3-I-25-DP
TIS Version 3
4/28/2025

ASHEVILLE HIGHWAY PROPERTY

Transportation Impact Analysis

Asheville Highway

Knoxville, TN

A Transportation Impact Analysis for the Asheville Highway Property Mixed-Use Development

Submitted to

Knoxville-Knox County Planning

Updated April 28, 2025
January 27, 2025
Ardurra Project No. 377.030

ADDIE LOUISE KIRKHAM
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 114265
STATE OF TENNESSEE
4-28-25

Submitted By:

ARDURRA

2160 LAKESIDE CENTRE WAY, SUITE 201 KNOXVILLE, TN 37922 T 865.690.6419 F 865.690.6448 www.ardurra.com

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

Executive Summary

Clarion REI, LLC is proposing the Asheville Highway Property Mixed-Use Development in Knoxville, TN. The project is located at the existing intersections of Asheville Highway at E Governor John Sevier Highway and Asheville Highway at Holston Ferry Road. The full buildout of the development will consist of a public park including four baseball practice fields, six soccer practice fields, storage facilities and a shared parking lot, approximately 20,000 SF for an indoor athletic training facility, an RV Park with an estimated 200 RV Pads and campsites, approximately 4,000 SF Fast Food Restaurant and approximately 90,000 SF of highway commercial split between nine outparcels.

The Asheville Highway Property Mixed-Use Development is proposing one new full access driveway connection to Asheville Highway located approximately 1,380 feet east of Holston Ferry Road at an existing highway median.

This report provides a summary of a transportation impact analysis that was performed for the Asheville Highway Property Mixed-Use Development.

Based on the results of the traffic analysis conducted to determine the impacts caused by the Asheville Highway Property on the studied intersections, the following observations have been made:

Asheville Highway at I-40 Eastbound Ramp
After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the traffic conditions for the intersection of Asheville Highway at I-40 Eastbound Ramp operate at an overall LOS C during both the AM and PM peak hours.

Asheville Highway at I-40 Westbound Ramp
After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the traffic conditions for the intersection of Asheville Highway at I-40 Westbound Ramp operate at an overall LOS B during both the AM and PM peak hours.

Asheville Highway at E Governor John Sevier Highway / River Turn Road
After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the traffic conditions for the intersection of Asheville Highway at E Governor John Sevier Highway / River Turn Road operate at an overall LOS D during both the AM and PM peak hours.

Asheville Highway at Holston Ferry Road
After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the traffic conditions for the two-way stop-controlled intersection of Asheville Highway at Holston Ferry Road operates at an acceptable LOS C or better for each approach during both the AM and PM peak hours.

Asheville Highway at Driveway Connection
After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the intersection of Asheville Highway at the proposed Driveway Connection will operate as follows. The eastbound left turn lane (Asheville Highway) will operate at a LOS A during both the AM and PM peak hours and the southbound approach (Driveway) will operate at a LOS F during both the AM and PM peak hours.

A westbound right turn lane and an eastbound left turn lane are warranted at the intersection of Asheville Highway at the Driveway Connection per the TDOT Highway System Access Manual (HSAM).

A traffic signal is not warranted at the intersection of Asheville Highway at the Driveway Connection per the "Manual of Uniform Traffic Control Devices, 11th Edition" (MUTCD) published by the Federal Highway Administration in 2023.

Recommendations
In order to maintain or provide an acceptable level-of-service for each of the intersections studied, some recommendations are presented.

- Asheville Highway at E Governor John Sevier Highway / River Turn Road
  - Extend the storage length of the existing eastbound left turn lane from 80 feet to 150 feet.
  - Recommended taper length of 50 – 100 feet (to be coordinated with COK Engineering). Turn lane length is limited by existing geometry.
  - Ardurra recommends that the pavement markings on River Turn Road at the signalized intersection be striped to indicate a separate left/thru lane and right turn lane between Asheville Highway and Riverview Crossing Drive.
  - Ardurra recommends that the signal timing be updated after the buildout of the Asheville Highway Property Mixed-Use Development and that consideration be made to adding a protected westbound left turn phase.
  - Ardurra recommends re-evaluating the need for a short southbound right turn lane on River Turn Road once the Commercial Land Uses along Asheville Highway are known.
- Asheville Highway at Driveway Connection

  - Install a westbound right turn lane with a minimum total length of 275 feet per the TDOT Highway System Access Manual.
  - Install an eastbound left turn lane with a minimum total length of 275 feet per the TDOT Highway System Access Manual.
  - Recommended taper length of 50 – 100 feet (to be coordinated with COK Engineering).
  - Ardurra recommends consideration of separate southbound right and left turn lanes at the driveway connection.
  - A traffic signal is not warranted during this phase of development.
- Ardurra recommends that the intersection sight distance be certified by a land surveyor prior to construction to verify that Asheville Highway at Driveway Connection has adequate intersection sight distance to comply with City of Knoxville and AASHTO requirements.
- Ardurra recommends that the signs and pavement markings be installed in accordance with the standards provided in the *Manual on Uniform Traffic Control Devices* (MUTCD).

1 Introduction

1.1 Project Description

This report provides a summary of a transportation impact analysis that was performed for the Asheville Highway Property Mixed-Use Development. The full buildout of the development will consist of a public park including four baseball practice fields, six soccer practice fields, storage facilities and a shared parking lot, approximately 20,000 SF for an indoor athletic training facility, an RV Park with an estimated 200 RV Pads and campsites, approximately 4,000 SF Fast Food Restaurant and approximately 90,000 SF of highway commercial split between nine outparcels.

The project is located at the existing intersections of Asheville Highway at E Governor John Sevier Highway and Asheville Highway at Holston Ferry Road in Knoxville, TN. The location of the site is shown in Figure 1.

Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2029.

The Asheville Highway Property Mixed-Use Development is proposing one new full access driveway connection to Asheville Highway located approximately 1,380 feet east of Holston Ferry Road at an existing highway median. The proposed site layout is shown in Figure 2.

River Breeze Event Center is located across the street from the proposed Asheville Highway Property Mixed-Use Development and will share parking with the proposed public park with pedestrian access under the Asheville Highway Holston River Bridge. The River Breeze Event Center is currently being renovated to better accommodate concert and entertainment events. The existing parking is currently limited, and the event offers a free shuttle to locations in Downtown Knoxville.

At this time any special events that will be scheduled are planned to occur on the weekends and will not interfere with weekday peak hour traffic. Examples of weekend special events will include private parties, live performances etc.

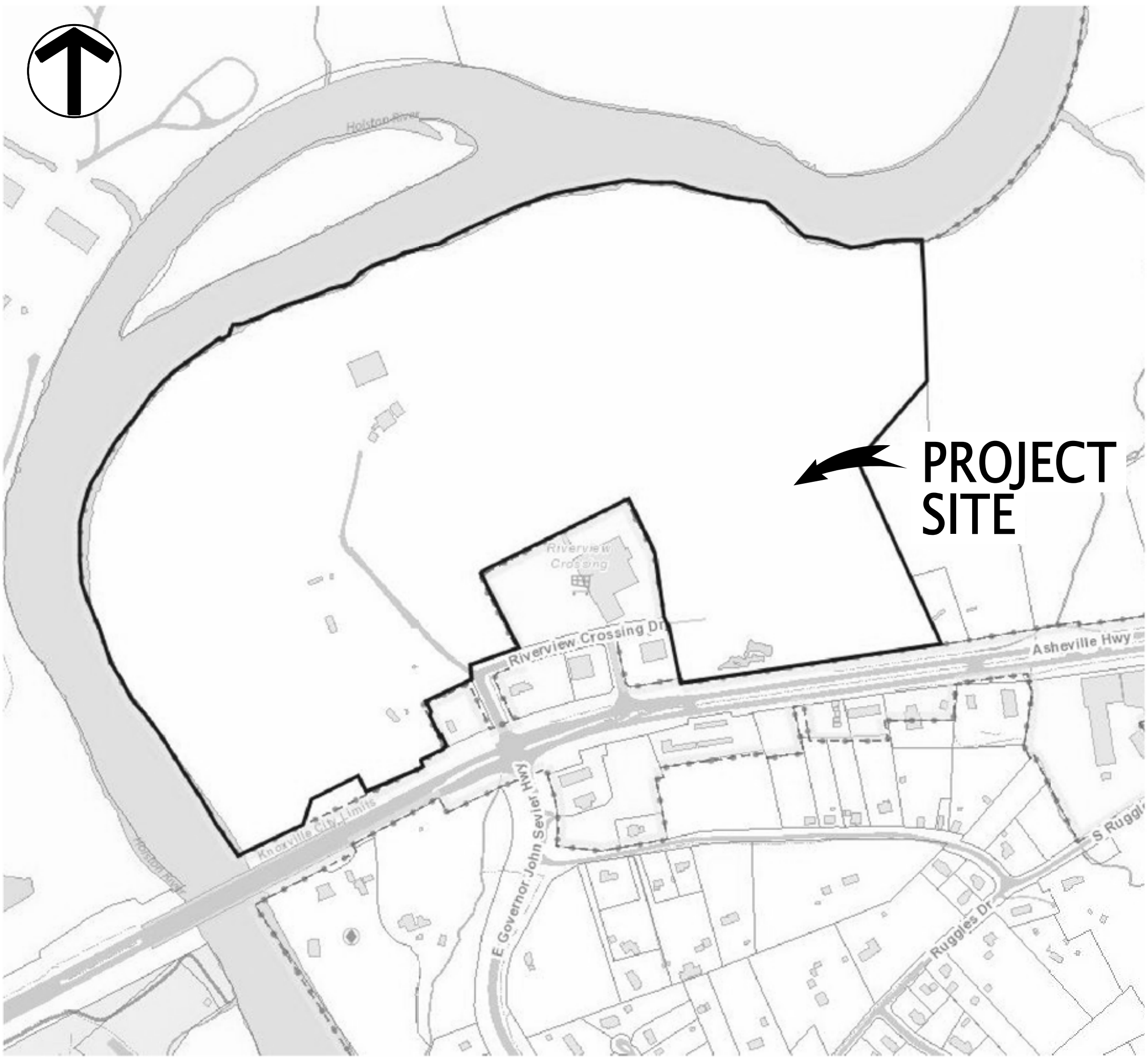


Figure 1: Location Map

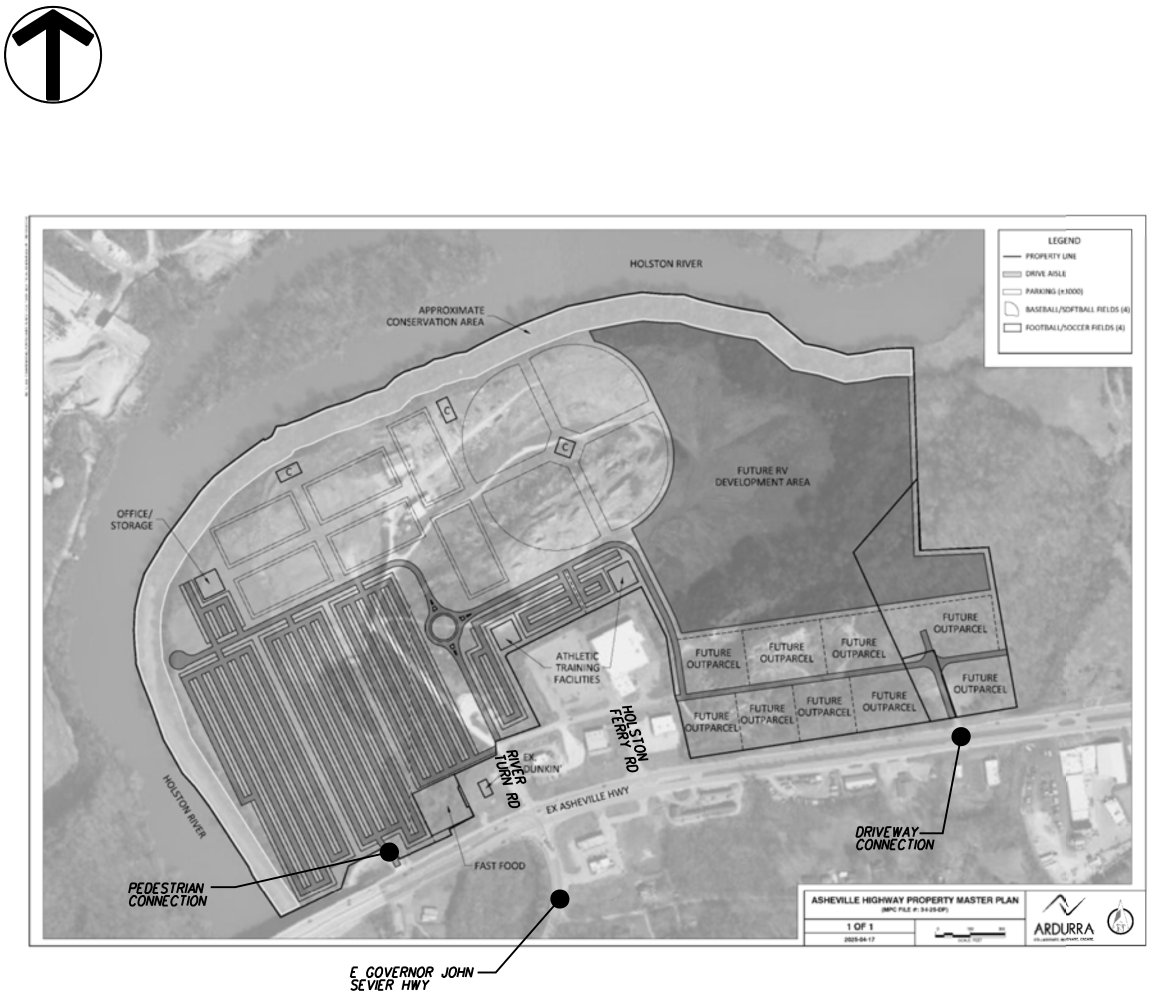


Figure 2: Site Plan

1.2 Study Area

The purpose of this study is to evaluate the impacts to the traffic conditions caused by the proposed development. I-40 Eastbound Ramp, I-40 Westbound Ramp, River Turn Road, Holston Ferry Road and E Governor John Sevier Highway are north-south oriented roadways and Asheville Highway is an east-west oriented roadway. The existing intersections and existing traffic control are summarized in Table 1.2-1 Study Area.

Table 1.2-1
Asheville Highway Property
Study Area

Intersection	**Existing Traffic Control**
Asheville Highway at I-40 EB Ramp	Signalized
Asheville Highway at I-40 WB Ramp	Signalized
Asheville Highway at E Governor John Sevier Highway	Signalized
Asheville Highway at Holston Ferry Road	RCUT

1.3 Existing Site Conditions

Roadway geometry and posted speed limits were obtained by field observations. Functional classifications for the roadways were obtained from "2018 Major Road Plan" adopted by Knoxville-Knox County Planning. This information is summarized in Table 1.3-1 Existing Site Conditions.

The speed limit on a roadway with no posted limit is 25 mph per City of Knoxville ordinance.

