION	CY	2,000	$28.47	$56,932
STORM DRAINAGE				
NORTHERN PHASE	LF	2,300	$85.40	$196,417
BASE AND PAVEMENT				
NORTHERN PHASE	SY	3,833	$59.70	$228,843
PAVEMENT MILLING & ASPHALT OVERLAY	SY	5,367	$15.00	$80,500
SIDEWALK	SY	1,533	$48.00	$73,600
CURB & GUTTER	LF	4,600	$21.35	$98,210
ROADWAY SUBTOTAL				$992,532
CONTINGENCIES (15 PERCENT)			15%	$148,879.82
ROADWAY TOTAL				**$1,141,412**
PRELIMINARY ENGINEERING (15 %)				$171,212
ENGINEERING INSPECTION (15 %)				$171,212
RIGHT-OF-WAY COSTS (NORTHERN PHASE)	AC	0.73	$550,000	**$401,500**
UTILITY RELOCATION				**$650,000**
GRAND TOTAL :				**$2,535,336**



SOUTHERN PHASE

- From Cahaba Heights to Green Valley
- Next in Priority After Northern Phase
- Can Be Accomplished w/ Local Funds & Independently of Others

SUMMARY OF ESTIMATED COST - SOUTHERN PHASE

PROJECT NO.: CROSSHAVEN DRIVE
COUNTY: JEFFERSON
WORK DESCRIPTION: ROADWAY WIDENING, INTERSECTION IMPROVEMENTS & SIDEWALK

ITEM DESCRIPTION	Unit	Quantity	Unit Cost	Amount
ROADWAY:				
GRADE & DRAIN	SY	4,878	$48.08	$234,524
BORROW EXCAVATION	CY	1,100	$28.50	$31,350
STORM DRAINAGE				
SOUTHERN PHASE	LF	1,750	$85.40	$149,448
BASE AND PAVEMENT				
SOUTHERN PHASE	SY	3,833	$59.70	$228,843
PAVEMENT MILLING & ASPHALT OVERLAY	SY	5,367	$15.00	$80,500
SIDEWALK	SY	1,167	$48.00	$56,000
CURB & GUTTER	LF	4,600	$21.35	$98,210
ROADWAY SUBTOTAL				$878,875
CONTINGENCIES (15 PERCENT)			15%	$131,831.19
ROADWAY TOTAL				**$1,010,706**
PRELIMINARY ENGINEERING (15 %)				$151,606
ENGINEERING INSPECTION (15 %)				$151,606
RIGHT-OF-WAY COSTS TOTAL	AC	0.75	$550,000	$412,500
UTILITY RELOCATION				$350,000
GRAND TOTAL :				**$2,076,418**