Table 1.3-1
Asheville Highway Property
Existing Site Conditions

Roadway	Speed Limit	Lanes	Road Width	Major Road Plan
Interstate 40	65 mph	6	~150 feet	Interstate
Asheville Highway	45 mph	4	~102 feet	Principal Arterial

E Governor John Sevier Highway	45 mph	3	~ 40 feet	Minor Arterial
River Turn Road	Not Posted	2	~ 34 feet	Not Classified (Local Street)
Riverview Crossing Drive	Not Posted	2	~ 26 feet	Not Classified (Local Street)
Holston Ferry Road	Not Posted	2	~ 28 feet	Not Classified (Local Street)

Asheville Highway or US 11E / US 25W / US 70 and SR 9 is four-lane divided highway with a grass median between the eastbound and westbound approaches.

At the existing signalized intersection of Asheville Highway at I-40 Eastbound Ramp the ramp is three lanes at the intersection. The southbound approach (I-40 EB Ramp) is a left turn lane, a thru/left lane both with an approximate storage length of 800 feet and a flared right turn lane with an approximate storage length of 400 feet. The westbound approach (Asheville Highway) has a separate left turn lane with a storage length of 75 feet. The existing total storage length for the I-40 Eastbound Ramp is approximately 2,075 feet including the exit only lane on Interstate 40.

At the existing signalized intersection of Asheville Highway at I-40 Westbound Ramp the ramp is a single lane at the intersection. The northbound approach (I-40 WB Ramp) is a thru/left lane and a flared right turn lane. The eastbound approach (Asheville Highway) has a separate left turn lane with a storage length of 55 feet. The existing total storage length for the I-40 Westbound Ramp is approximately 620 feet.

At the existing signalized intersection of Asheville Highway at River Turn Road / E Governor John Sevier Highway the eastbound approach (Asheville Highway) has a left turn lane with an approximate storage length of 80 feet and a right turn lane with an approximate storage length of 200 feet and the westbound approach (Asheville Highway) has a left turn lane with an approximate storage length of 190 feet and a right turn lane with an approximate storage length of 120 feet.

At the existing stop-controlled intersection of Asheville Highway at Holston Ferry Road / Gas Station Driveway the eastbound approach (Asheville Highway) has a left turn lane with an approximate storage length of 150 feet and the westbound approach (Asheville Highway) has a left turn lane with an approximate storage length of 175 feet and a right turn lane with an approximate storage length of 120 feet. The curbed median allows for eastbound and westbound left turns and U-turns but does not allow thru traffic to cross Asheville Highway between Holston Ferry Road and the access driveway.

Aerial photos of the existing intersections are included in Attachment 1.

1.4 Transit Network

The Knoxville Area Transit (KAT) operates in the vicinity of the proposed development.

Route 34 (Burlington Shopper) stops include Austin East High, Kirkwood St Superstop WB, Walmart and Knoxville Station Bay H. The nearest KAT stops to the development along Route 34 are located at the intersection of Asheville Highway at N and S Chilhowee Drive approximately 1.5 miles from the development with an approximate 35-minute walk. This route provides headways of approximately 30 minutes.

A copy of the KAT Bus map for Route 34 (Burlington Shopper) is included in Attachment 3.

1.5 Pedestrian/Bicycle Network

There is an existing sidewalk on the south side of Asheville Highway west of the Interstate Ramp.

The Chillowee Greenway is located around the Holston Chillowee Ballfields south of Asheville Highway and west of the Holston River.

2 Existing Traffic Volumes

Ardurra conducted a peak hour turning movement count at the signalized intersection of Asheville Highway at Intersection 40 Eastbound Ramp on Tuesday November 19, 2024. The AM peak hour occurred between 7:15 a.m. and 8:15 a.m. with an AM PHF of 0.88. The PM peak hour occurred between 4:30 p.m. and 5:30 p.m. with a PM PHF of 0.97.

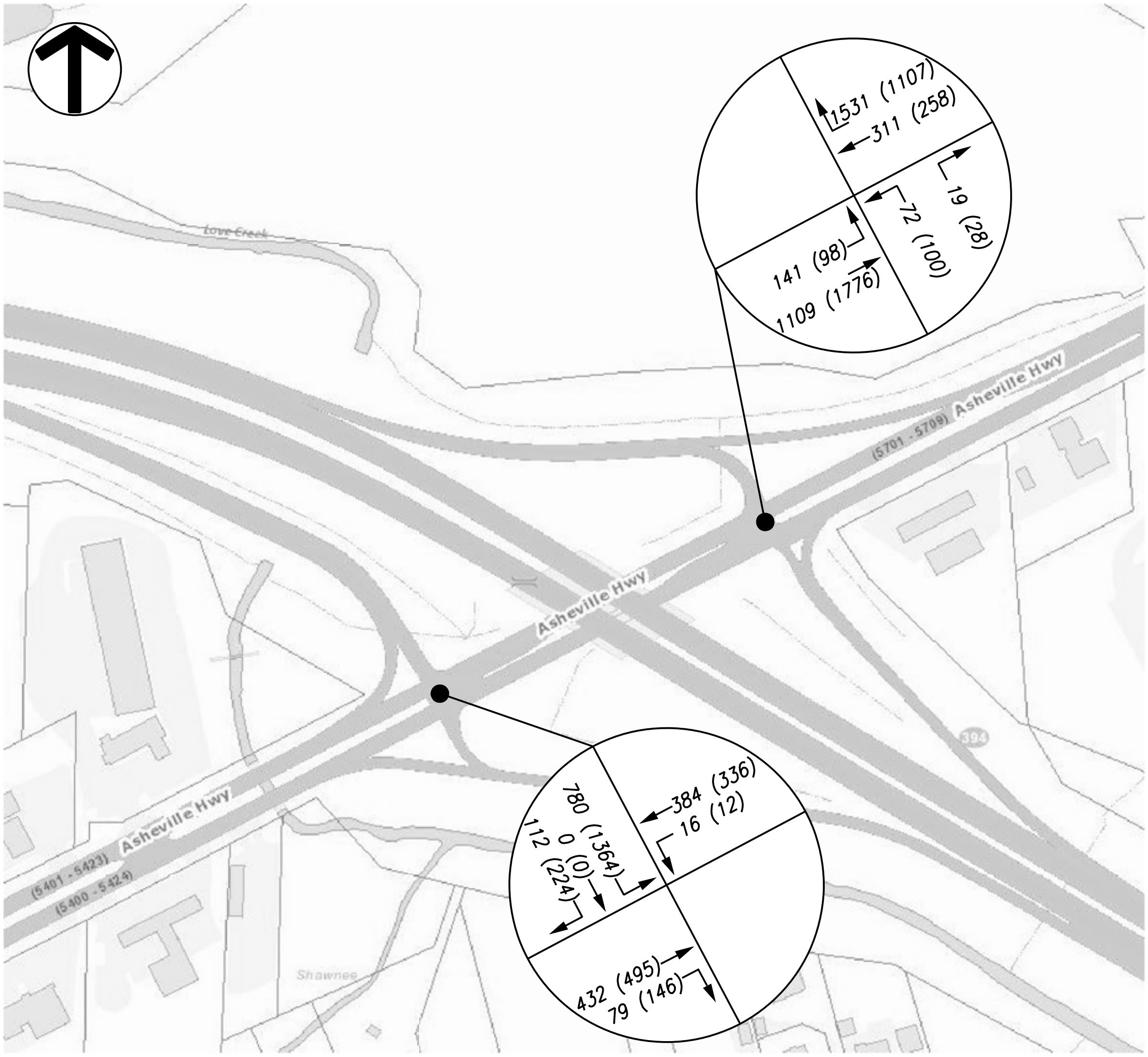
Ardurra conducted a peak hour turning movement count at the signalized intersection of Asheville Highway at Intersection 40 Westbound Ramp on Tuesday November 19, 2024. The AM peak hour occurred between 7:00 a.m. and 8:00 a.m. with an AM PHF of 0.94. The PM peak hour occurred between 4:30 p.m. and 5:30 p.m. with a PM PHF of 0.99.

Ardurra conducted a peak hour turning movement count at the signalized intersection of Asheville Highway at River Turn Road / E Governor John Sevier Highway on Tuesday December 4, 2024 and Wednesday December 5, 2024. The AM peak hour occurred between 7:15 a.m. and 8:15 a.m. with an AM PHF of 0.93. The PM peak hour occurred between 4:30 p.m. and 5:30 p.m. with a PM PHF of 0.99.

Ardurra conducted a peak hour turning movement count at the signalized intersection of Asheville Highway at Holston Ferry Road on Wednesday December 4, 2024. The AM peak hour occurred between 7:00 a.m. and 8:00 a.m. with an AM PHF of 0.92. The PM peak hour occurred between 5:00 p.m. and 6:00 p.m. with a PM PHF of 0.94.

The existing heavy vehicle volumes on Asheville Highway and the Interstate ramps are approximately 5% during both the AM and PM peak hour and the existing heavy vehicle volumes on E Governor John Sevier Highway are approximately 10% during the AM peak hour and approximately 5% during the PM peak hour.

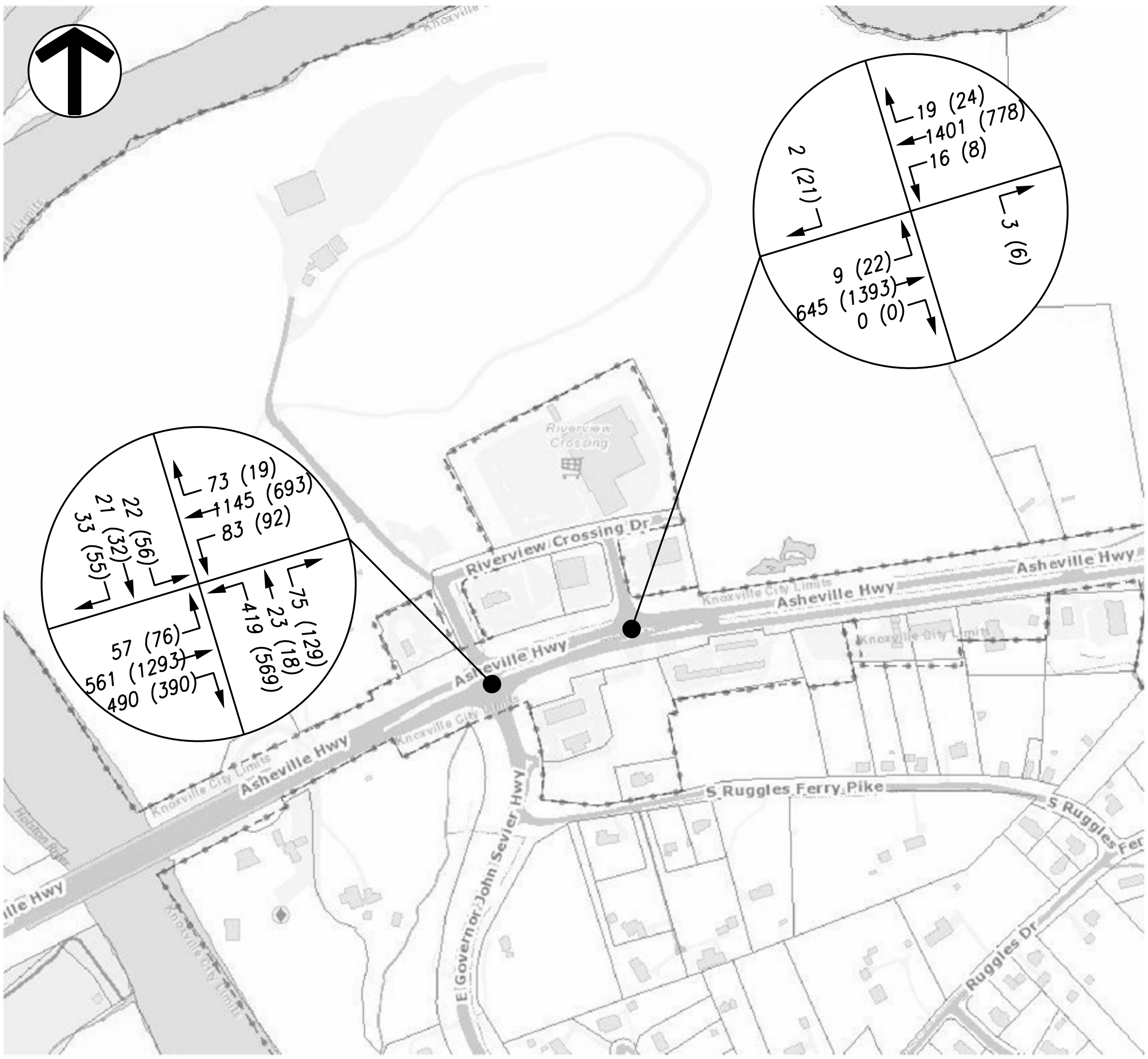
The existing volumes including the AM and PM peak hour traffic volumes at the count locations are shown in Figure 3 and Figure 4, and the count data collected is included in Attachment 2.



LEGEND:

← 5 (16) *TURNING MOVEMENT VOLUME AM (PM)*

Figure 3: 2024 Existing Peak Hour Traffic - I-40 Ramps



LEGEND:

5 (16) TURNING MOVEMENT VOLUME AM (PM)

Figure 4: 2024 Existing Peak Hour Traffic - Asheville Hwy

3 Background Growth

The Tennessee Department of Transportation (TDOT) maintains count stations in the vicinity of the proposed development.

TDOT count station Location ID: 47000385 is located on Asheville Highway east of the signalized intersection of Asheville Highway at E Governor John Sevier Highway and hear the Holston River. The annual growth rate for this station over the last twenty years is approximately 0.90%. The 2022 ADT was 40,265 vehicles per day.

For the purpose of this study, an annual growth rate of 1.0% was assumed for traffic at the studied intersections until full occupancy is reached in 2029. Attachment 4 shows the trend line growth charts for the TDOT count station.

Figure 5 and Figure 6 demonstrates the projected background peak hour volumes at the studied intersections after applying the background growth rate to the existing conditions.

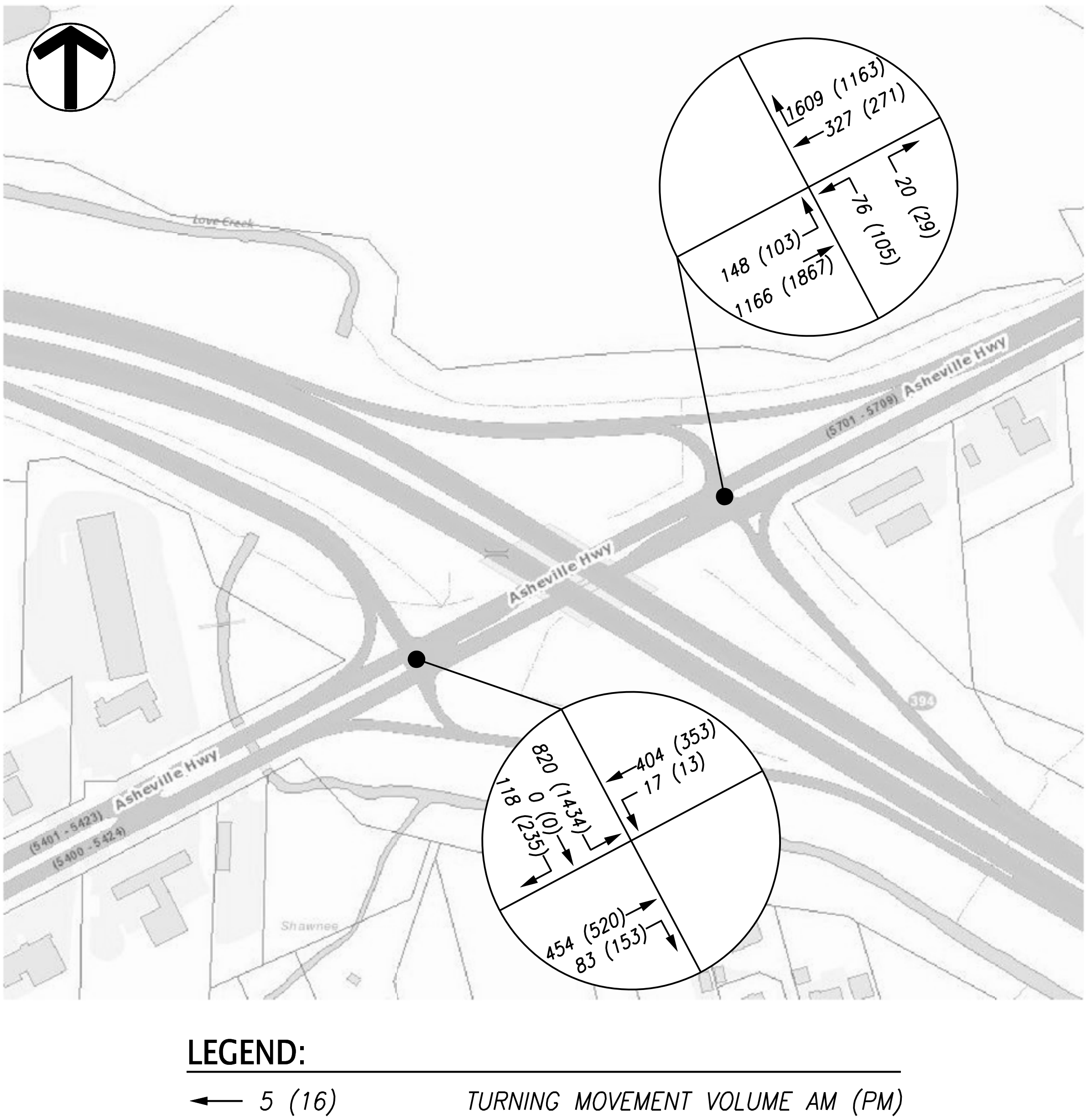


Figure 5: 2029 Background Peak Hour Traffic - I-40 Ramps

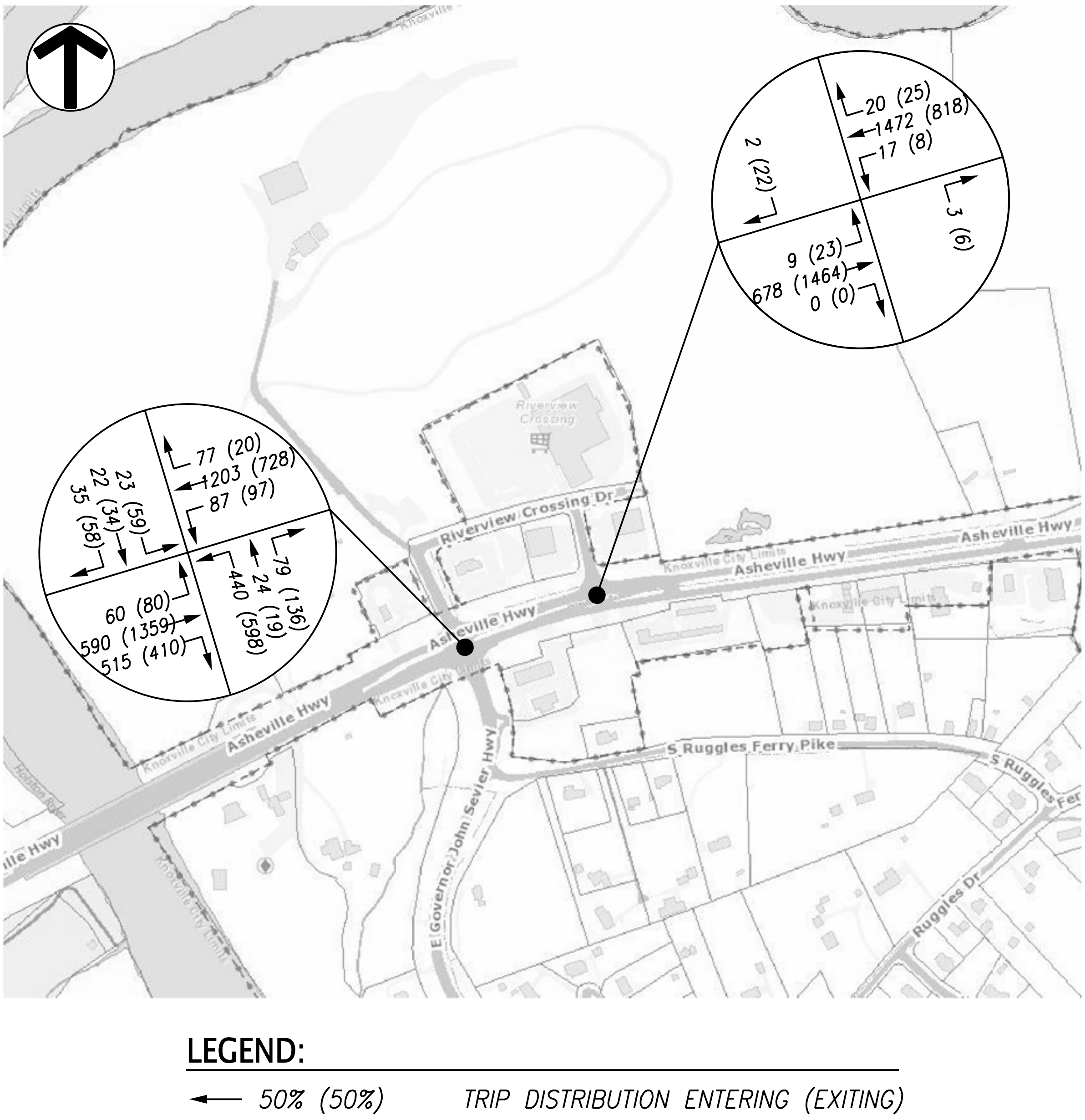


Figure 6: 2029 Background Peak Hour Traffic - Asheville Hwy

4 Trip Generation and Trip Distribution

The Asheville Highway Property Mixed-Use Development proposes a public park including four baseball practice fields, six soccer practice fields, storage facilities and a shared parking lot, approximately 20,000 SF for an indoor athletic training facility, an RV Park with an estimated 200 RV Pads and campsites, approximately 4,000 SF Fast Food Restaurant and approximately 90,000 SF of highway commercial split between nine outparcels.

Soccer Complex or Land Use 488 was used to calculate the site trips for the practice fields and shared parking lot, Health/Fitness Club or Land Use 492 was used to calculate the site trips for the athletic training facility buildings, Fast Food Restaurant with Drive-Through Window or Land Use 934 was used to calculate the site trips for the fast food restaurant and Shopping Plaza (40-150K) – No Supermarket or Land Use 821 was used to calculate the site trips for the highway commercial outparcels. RV Park or Land Use 416 was used to calculate the RV pads and campsites.

The site trips were calculated using a combination of fitted curve equations and the average rates from the *Trip Generation, 11th Edition,* published by the Institute of Transportation Engineers.

A pass-by trip is defined as an intermediate stop on the way from an origin to a primary trip destination without a route diversion and are trips attracted from traffic passing the site on an adjacent street or roadway that offers direct access to the generator. A *Memorandum to MPC Traffic Impact Study Reviewers and Preparers Group* was published on March 10, 1997 to document the maximum pass-by percentages for selected land uses in Knox County. Fast-Food Restaurant has a maximum pass-by rate of 40%; therefore, a pass-by rate of 40% was assumed for the proposed fast-food restaurant during both the AM and PM peak hours. Shopping Center has a maximum pass-by rate of 30%; therefore, a pass-by rate of 30% was assumed for the highway commercial outparcels during both the AM and PM peak hours.

The trip generation land use worksheets and pass-by rate memo are included in Attachment 5.

A trip generation summary is shown in Table 4-1.

Table 4-1
Asheville Highway Property
Trip Generation Summary

Land Use	Density	Daily Trips	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Soccer Complex (LUC 488)	10 Fields	713	6	4	108	56
RV Park (LUC 416)	200 RV Pads	35	13	22	35	19
Health/Fitness Club (LUC 492)	20,000 SF	-	13	13	39	30
Fast-Food Restaurant With Drive-Through Window (LUC 934)	4,000 SF	1870	91	87	69	63
Fast Food Restaurant Pass-By Trips 40%		-748	-36	-35	-28	-25
Shopping Plaza (40-150K) – No Supermarket (LUC 821)	90,000 SF	6077	97	59	229	238
Shopping Plaza Pass-By Trips 30%		-1823	-29	-18	-69	-71
New Trips		**6124**	**155**	**133**	**384**	**309**
Pass-By Trips		2571	66	53	96	97

The new trips generated by the Asheville Highway Property Mixed-Use Development were estimated to be 6,124 daily trips. The estimated new trips are 288 trips during the AM peak hour and 693 trips during the PM peak hour.

The pass-by trips generated by the Asheville Highway Property Mixed-Use Development were estimated to be 2,571 daily trips. The estimated pass-by trips are 119 during the AM peak hour and 193 trips during the PM peak hour.

Trip Distribution

Asheville Highway at the intersection of E Governor John Sevier Highway has an existing trip distribution of 30% eastbound and 70% westbound during the AM peak hour and 50% eastbound and 50% westbound during the PM peak hour.

The directional distribution of the traffic generated by the Asheville Highway Property Mixed-Use Development was determined using the existing traffic volumes in combination with the site plan layout.

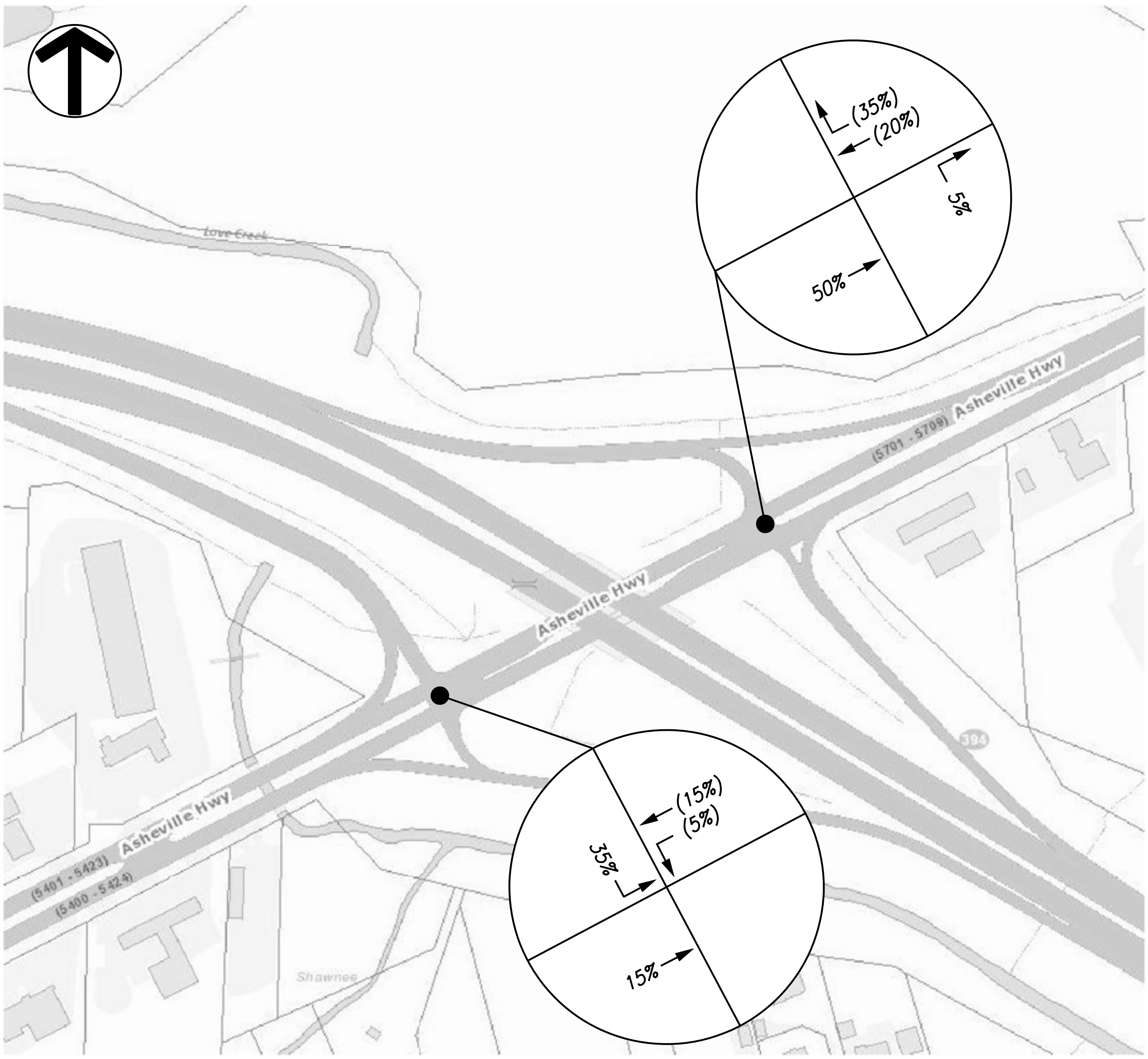
The entering and exiting traffic for primary trips was assumed to be 15% Asheville Highway to/from Knoxville, 30% Asheville Highway to/from Trentville, 15% E Governor John Sevier Highway, 35% Interstate 40 to/from Knoxville and 5% Interstate 40 to/from Strawberry Plains Pike.

The entering and exiting traffic for pass-by trips was assumed to be 50% Asheville Highway eastbound and 50% Asheville Highway westbound.

Figure 7 and Figure 8 show the peak hour trip distribution for primary trips and Figure 9 shows the peak hour trip distribution for pass-by trips.

Figure 10 and Figure 11 show the peak hour site trips for primary trips and Figure 12 shows the peak hour site trips for the pass-by trips.

Figure 13 and Figure 14 shows the 2029 full buildout peak hour traffic including the background traffic, and peak hour site trips from the Asheville Highway Property Mixed-Use Development.



LEGEND:

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

Figure 7: Commercial Peak Hour Trip Distribution - I-40 Ramps

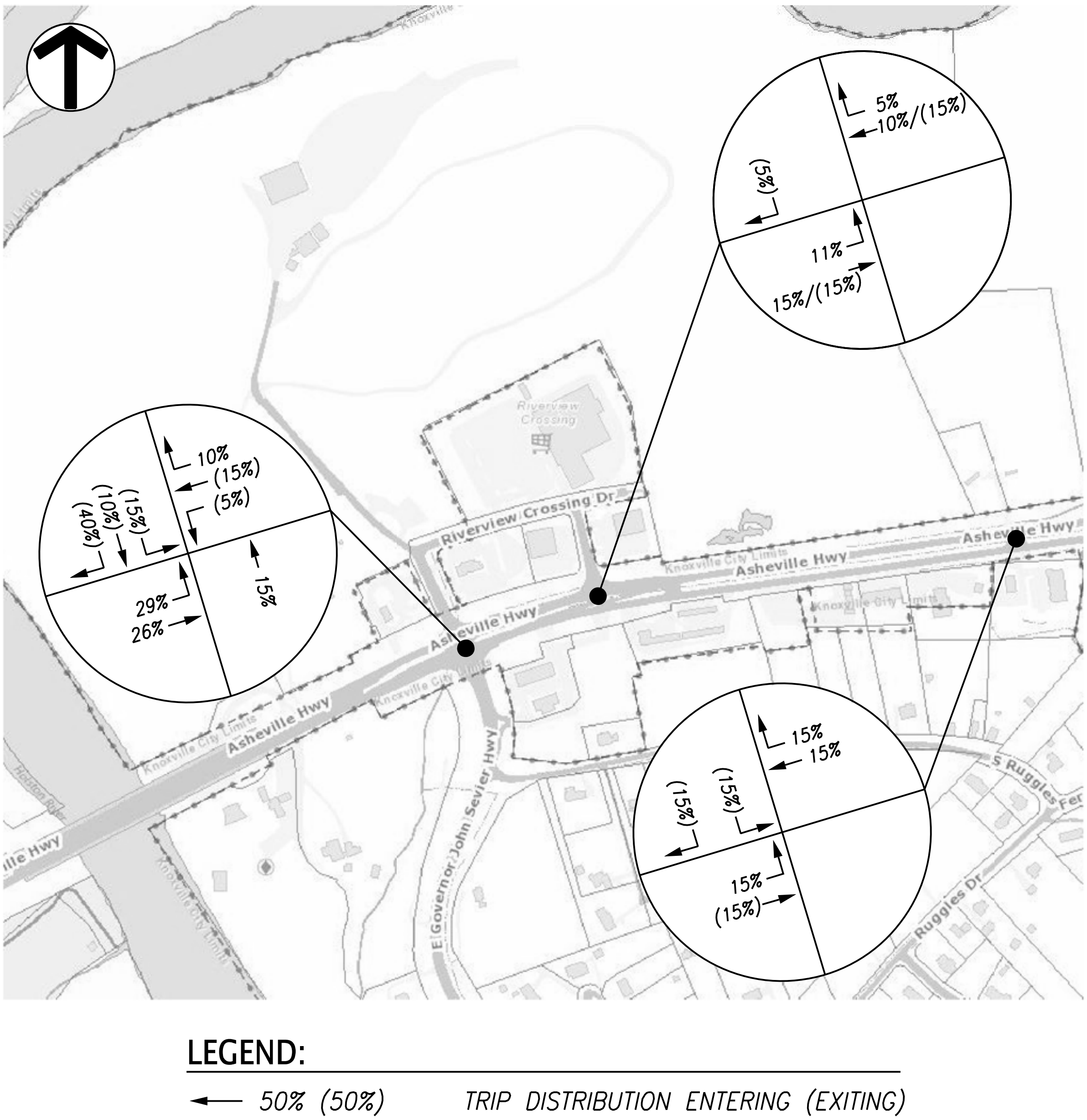


Figure 8: Commercial Peak Hour Trip Distribution - Asheville Hwy

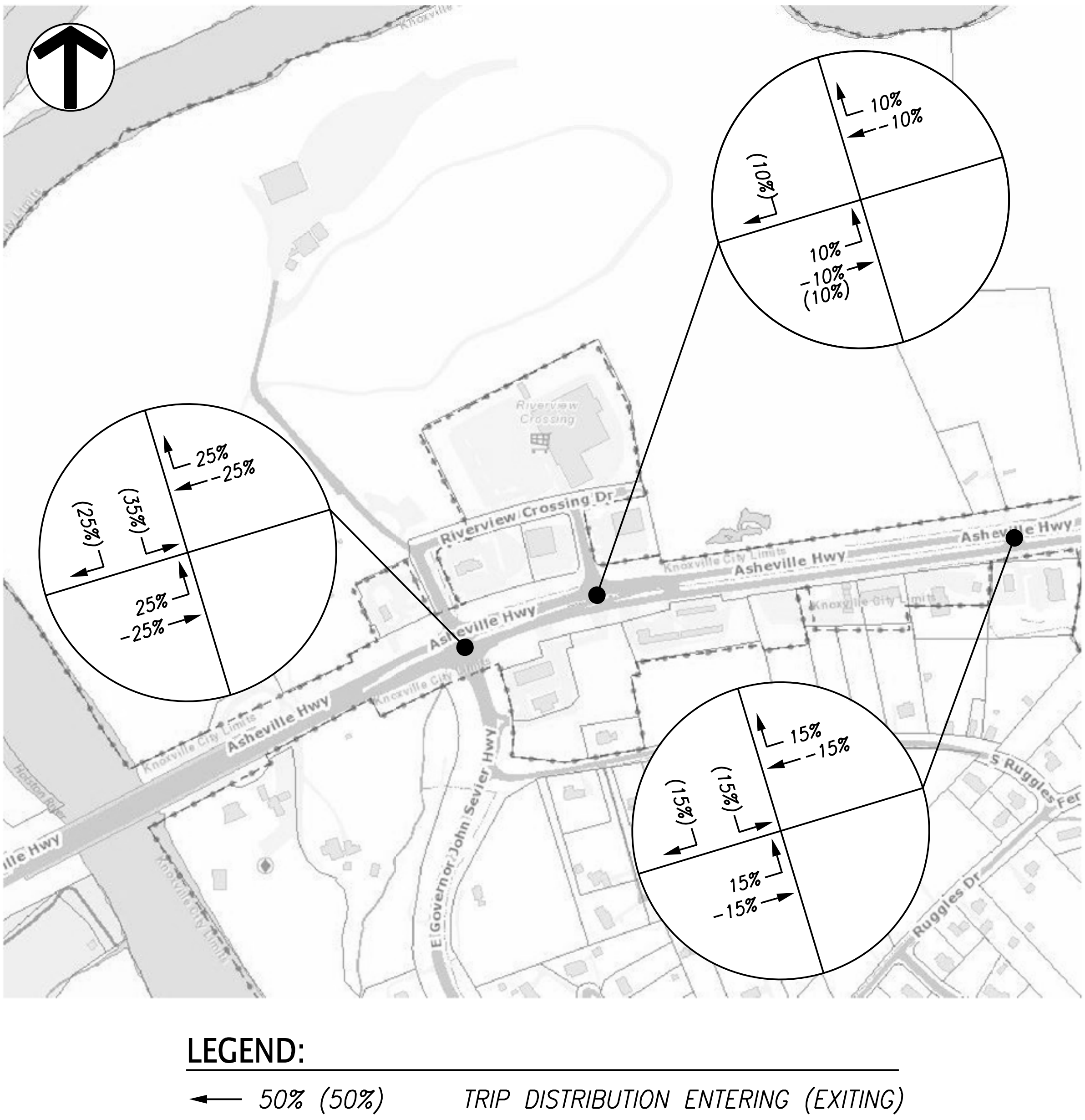


Figure 9: Commercial Peak Hour Pass-By Trip Distribution - Asheville Hwy

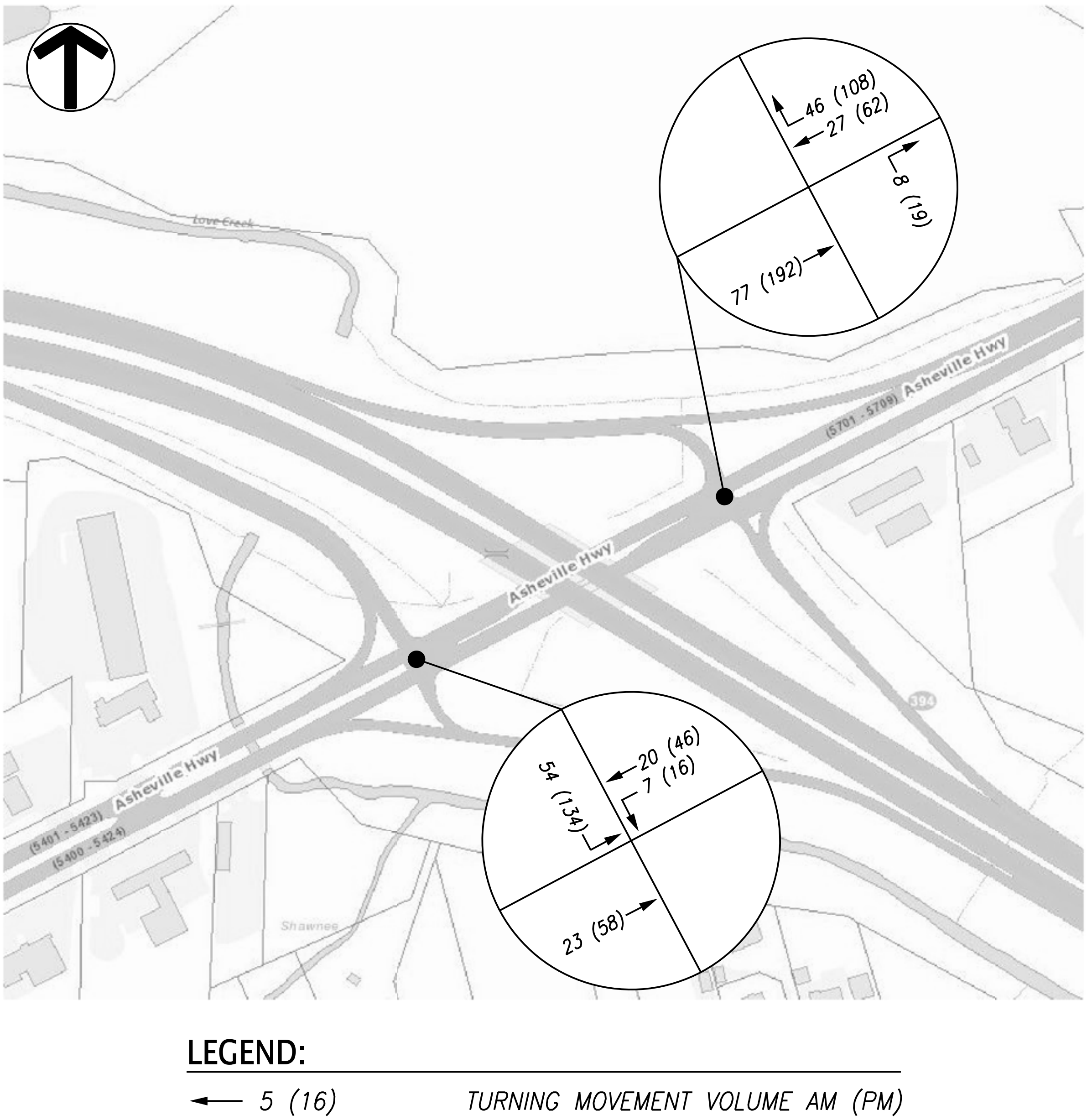


Figure 10: Commercial Peak Hour Site Trips - I-40 Ramps

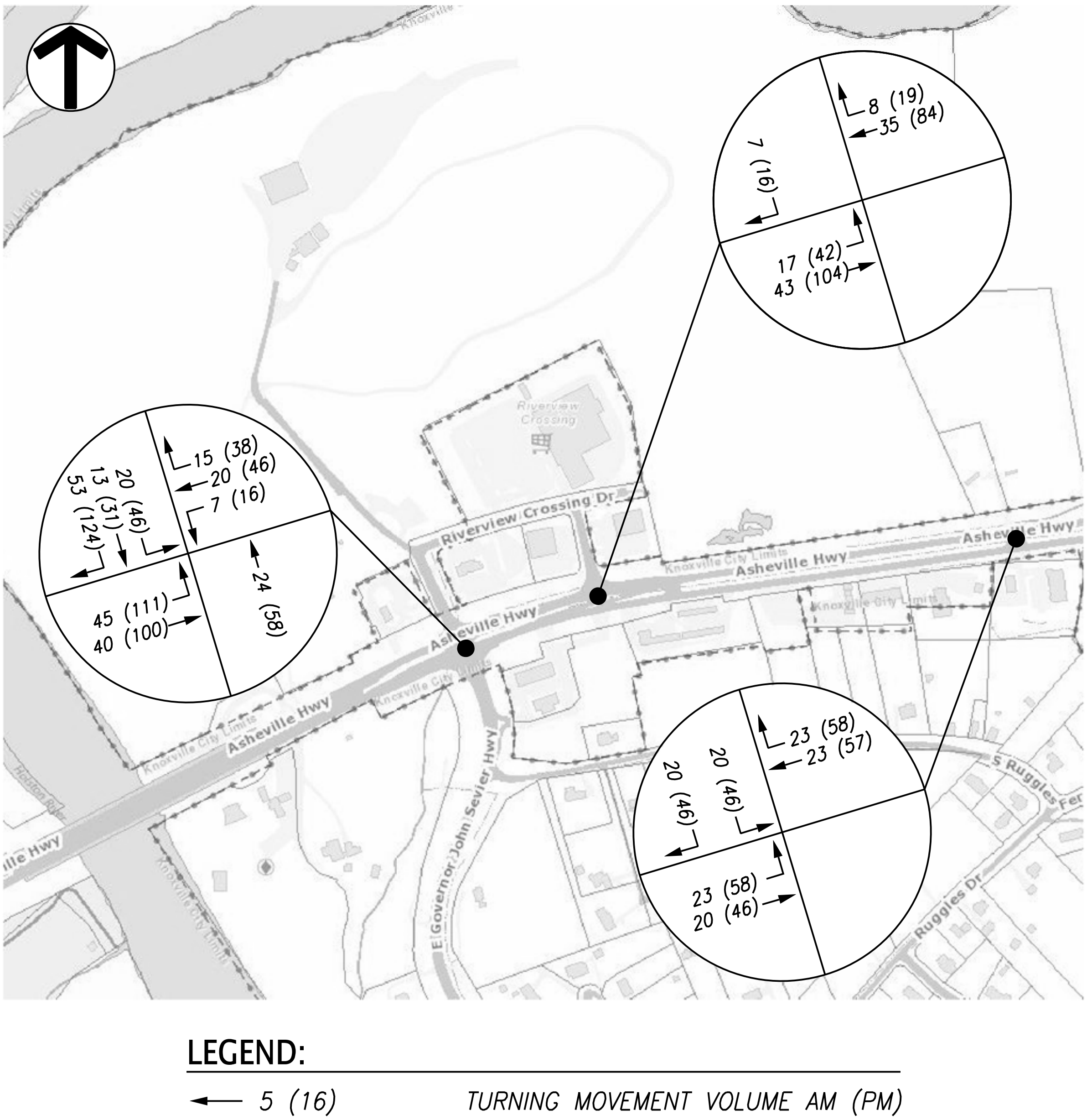
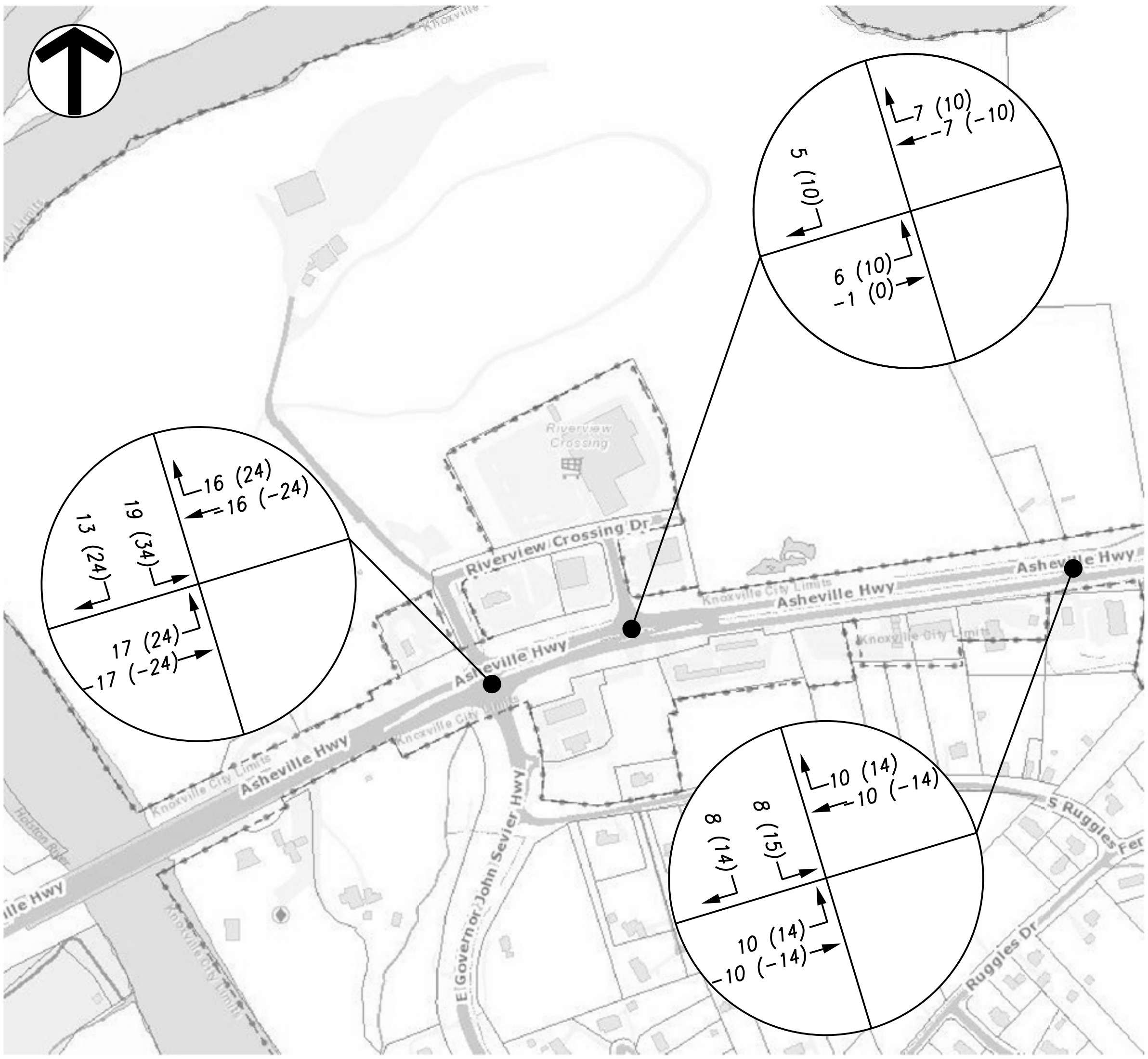


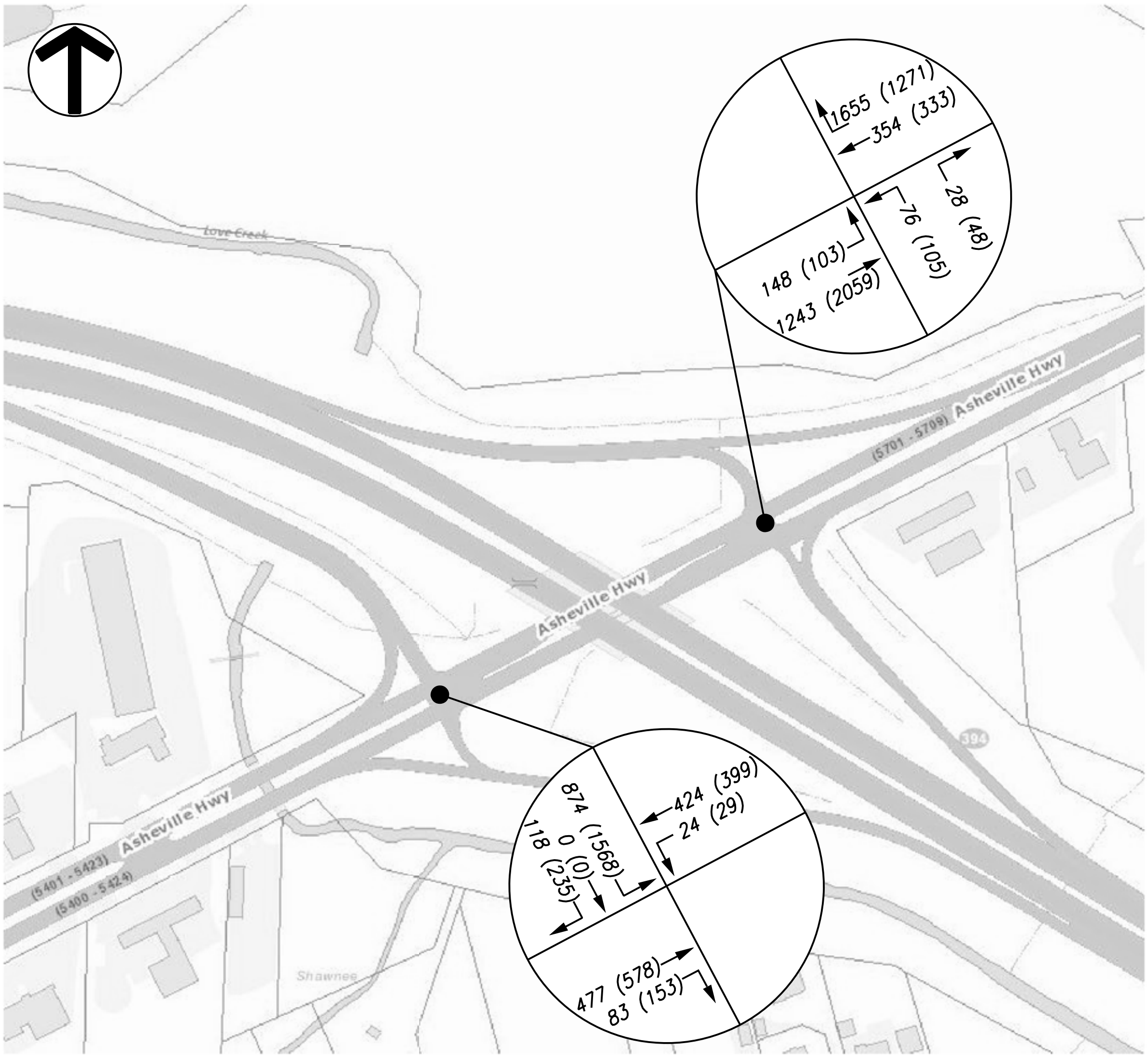
Figure 11: Commercial Peak Hour Site Trips - Asheville Hwy



LEGEND:

5 (16) — *TURNING MOVEMENT VOLUME AM (PM)*

Figure 12: Commerial Peak Hour Pass-By Site Trips - Asheville Hwy



LEGEND:

5 (16) TURNING MOVEMENT VOLUME AM (PM)

Figure 13: 2029 Full Buildout Peak Hour Traffic - I-40 Ramps

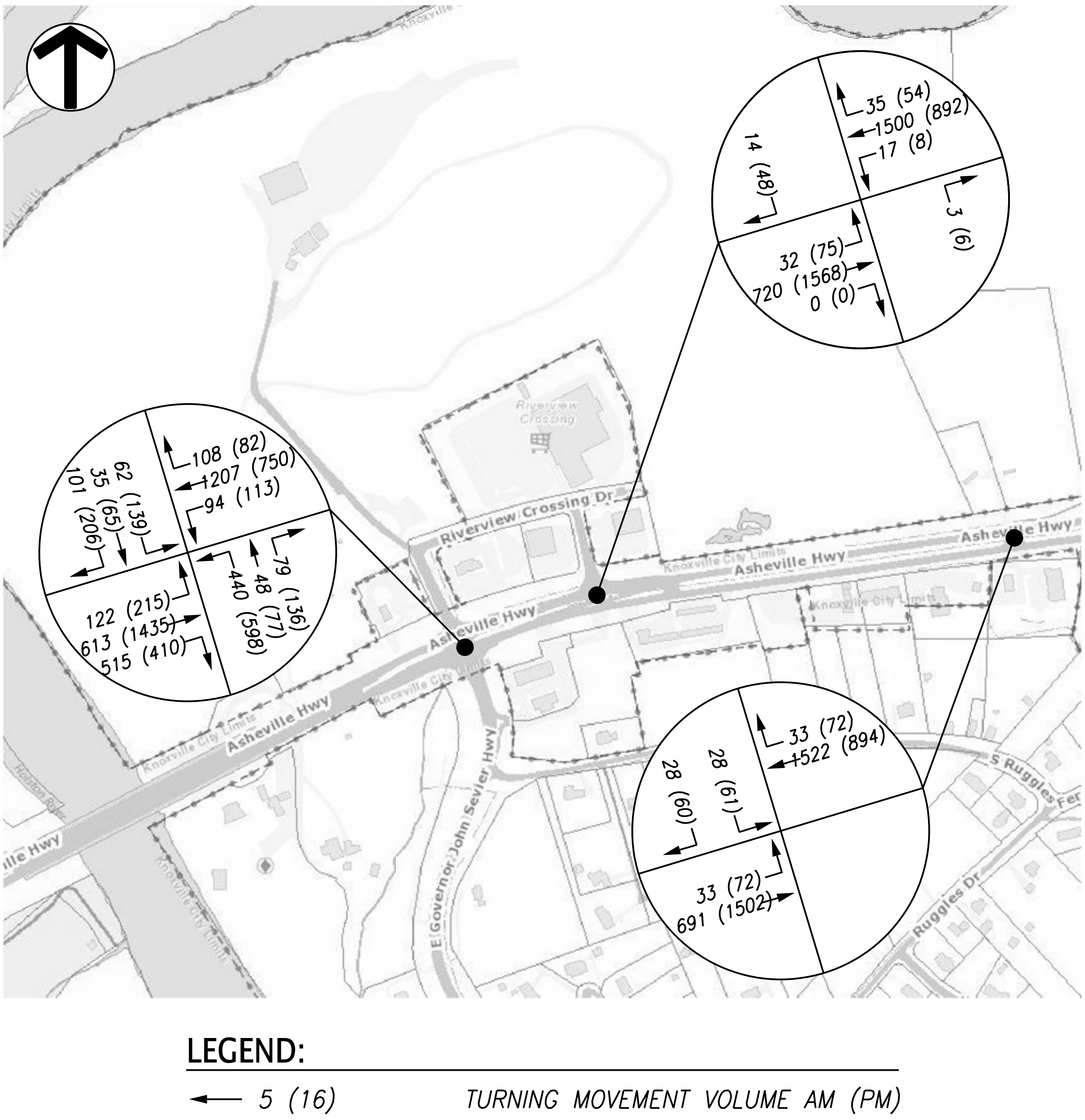


Figure 14: 2029 Full Buildout Peak Hour Traffic - Asheville Hwy

5 Projected Capacity and Level of Service

Signalized intersection capacity analyses were performed using the Synchro 11 Software at the intersection of Asheville Highway at I-40 Eastbound Ramp, Asheville Highway at I-40 Westbound Ramp and Asheville Highway at River Turn Road / E Governor John Sevier Highway in order to evaluate the AM and PM peak hours for the existing, background and full buildout conditions. The signal timing worksheets were provided by the City of Knoxville and are included in Attachment 6. The capacity analyses for the signalized intersections were performed with existing signal timing for the existing and background conditions and optimized signal timing splits for the full buildout conditions.

Unsignalized intersection capacity analyses were performed using the Synchro 11 Software at the intersection of Asheville Highway at Holston Ferry Road in order to evaluate the AM and PM peak hours for the existing, background and full buildout conditions and at the proposed driveway connection to Asheville Highway in order to evaluate the AM and PM peak hours for the full buildout conditions.

A 5% heavy vehicle factor was used in the Synchro Analysis reports for traffic along Asheville Highway and the Interstate Ramps during both the AM and PM peak hours. A 10% heavy vehicle factor was used during the AM peak hour and a 5% heavy vehicle factor was used during the PM peak hour in the Synchro Analysis report for northbound traffic on E Governor John Sevier Highway.

The results from the analyses are expressed with a term "level of service" (LOS), which is based on the amount of delay experienced at the intersection. The LOS index ranges from LOS A, indicating excellent traffic conditions with minimal delay, to LOS F indicating very congested conditions with excessive delay. LOS D generally is considered acceptable in urban areas. Table 5-1 shows the LOS index range for signalized and unsignalized intersections as defined by the Highway Capacity Manual (HCM).

Table 5-1
Level of Service (LOS) Index

Level of Service	Signalized Intersection	Unsignalized Intersection
LOS A	≤ 10 sec	≤ 10 sec
LOS B	10 – 20 sec	10 – 15 sec
LOS C	20 – 35 sec	15 – 25 sec
LOS D	35 – 55 sec	25 – 35 sec
LOS E	55 – 80 sec	35 – 50 sec
LOS F	> 80 sec	> 50 sec

The Synchro 11 worksheets are included in Attachments 7, 8, and 9. Table 5-2 shows the results of the capacity analyses.

Table 5-2
Intersection Analysis
Level of Service (LOS) Summary

Intersection	Time Period	Year 2024 Existing (Delay/LOS)	Year 2029 Background (Delay/LOS)	Year 2029 Full Buildout (Delay/LOS)
Asheville Highway @ I-40 Eastbound Ramp	**AM Peak**			
	EB Thru	32.4 / C	31.8 / C	34.9 / C
	WB Left	29.4 / C	28.6 / C	21.1 / C
	WB Thru	31.1 / C	30.3 / C	22.6 / C
	SB Left	14.1 / B	15.3 / B	15.0 / B
	SB Thru	14.1 / B	15.3 / B	15.0 / B
	SB Right	9.5 / A	10.0 / B	9.5 / A
	Intersection	**22.8 / C**	**22.9 / C**	**21.9 / C**
	PM Peak			
	EB Thru	35.1 / D	34.0 / C	48.7 / D
	WB Left	24.1 / C	22.9 / C	26.0 / C
	WB Thru	24.7 / C	23.6 / C	26.3 / C
	SB Left	22.2 / C	26.6 / C	29.5 / C
	SB Thru	22.2 / C	26.6 / C	29.5 / C
	SB Right	10.6 / B	11.5 / B	10.8 / B
	Intersection	**24.7 / C**	**26.7 / C**	**32.3 / C**

Asheville Highway @ I-40 Westbound Ramp	**AM Peak**			
	EB Left	28.6 / C	28.0 / C	37.9 / D
	EB Thru	9.6 / A	7.4 / A	7.9 / A
	WB Approach	45.8 / D	68.1 / E	24.8 / C
	NB Approach	31.5 / C	31.7 / C	41.4 / D
	Intersection	**31.2 / C**	**44.2 / D**	**18.6 / B**
	PM Peak			
	EB Left	10.4 / B	12.2 / B	13.5 / B
	EB Thru	7.4 / A	8.4 / A	11.6 / B
	WB Approach	9.8 / A	9.8 / A	11.6 / B
	NB Approach	41.4 / D	43.8 / D	43.7 / D
	Intersection	**9.8 / A**	**10.4 / B**	**12.9 / B**
Asheville Highway @ E Gov John Sevier Hwy / River Turn Road	**AM Peak**			
	EB Approach	27.2 / C	27.7 / C	24.2 / C
	WB Approach	34.4 / C	36.9 / D	32.8 / C
	NB Approach	42.3 / D	43.1 / D	55.6 / E
	SB Approach	57.3 / E	57.6 / E	64.4 / E
	Intersection	**33.7 / C**	**35.1 / D**	**35.3 / D**
	PM Peak			
	EB Approach	30.3 / C	33.7 / C	42.8 / D
	WB Approach	21.3 / C	21.1 / C	28.9 / C
	NB Approach	68.3 / E	82.8 / F	81.5 / F
	SB Approach	48.1 / D	50.1 / D	74.7 / E
	Intersection	**36.9 / D**	**41.7 / D**	**50.2 / D**
Asheville Highway @ Holston Ferry Road	**AM Peak**			
	EB Left Turn	14.0 / B	14.6 / B	15.8 / C
	WB Left Turn	8.6 / A	8.7 / A	8.9 / A
	NB Right Turn	8.8 / A	8.8 / A	9.0 / A
	SB Right Turn	15.4 / C	16.0 / C	16.8 / C
	PM Peak			
	EB Left Turn	9.9 / A	10.1 / B	11.1 / B
	WB Left Turn	11.3 / B	11.6 / B	12.4 / B
	NB Right Turn	10.1 / B	10.4 / B	10.7 / B
	SB Right Turn	11.4 / B	11.6 / B	12.4 / B
Asheville Highway @ Driveway	**AM Peak**			
	EB Left Turn			3.5 / A
	SB Approach			172.3 / F
	PM Peak			
	EB Left Turn			3.1 / A
	SB Approach			374.4 / F

6 Queue Analysis

Table 6-1 presents the traffic queueing summary for the 95th percentile queue at the signalized intersections and the proposed driveway connections for both the AM and PM peak hour.

Table 6-1
Queue Summary

Intersection	Movement	Storage Capacity (ft)	Year 2024 Existing AM	Year 2024 Existing PM	Year 2029 Background AM	Year 2029 Background PM	Year 2029 Full Buildout AM	Year 2029 Full Buildout PM
Asheville Hwy @ I-40 EB Ramp	EBT	1,000 ft	178	218	185	224	216	363
	WBL	75 ft	10	8	10	8	11	19
	WBT	520 ft	101	99	100	100	103	146
	SBL	800 ft	294	710	322	785	309	733
	SBT	800 ft	294	710	322	785	309	733
	SBR	400 ft	29	43	30	50	27	45
Asheville Hwy @ I-40 WB Ramp	EBL	55 ft	**111**	33	**113**	37	**117**	16
	EBT	520 ft	272	436	293	**533**	102	**697**
	WBT	1,000 ft	662	130	731	165	706	233
	NBT	620 ft	47	89	51	94	65	107
Asheville Hwy E Gov John Sevier Hwy / River Turn Rd	EBL	80 ft	48	47	52	49	**139**	**125**
	EBT	1,000 ft+	244	550	258	632	233	691
	EBR	200 ft	71	118	74	135	60	145
	WBL	190 ft	66	66	69	73	67	125
	WBT	450 ft	**590**	235	**675**	250	**604**	301
	WBR	120 ft	19	0	23	0	42	0
	NBL	200 ft	**273**	**392**	**288**	**418**	**322**	**449**
	NBT	1,000 ft+	271	403	285	429	327	456
	NBR	200 ft	26	50	30	51	32	31
	SBT	250 ft	78	112	82	118	161	**295**
	SBR	250 ft	0	0	0	0	60	85
Asheville Hwy @ Holston Ferry Rd	EBL	150 ft	2	2	2	3	8	10
	WBL	180 ft	1	1	1	1	1	1
	NBR	50 ft	0	1	0	1	0	1
	SBR	250 ft	0	3	0	3	4	8
Asheville Hwy @ Driveway	EBL						8	10
	SB						105	260

Bold cells indicate that the queue lengths are more than the available storage. The 95th percentile queue length is defined as the queue length that has only a 5-percent probability of being exceeded during the analysis time period. The 95th queue length is typically used to determine the length of turning lanes in order to minimize the risk of blockage. Synchro 11 assumes a vehicle length of 25 feet for a passenger vehicle and a vehicle length of 45 feet for a heavy vehicle.

7 Turn Lane Warrant

The proposed intersection of Asheville Highway at the driveway connection was evaluated to determine if a westbound right turn lane or an eastbound left turn lane is warranted on Asheville Highway. The TDOT Highway System Access Manual (HSAM) Volume 3: Geometric Design Criteria dated April 2021 was used to analyze the information.

In order to evaluate a right turn lane warrant, the Major-Road Volume, (one direction), veh/h and Right-Turn Volume, veh/h were reference from Figure 14: 2029 Full Buildout Peak Hour Traffic – Asheville Hwy. Per Figure 3-19: Right-Turn Warrant along Four-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control) the full buildout conditions at the intersection of Asheville Highway at the driveway connection will warrant a right turn lane during both the AM and PM peak hours per the TDOT Highway System Access Manual.

In order to evaluate a left turn lane warrant, the Major Arterial Volume (veh/h/ln) and Left-Turn Volume, veh/h were referenced from Figure 14: 2029 Full Buildout Peak Hour Traffic – Asheville Hwy. Per Figure 3-15: Left-Turn Lane Warrant for Urban and Suburban Arterials (Unsignalized) the full buildout conditions at the intersection of Asheville Highway at the driveway connection will warrant a left turn lane during both the AM and PM peak hours per the TDOT Highway System Access Manual.

Per the TDOT HSAM Table 3-11: Lane Change and Deceleration Distance the recommended lane change and deceleration distance for a roadway with a speed limit of 45 mph is 340 feet and the minimum queue storage length for a turn lane is 50 feet. Therefore, the total recommended turn lane length at the driveway connection is 390 feet.

Per the TDOT HSAM "when it is not practical to accommodate the full length, designers may assume some deceleration prior to the lane change. A speed of ten mph less than the design speed may be utilized in constrained conditions when selecting the lane change and deceleration distance." The total recommended turn lane length for a roadway with a speed limit of 35 mph is 205 feet and the minimum storage remains the same at 50 feet for a minimum recommended total turn lane length of 255 feet in constrained conditions.

The TDOT Highway System Access Manual Figure is included in Attachment 10.

8 Signal Warrant Analysis

The intersection of Asheville Highway at the driveway connection was evaluated to determine if a traffic signal is warranted for the existing, background and full buildout conditions. The "Manual of Uniform Traffic Control Devices, 11th Edition" (MUTCD) published by the Federal Highway Administration in 2023 was used to determine if the intersection met a warrant for a signal. The volume-based warrants including Warrant 1, Eight-Hour Vehicular Volume, Warrant 2, Four-Hour Vehicular Volume and Warrant 3, Peak Hour were evaluated based on existing, background and full buildout conditions.

Per the TDOT Traffic Design Manual right-turn traffic should not be considered when an exclusive or channelized right-turn lane is present; therefore, right turning traffic was not considered when evaluating the need for a traffic signal at the intersection of Highway 72 at I-75 Northbound Ramp. At the intersection of Highway 72 at Elizabeth Lee Parkway the installation of a northbound right turn lane is a recommended intersection improvement; therefore, right turning traffic was not considered during the evaluation of the Full Buildout conditions.

The proposed total Asheville Highway Mixed-Use Development Average Daily Trips (ADT) was used to estimate the trips during the peak hours. The estimated ADT is 6,124 New Trips and 2,571 Pass-By Trips per day with 50% entering and 50% exiting. The percentage of ADT per peak hour was referenced from the TDOT AADT maps in the vicinity of the proposed development.

At the intersection of Asheville Highway at the proposed driveway connection Ardurra assumed the Asheville Highway Mixed-Use Development would add 30% of the exiting ADT to the driveway connection. The maximum percentage of ADT was 8.2% during the 7:00 a.m. and 4:00 p.m. peak hours and the minimum percentage of ADT was 5.7% during the 12:00p.m. peak hour.

The existing, background and full buildout conditions do not meet the requirements for Warrant 1, Eight-Hour Vehicular Volume, Warrant 2, Four-Hour Vehicular Volume and Warrant 3, Peak Hour.

The MUTCD states that "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal."

The traffic signal warrant worksheet is included in Attachment 12.

9 Conclusions and Recommendations

9.1 Asheville Highway at I-40 Eastbound Ramp

The existing, background and full buildout conditions at the signalized intersection of Asheville Highway at I-40 Eastbound Ramp were analyzed using the Synchro 11 software. The existing intersection of Asheville Highway at I-40 Eastbound Ramp is a signalized three-way intersection.

The existing and background traffic conditions for the signalized intersection of Asheville Highway at I-40 Eastbound Ramp operate at an overall LOS C during the AM and PM peak hours.

After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the traffic conditions for the intersection of Asheville Highway at I-40 Eastbound Ramp operate at an overall LOS C during both the AM and PM peak hours.

The 95% queue length is defined as the queue length that has only a 5-percent probability of being exceeded during the analysis time period. The 95% queue length is typically used to determine the length of turning lanes in order to minimize the risk of blockage. Synchro 11 assumes a vehicle length of 25 feet for a passenger vehicle and a vehicle length of 45 feet for a heavy vehicle.

The existing westbound left turn lane at the signalized intersection of Asheville Highway at I-40 Eastbound Ramp has an available storage length of 75 feet. The signalized intersection capacity analysis for the full buildout conditions shows the 95% queue length for the westbound left turn lane (Asheville Highway) of 11 feet (one vehicle) during the AM peak hour and 19 feet (one vehicle) during the PM peak hour.

The existing southbound left/thru lanes at the signalized intersection of Asheville Highway at I-40 Eastbound Ramp have an available storage length of 800 feet with an additional 1,275 feet of storage as a part of the Interstate 40 exit only lane. The signalized intersection capacity analysis for the full buildout conditions shows the 95% queue length for the southbound left/thru lanes (I-40 Eastbound Ramp) of 309 feet (13 vehicles) during the AM peak hour and 733 feet (30 vehicles) during the PM peak hour; therefore, the queue will remain within the interstate ramp and the queue is not expected to impede flow on Interstate 40.

The result of the queue analysis is that the existing storage lengths at the intersection of Asheville Highway at I-40 Eastbound Ramp are adequate, and no additional improvements are necessary in order to accommodate the Asheville Highway Property Mixed-Use Development.

Any future improvements to the intersection or the various traffic management infrastructure, would need to be reviewed, coordinated, and approved by the Tennessee Department of Transportation and the City of Knoxville Department of Engineering.

9.2 Asheville Highway at I-40 Westbound Ramp

The existing, background and full buildout conditions at the unsignalized intersection of Asheville Highway at I-40 Westbound Ramp were analyzed using the Synchro 11 software. Asheville Highway at I-40 Westbound Ramp is a signalized three-way intersection.

The existing traffic conditions for the signalized intersection of Asheville Highway at I-40 Westbound Ramp operate at an overall LOS C during the AM peak hour and a LOS A during the PM peak hour.

The background traffic conditions for the signalized intersection of Asheville Highway at I-40 Westbound Ramp operate at an overall LOS D during the AM peak hour and a LOS B during the PM peak hour.

After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the traffic conditions for the intersection of Asheville Highway at I-40 Westbound Ramp operate at an overall LOS B during the both the AM and PM peak hours.

The 95% queue length is defined as the queue length that has only a 5-percent probability of being exceeded during the analysis time period. The 95% queue length is typically used to determine the length of turning lanes in order to minimize the risk of blockage. Synchro 11 assume a vehicle length of 25 feet for a passenger vehicle and a vehicle length of 45 feet for a heavy vehicle.

The existing eastbound left turn lane at the intersection of Asheville Highway at I-40 Westbound Ramp has an available storage length of 55 feet. The signalized intersection capacity analysis for the full buildout conditions shows the 95% queue length for the eastbound left turn lane (Asheville Highway) of 117 feet (5 vehicles) during the AM peak hour and 16 feet (one vehicle) during the PM peak hour. The eastbound left turn lane exceeds capacity during the AM peak hour for the existing, background and full buildout conditions.

The existing northbound approach at the intersection of Asheville Highway at I-40 Westbound Ramp has an available storage length of 620 feet before the queue will back up onto Interstate 40. The signalized intersection capacity analysis for the full buildout conditions shows the 95% queue length for the northbound approach (I-40 Westbound Ramp) of 65 feet (3 vehicles) during the AM peak hour and 107 feet (5 vehicles) during the PM peak hour.

The result of the queue analysis is that the existing eastbound left turn lane exceeds capacity during the existing, background and full buildout conditions. The existing geometry including the location of the Interstate 40 Bridge prohibits increasing the storage length for the eastbound left turn lane; therefore, there are no additional recommended improvements at this intersection.

Any future improvements to the intersection or the various traffic management infrastructure, would need to be reviewed, coordinated, and approved by the Tennessee Department of Transportation and the City of Knoxville Department of Engineering.

9.3 Asheville Highway at E Governor John Sevier Highway / River Turn Road

The existing, background and full buildout conditions at the signalized intersection of Asheville Highway at E Governor John Sevier Highway / River Turn Road were analyzed using the Synchro 11 software. The existing intersection of Asheville Highway at E Governor John Sevier Highway / River Turn Road is a signalized four-way intersection. The existing signal timing was used to analyze the intersection during existing and background conditions and optimized signal timing was used to analyze the full buildout conditions.

The existing traffic conditions for the signalized intersection of Asheville Highway at E Governor John Sevier Highway / River Turn Road operate at an overall LOS C during the AM peak hour and a LOS D during the PM peak hour.

The background traffic conditions for the signalized intersection of Asheville Highway at E Governor John Sevier Highway / River Turn Road operate at an overall LOS D during the AM and PM peak hours.

After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the traffic conditions for the intersection of Asheville Highway at E Governor John Sevier Highway / River Turn Road operate at an overall LOS D during both the AM and PM peak hours.

The 95% queue length is defined as the queue length that has only a 5-percent probability of being exceeded during the analysis time period. The 95% queue length is typically used to determine the length of turning lanes in order to minimize the risk of blockage. Synchro 11 assumes a vehicle length of 25 feet for a passenger vehicle and a vehicle length of 45 feet for a heavy vehicle.

The existing eastbound left turn lane at the intersection of Asheville Highway at E Governor John Sevier Highway / River Turn Road has an available storage length of 80 feet. The signalized intersection capacity analysis for the full buildout conditions shows the 95% queue length for the eastbound left turn lane (Asheville Highway) of 139 feet (6 vehicles) during the AM peak hour and 125 feet (5 vehicles) during the PM peak hour.

Ardurra recommends increasing the storage capacity of the eastbound left turn lane from 80 feet to 150 feet in order to accommodate the Asheville Highway Property Mixed Use Development.

The existing southbound approach has a left/thru lane and a separate right turn lane that extends approximately 250 feet to the stop-controlled intersection of Riverview Crossing Drive. The signalized intersection capacity analysis for the full buildout condition shows the 95% queue length for the southbound left/thru lane of 161 feet (7 vehicles) during the AM peak hour and 295 feet (12 vehicles) during the PM peak hour. And the 95% queue for the southbound right turn lane of 60 feet (3 vehicles) during the AM peak hour and 85 feet (4 vehicles) during the PM peak hour. Therefore, the queue from the signalized intersection will queue past the stop-controlled intersection of Riverview Crossing Drive.

Ardurra recommends that the pavement markings on River Turn Road at the signalized intersection be striped to indicate a separate left/thru lane and right turn lane between Asheville Highway and Riverview Crossing Drive.

Consideration should be made to the addition of either a southbound right turn lane on River Turn Lane at the signalized intersection or a separate exit only right turn lane for the parcel designated for a fast-food restaurant west of the signalized intersection. Either roadway improvement would help alleviate the southbound queue at the signalized intersection. Ardurra recommends re-evaluating the need for a southbound right turn lane on River Turn Road once the Commercial Land Uses along Asheville Highway are known.

The minimum required stopping sight distance and intersection sight distance for the left turn from the Major Road (Case F) at the signalized intersection of Asheville Highway at Governor John Sevier Highway was determined using the AASHTO "Geometric Design of Highways and Streets". The required stopping sight distance is 360 feet for a road with a 45 mph design speed. The required intersection sight distance for a left turn from the major approach on a roadway with a 45 mph design speed is 480 feet, accounting for crossing two lanes of traffic and a median.

Attachment 11 shows the intersection sight distance triangles for the eastbound and westbound left turns at the signalized intersection of Asheville Highway at E Governor John Sevier Highway.

Based on the intersection sight triangles the westbound left turn lane has the potential for compromised sight distance when the eastbound left turn lane has vehicles queued at the signal.

Per the recommendation of the Knoxville-Knox County Planning Commission an alternative scenario was analyzed for the westbound left turn to operate as a protected only phase due to the potential for limited sight distance from the left turn lanes not being directly opposite from one another.

Attachment 11 includes the Synchro 11 capacity analysis worksheets for an alternative scenario at the signalized intersection of Asheville Highway at E Governor John Sevier Highway. The result of the capacity analysis is that the intersection will operate at a LOS D during the AM peak hour and a LOS E during the PM peak hour and the westbound left turn 95% queue would be contained within the existing turn lane dimensions.

Ardurra recommends that the signal timing be updated after the buildout of the Asheville Highway Property Mixed-Use Development and that consideration be made to adding a protected westbound left turn phase.

Any future improvements to the intersection or the various traffic management infrastructure, would need to be reviewed, coordinated, and approved by the Tennessee Department of Transportation and the City of Knoxville Department of Engineering.

9.4 Asheville Highway at Holston Ferry Road

The existing, background and full buildout conditions at the two-way stop-controlled intersection of Asheville Highway at Holston Ferry Road were analyzed using the Synchro 11 software.

The existing intersection of Asheville Highway at Holston Ferry Road is a four-way intersection with existing stop signs located on the southbound approach (Holston Ferry Road) and northbound approach (driveway). The curbed median allows for eastbound and westbound left turns and U-turns but does not allow thru traffic to cross Asheville Highway between Holston Ferry Road and the access driveway.

The existing traffic conditions for the two-way stop-controlled intersection of Asheville Highway at Holston Ferry Road operates as follows. The eastbound left turn lane (Asheville Highway) operates at a LOS B during the AM peak hour and a LOS A during the PM peak hour, the westbound left turn lane (Asheville Highway) operates at a LOS A during the AM peak hour and a LOS B during the PM peak hour, the northbound approach (driveway) operates at a LOS A during the AM peak hour and a LOS B during the PM peak hour and the southbound approach (Holston Ferry Road) operates at a LOS C during the AM peak hour and a LOS B during the PM peak hour.

The background traffic conditions for the two-way stop-controlled intersection of Asheville Highway at Holston Ferry Road operates as follows. The eastbound left turn lane (Asheville Highway) operates at a LOS B during both the AM and PM peak hours, the westbound left turn lane (Asheville Highway) operates at a LOS A during the AM peak hour and a LOS B during the PM peak hour, the northbound approach (driveway) operates at a LOS A during the AM peak hour and a LOS B during the PM peak hour and the southbound approach (Holston Ferry Road) operates at a LOS C during the AM peak hour and a LOS B during the PM peak hour.

After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the traffic conditions for the two-way stop-controlled intersection of Asheville Highway at Holston Ferry Road operates as follows. The eastbound left turn lane (Asheville Highway) operates at a LOS C during the AM peak hour and a LOS B during the PM peak hours, the westbound left turn lane (Asheville Highway) operates at a LOS A during the AM peak hour and a LOS B during the PM peak hour, the northbound approach (driveway) operates at a LOS A during the AM peak hour and a LOS B during the PM peak hour and the southbound approach (Holston Ferry Road) operates at a LOS C during the AM peak hour and a LOS B during the PM peak hour.

The 95% queue length is defined as the queue length that has only a 5-percent probability of being exceeded during the analysis time period. The 95% queue length is typically used to determine the length of turning lanes in order to minimize the risk of blockage. Synchro 11 assumes a vehicle length of 25 feet for a passenger vehicle and a vehicle length of 45 feet for a heavy vehicle.

The existing eastbound left turn lane at the intersection of Asheville Highway at Holston Ferry Road has an available storage length of 150 feet. The unsignalized intersection capacity analysis for the full buildout conditions shows the 95% queue length for the eastbound left turn lane (Asheville Highway) of 8 feet (one vehicle) during the AM peak hour and 10 feet (one vehicle) during the PM peak hour.

The existing westbound left turn lane at the intersection of Asheville Highway at Holston Ferry Road has an available storage length of 180 feet. The unsignalized intersection capacity analysis for the full buildout conditions shows the 95% queue length for the westbound left turn lane (Asheville Highway) of 1 foot (one vehicle) during the AM peak hour and 1 foot (one vehicle) during the PM peak hour.

The result of the queue analysis is that the existing storage lengths at the intersection of Asheville Highway at Holston Ferry Road are adequate, and no additional improvements are necessary in order to accommodate the Asheville Highway Property Mixed-Use Development.

Any future improvements to the intersection or the various traffic management infrastructure, would need to be reviewed, coordinated, and approved by the Tennessee Department of Transportation and the City of Knoxville Department of Engineering.

9.5 Asheville Highway at Driveway Connection

The proposed full buildout conditions at the unsignalized intersection of Asheville Highway at the Driveway Connection were analyzed using the Synchro 11 software.

After the completion of the full buildout of the Asheville Highway Property Mixed-Use Development the intersection of Asheville Highway at the proposed Driveway Connection will operate as follows. The eastbound left turn lane (Asheville Highway) will operate at a LOS A during both the AM and PM peak hours and the southbound approach (Driveway) will operate at a LOS F during both the AM and PM peak hours.

The 95% queue length is defined as the queue length that has only a 5-percent probability of being exceeded during the analysis time period. The 95% queue length is typically used to determine the length of turning lanes in order to minimize the risk of blockage. Synchro 11 assumes a vehicle length of 25 feet for a passenger vehicle and a vehicle length of 45 feet for a heavy vehicle.

The southbound approach (Driveway) at the unsignalized intersection of Asheville Highway at the proposed Driveway Connection has an approximate storage length of 250 feet. The unsignalized intersection capacity analysis for the full buildout condition shows the 95% queue length for the southbound approach (Driveway) of 105 feet (five vehicles) during the AM peak hour and 260 feet (11 vehicles) during the PM peak hour; therefore, the queue will exceed capacity during the PM peak hour. Ardurra recommends consideration of separate right and left turn lanes at the driveway connection.

A westbound right turn lane and an eastbound left turn are both warranted at the intersection of Asheville Highway at the Driveway Connection during both the AM and PM peak hours per the TDOT Highway System Access Manual (HSAM) Volume 3: Geometric Design Criteria dated April 2021.

Per the TDOT HSAM the total recommended turn lane length for a roadway with a speed limit of 45 mph is 390 feet or 255 feet under constrained conditions including both storage length and lane change and deceleration distance.

The minimum required driveway spacing on a Principal Arterial in a suburban area is 660 feet for a full access driveway and 330 feet for a restricted access with a non-traversable median per the TDOT Highway System Access Manual.

Depending on the final design of the driveway connection the total recommended turn lane length can be shortened to the minimum allowed under constrained conditions to ensure no portion of the turn lane interferes with the existing driveway connections along Asheville Highway.

The need for a traffic control signal was analyzed using the "Manual of Uniform Traffic Control Devices, 11th Edition" (MUTCD) published by the Federal Highway Administration in 2023.

The intersection of Asheville Highway at Driveway Connection does not meet the requirements for Warrant 1, Eight-Hour Vehicular Volume, Warrant 2, Four-Hour Vehicular Volume or Warrant 3, Peak Hour after the full buildout of the Asheville Highway Mixed-Use Development; therefore, Ardurra does not recommend the installation of a traffic signal during this phase of the development.

The minimum required stopping sight distance and intersection sight distance for the intersection of Asheville Highway at the Driveway Connection was determined using the AASHTO "Geometric Design of Highways and Streets". The required stopping sight distance is 360 feet for a road with a 45 mph design speed. The required intersection sight distance on a road with a 45 mph design speed is 430 feet a passenger vehicle turning right and 630 feet for a passenger vehicle turning left across the existing median.

Ardurra recommends that the intersection sight distance be certified by a land surveyor prior to construction in order to verify that the driveway connection has adequate intersection sight distance to comply with City of Knoxville and AASHTO requirements.

Ardurra recommends that the signs and pavement markings be installed in accordance with the standards provided in the *Manual on Uniform Traffic Control Devices* (MUTCD).

Any future improvements to the intersection or the various traffic management infrastructure, would need to be reviewed, coordinated, and approved by the

Tennessee Department of Transportation and the City of Knoxville Department of Engineering.

9.6 Recommendations

In order to maintain or provide an acceptable level-of-service for each of the intersections studied, some recommendations are presented.

- Asheville Highway at E Governor John Sevier Highway / River Turn Road
  - Extend the storage length of the existing eastbound left turn lane from 80 feet to 150 feet.
  - Recommended taper length of 50 – 100 feet (to be coordinated with COK Engineering). Turn lane length is limited by existing geometry.
  - Ardurra recommends that the pavement markings on River Turn Road at the signalized intersection be striped to indicate a separate left/thru lane and right turn lane between Asheville Highway and Riverview Crossing Drive.
  - Ardurra recommends that the signal timing be updated after the buildout of the Asheville Highway Property Mixed-Use Development and that consideration be made to adding a protected westbound left turn phase.
  - Ardurra recommends re-evaluating the need for a short southbound right turn lane on River Turn Road once the Commercial Land Uses along Asheville Highway are known.
- Asheville Highway at Driveway Connection
  - Install a westbound right turn lane with a minimum total length of 275 feet per the TDOT Highway System Access Manual.
  - Install an eastbound left turn lane with a minimum total length of 275 feet per the TDOT Highway System Access Manual.
  - Recommended taper length of 50 – 100 feet (to be coordinated with COK Engineering).
  - Ardurra recommends consideration of separate southbound right and left turn lanes at the driveway connection.
  - A traffic signal is not warranted during this phase of development.
- Ardurra recommends that the intersection sight distance be certified by a land surveyor prior to construction to verify that Asheville Highway at the Driveway Connection has adequate intersection sight distance to comply with City of Knoxville and AASHTO requirements.
- Ardurra recommends that the signs and pavement markings be installed in accordance with the standards provided in the *Manual on Uniform Traffic Control Devices* (MUTCD).

Attachment 1
Aerial Photos

Asheville Highway at I-40 Eastbound Ramp

Asheville Highway at I-40 Westbound Ramp

Asheville Highway at E Governor John Sevier Highway / River Turn Road

Asheville Highway at Holston Ferry Road

Attachment 2
Traffic Counts

Project: 377.030 Asheville Highway Commercial Development
Intersection: Asheville Highway at I-40 Eastbound Ramp
Date Conducted: Tuesday November 19, 2024

	I-40 Eastbound Ramp Southbound				Asheville Highway Westbound				Northbound				Asheville Highway Eastbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
7:00 AM	168	0	20	188	1	70	0	71	0	0	0	0	0	97	15	112	371
7:15 AM	186	0	32	218	6	100	0	106	0	0	0	0	0	114	15	129	453
7:30 AM	208	0	26	234	5	117	0	122	0	0	0	0	0	130	24	154	510
7:45 AM	217	0	30	247	4	83	0	87	0	0	0	0	0	102	21	123	457
Total	779	0	108	887	16	370	0	386	0	0	0	0	0	443	75	518	1791
8:00 AM	169	0	24	193	1	84	0	85	0	0	0	0	0	86	19	105	383
8:15 AM	190	0	29	219	4	73	0	77	0	0	0	0	0	64	12	76	372
8:30 AM	166	0	47	213	2	63	0	65	0	0	0	0	0	81	23	104	382
8:45 AM	159	0	39	198	4	52	0	56	0	0	0	0	0	86	27	113	367
Total	684	0	139	823	11	272	0	283	0	0	0	0	0	317	81	398	1504
9:00 AM	143	0	31	174	5	59	0	64	0	0	0	0	0	74	20	94	332
9:15 AM	142	0	30	172	3	63	0	66	0	0	0	0	0	82	24	106	344
9:30 AM	146	0	35	181	2	51	0	53	0	0	0	0	0	88	13	101	335
9:45 AM	163	0	40	203	5	33	0	38	0	0	0	0	0	85	19	104	345
Total	594	0	136	730	15	206	0	221	0	0	0	0	0	329	76	405	1356
10:00 AM	139	1	28	168	7	61	0	68	0	0	0	0		71	20	91	327
10:15 AM	156	0	32	188	1	56	0	57	0	0	0	0	0	87	15	102	347
10:30 AM	158	0	26	184	5	48	0	53	0	0	0	0	0	99	13	112	349
10:45 AM	151	0	23	174	4	57	0	61	0	0	0	0	0	79	16	95	330
Total	604	1	109	714	17	222	0	239	0	0	0	0	0	336	64	400	1353
11:00 AM	155	0	31	186	8	69	0	77	0	0	0	0	0	92	22	114	377
11:15 AM	158	0	39	197	4	49	0	53	0	0	0	0	0	82	13	95	345
11:30 AM	172	0	37	209	3	74	0	77	0	0	0	0	0	101	25	126	412
11:45 AM	142	0	44	186	6	65	0	71	0	0	0	0	0	71	21	92	349
Total	627	0	151	778	21	257	0	278	0	0	0	0	0	346	81	427	1483
12:00 PM	168	0	42	210	1	56	0	57	0	0	0	0	0	105	30	135	402
12:15 PM	180	0	35	215	3	70	0	73	0	0	0	0	0	93	30	123	411
12:30 PM	195	0	44	239	3	54	0	57	0	0	0	0	0	84	15	99	395
12:45 PM	185	0	36	221	2	67	0	69	0	0	0	0	0	92	16	108	398
Total	728	0	157	885	9	247	0	256	0	0	0	0	0	374	91	465	1606
1:00 PM	184	0	35	219	3	67	0	70	0	0	0	0	0	90	24	114	403
1:15 PM	188	0	33	221	3	68	0	71	0	0	0	0	0	95	20	115	407
1:30 PM	219	0	32	251	7	71	0	78	0	0	0	0	0	103	19	122	451
1:45 PM	208	0	29	237	2	57	0	59	0	0	0	0	0	96	21	117	413
Total	799	0	129	928	15	263	0	278	0	0	0	0	0	384	84	468	1674
2:00 PM	193	0	38	231	3	74	0	77	0	0	0	0	0	106	24	130	438
2:15 PM	235	0	37	272	3	62	0	65	0	0	0	0	0	103	24	127	464
2:30 PM	200	2	43	245	1	87	0	88	0	0	0	0	0	98	27	125	458
2:45 PM	334	3	36	373	5	102	0	107	0	0	0	0	0	135	37	172	652
Total	962	5	154	1121	12	325	0	337	0	0	0	0	0	442	112	554	2012
3:00 PM	217	0	32	249	7	62	0	69	0	0	0	0	0	116	27	143	461
3:15 PM	225	0	49	274	3	83	0	86	0	0	0	0	0	111	30	141	501
3:30 PM	271	0	53	324	1	76	0	77	0	0	0	0	0	93	21	114	515
3:45 PM	257	0	54	311	2	92	0	94	0	0	0	0	0	134	27	161	566
Total	970	0	188	1158	13	313	0	326	0	0	0	0	0	454	105	559	2043
4:00 PM	296	0	59	355	2	83	0	85	0	0	0	0	0	128	45	173	613
4:15 PM	322	1	48	371	4	81	0	85	0	0	0	0	0	96	28	124	580
4:30 PM	324	0	51	375	4	83	0	87	0	0	0	0	0	139	28	167	629
4:45 PM	337	0	51	388	2	89	0	91	0	0	0	0	0	130	26	156	635
Total	1279	1	209	1489	12	336	0	348	0	0	0	0	0	493	127	620	2457
5:00 PM	347	0	72	419	3	85	0	88	0	0	0	0	0	107	50	157	664
5:15 PM	356	0	50	406	3	79	0	82	0	0	0	0	0	119	42	161	649
5:30 PM	300	0	50	350	5	89	0	94	0	0	0	0	0	110	32	142	586
5:45 PM	242	0	51	293	1	71	0	72	0	0	0	0	0	92	31	123	488
Total	1245	0	223	1468	12	324	0	336	0	0	0	0	0	428	155	583	2387
Grand Total	9271	7	1703	10981	153	3135	0	3288	0	0	0	0	0	4346	1051	5397	19666
Approach %	84.4	0.1	15.5		4.7	95.3	0.0		#####	#####	#####		0.0	80.5	19.5		
Total %	47.1	0.0	8.7	55.8	0.8	15.9	0.0	16.7	0.0	0.0	0.0	0.0	0.0	22.1	5.3	27.4	

Project: 377.030 Asheville Highway Commercial Development
Intersection: Asheville Highway at I-40 Eastbound Ramp
Date Conducted: Tuesday November 19, 2024

AM Peak Hour	7:15 AM - 8:15 AM	1803
PM Peak Hour	4:30 PM - 5:30 PM	2577

	I-40 EB Ramp Southbound				Asheville Highway Westbound				Northbound				Asheville Highway Eastbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM																	
AM Peak Hour begins at 7:15 AM																	
7:15 AM	186	0	**32**	218	**6**	100	0	106	0	0	0	0	**0**	114	15	129	453
7:30 AM	208	0	26	234	5	**117**	0	122	0	0	0	0	0	**130**	**24**	154	**510**
7:45 AM	**217**	0	30	247	4	83	0	87	0	0	0	0	0	102	21	123	457
8:00 AM	169	0	24	193	1	84	0	85	0	0	0	0	0	86	19	105	383
Total Volume	780	0	112	892	16	384	0	400	0	0	0	0	0	432	79	511	1803
Future (1.0% over 5 yrs)	820	0	118		17	404	0		0	0	0		0	454	83		1895
PHF	0.90	-	0.88		0.67	0.82	-		-	-	-		-	0.83	0.82		0.88
Peak Hour Analysis from 3:00 PM to 6:00 PM																	
PM Peak Hour begins at 4:30 PM																	
4:30 PM	324	0	51	375	**4**	83	0	87	0	0	0	0	0	**139**	28	167	629
4:45 PM	337	0	51	388	2	**89**	0	91	0	0	0	0	0	130	26	156	635
5:00 PM	347	0	**72**	419	3	85	**0**	88	0	0	0	0	0	107	**50**	157	**664**
5:15 PM	**356**	0	50	406	3	79	0	82	0	0	0	0	0	119	42	161	649
Total Volume	1364	0	224	1588	12	336	0	348	0	0	0	0	0	495	146	641	2577
Future (1.0% over 5 yrs)	1434	0	235		13	353	0		0	0	0		0	520	153		2708
PHF	0.96	-	0.78		0.75	0.94	-		-	-	-		-	0.89	0.73		0.97

Project: 377.030 Asheville Highway Commercial Development
Intersection: Asheville Highway at I-40 Westbound Ramp
Date Conducted: Tuesday November 19, 2024

	Southbound				Asheville Highway Westbound				I-40 Westbound Ramp Northbound				Asheville Highway Eastbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
7:00 AM	0	0	0	0	0	60	365	425	12	0	5	17	30	230	0	260	702
7:15 AM	0	0	0	0	0	93	391	484	15	0	6	21	32	274	0	306	811
7:30 AM	0	0	0	0	0	94	379	473	22	0	3	25	38	310	0	348	846
7:45 AM	0	0	0	0	0	64	396	460	23	0	5	28	41	295	0	336	824
Total	0	0	0	0	0	311	1531	1842	72	0	19	91	141	1109	0	1250	3183
8:00 AM	0	0	0	0	0	68	304	372	17	0	1	18	42	220	0	262	652
8:15 AM	0	0	0	0	0	72	300	372	9	0	9	18	26	244	0	270	660
8:30 AM	0	0	0	0	0	51	301	352	14	0	4	18	23	217	0	240	610
8:45 AM	0	0	0	0	0	43	246	289	12	0	3	15	32	227	0	259	563
Total	0	0	0	0	0	234	1151	1385	52	0	17	69	123	908	0	1031	2485
9:00 AM	0	0	0	0	0	56	249	305	7	0	6	13	27	198	0	225	543
9:15 AM	0	0	0	0	0	49	257	306	18	1	6	25	32	188	0	220	551
9:30 AM	0	0	0	0	0	45	264	309	8	0	4	12	35	205	0	240	561
9:45 AM	0	0	0	0	0	30	220	250	7	0	6	13	29	231	0	260	523
Total	0	0	0	0	0	180	990	1170	40	1	22	63	123	822	0	945	2178
10:00 AM	0	0	0	0	0	54	200	254	15	0	4	19	21	204	0	225	498
10:15 AM	0	0	0	0	0	49	211	260	8	0	4	12	28	220	0	248	520
10:30 AM	0	0	0	0	0	44	213	257	8	0	8	16	32	247	0	279	552
10:45 AM	0	0	0	0	0	59	225	284	7	0	3	10	32	203	0	235	529
Total	0	0	0	0	0	206	849	1055	38	0	19	57	113	874	0	987	2099
11:00 AM	0	0	0	0	0	70	232	302	7	1	6	14	34	228	0	262	578
11:15 AM	0	0	0	0	0	46	192	238	6	0	7	13	26	226	0	252	503
11:30 AM	0	0	0	0	0	55	218	273	19	0	7	26	19	255	0	274	573
11:45 AM	0	0	0	0	0	59	209	268	15	0	6	21	27	199	0	226	515
Total	0	0	0	0	0	230	851	1081	47	1	26	74	106	908	0	1014	2169
12:00 PM	0	0	0	0	0	51	203	254	9	1	5	15	23	258	0	281	550
12:15 PM	0	0	0	0	0	57	229	286	12	1	6	19	25	254	0	279	584
12:30 PM	0	0	0	0	0	50	197	247	11	0	8	19	26	253	0	279	545
12:45 PM	0	0	0	0	0	55	175	230	19	0	7	26	25	255	0	280	536
Total	0	0	0	0	0	213	804	1017	51	2	26	79	99	1020	0	1119	2215
1:00 PM	0	0	0	0	0	56	225	281	14	0	4	18	38	244	0	282	581
1:15 PM	0	0	0	0	0	59	212	271	10	0	8	18	33	258	0	291	580
1:30 PM	0	0	0	0	0	59	198	257	19	0	6	25	34	290	0	324	606
1:45 PM	0	0	0	0	0	52	196	248	13	0	5	18	29	280	0	309	575
Total	0	0	0	0	0	226	831	1057	56	0	23	79	134	1072	0	1206	2342
2:00 PM	0	0	0	0	0	66	184	250	13	0	10	23	40	264	0	304	577
2:15 PM	0	0	0	0	0	56	197	253	13	0	7	20	31	314	0	345	618
2:30 PM	0	0	0	0	0	75	224	299	14	1	2	17	29	276	0	305	621
2:45 PM	0	0	0	0	0	96	254	350	17	0	6	23	48	317	0	365	738
Total	0	0	0	0	0	293	859	1152	57	1	25	83	148	1171	0	1319	2554
3:00 PM	0	0	0	0	0	53	224	277	17	0	5	22	26	315	0	341	640
3:15 PM	0	0	0	0	0	65	246	311	16	0	4	20	21	329	0	350	681
3:30 PM	0	0	0	0	0	70	242	312	16	0	8	24	24	339	0	363	699
3:45 PM	0	0	0	0	0	81	292	373	13	0	5	18	35	358	0	393	784
Total	0	0	0	0	0	269	1004	1273	62	0	22	84	106	1341	0	1447	2804
4:00 PM	0	0	0	0	0	62	241	303	17	0	6	23	38	384	0	422	748
4:15 PM	0	0	0	0	0	70	260	330	14	0	2	16	27	406	0	433	779
4:30 PM	0	0	0	0	0	66	280	346	22	0	5	27	28	437	0	465	838
4:45 PM	0	0	0	0	0	64	276	340	29	0	9	38	20	447	0	467	845
Total	0	0	0	0	0	262	1057	1319	82	0	22	104	113	1674	0	1787	3210
5:00 PM	0	0	0	0	0	61	281	342	25	0	7	32	17	444	0	461	835
5:15 PM	0	0	0	0	0	67	270	337	24	0	7	31	33	448	0	481	849
5:30 PM	0	0	0	0	0	63	275	338	25	0	8	33	20	400	0	420	791
5:45 PM	0	0	0	0	0	52	187	239	20	0	1	21	13	312	0	325	585
Total	0	0	0	0	0	243	1013	1256	94	0	23	117	83	1604	0	1687	3060
Grand Total	0	0	0	0	0	2667	10940	13607	651	5	244	900	1289	12503	0	13792	28299
Approach %	#####	#####	#####		0.0	19.6	80.4		72.3	0.6	27.1		9.3	90.7	0.0		
Total %	0.0	0.0	0.0	0.0	0.0	9.4	38.7	48.1	2.3	0.0	0.9	3.2	4.6	44.2	0.0	48.7	

Project: 377.030 Asheville Highway Commercial Development
Intersection: Asheville Highway at I-40 Westbound Ramp
Date Conducted: Tuesday November 19, 2024

AM Peak Hour	7:00 AM - 8:00 AM	3183
PM Peak Hour	4:30 PM - 5:30 PM	3367

	I-40 EB Ramp Southbound				Asheville Highway Westbound				Northbound				Asheville Highway Eastbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM																	
AM Peak Hour begins at 7:00 AM																	
7:00 AM	0	0	0	0	0	60	365	425	12	0	5	17	30	230	0	260	702
7:15 AM	0	0	0	0	0	93	391	484	15	0	**6**	21	32	274	0	306	811
7:30 AM	0	0	0	0	0	**94**	379	473	22	0	3	25	38	**310**	0	348	**846**
7:45 AM	0	0	0	0	0	64	**396**	460	**23**	0	5	28	**41**	295	0	336	824
Total Volume	0	0	0	0	0	311	1531	1842	72	0	19	91	141	1109	0	1250	3183
Future (1.0% over 5 yrs)	0	0	0		0	327	1609		76	0	20		148	1166	0		3345
PHF	-	-	-		-	0.83	0.97		0.78	-	0.79		0.86	0.89	-		0.94
Peak Hour Analysis from 3:00 PM to 6:00 PM																	
PM Peak Hour begins at 4:30 PM																	
4:30 PM	0	0	0	0	0	66	280	346	22	0	5	27	28	437	0	465	838
4:45 PM	0	0	0	0	0	64	276	340	**29**	0	**9**	38	20	447	0	467	845
5:00 PM	0	0	0	0	0	61	**281**	342	25	0	7	32	17	444	0	461	835
5:15 PM	0	0	0	0	0	**67**	270	337	24	0	7	31	**33**	**448**	0	481	**849**
Total Volume	0	0	0	0	0	258	1107	1365	100	0	28	128	98	1776	0	1874	3367
Future (1.0% over 5 yrs)	0	0	0		0	271	1163		105	0	29		103	1867	0		3539
PHF	-	-	-		-	0.96	0.98		0.86	-	0.78		0.74	0.99	-		0.99

Project: 377.030 Asheville Highway Commercial Development
Intersection: Asheville Highway at River Turn Road / E Governor John Sevier Highway
Date Conducted: Tuesday December 4, 2024 & Wednesday December 5, 2024

	River Turn Road Southbound				Asheville Highway Westbound				E Gov. John Sevier Hwy Northbound				Asheville Highway Eastbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
7:00 AM	4	1	1	6	27	258	15	300	99	0	18	117	9	106	103	218	641
7:15 AM	5	3	6	14	18	292	23	333	130	7	21	158	12	113	124	249	754
7:30 AM	5	7	13	25	22	298	19	339	96	3	19	118	17	171	134	322	804
7:45 AM	8	4	7	19	20	301	13	334	99	6	14	119	11	167	127	305	777
Total	22	15	27	64	87	1149	70	1306	424	16	72	512	49	557	488	1094	2976
8:00 AM	4	7	7	18	23	254	18	295	94	7	21	122	17	110	105	232	667
8:15 AM	4	4	13	21	14	246	18	278	83	4	14	101	18	124	92	234	634
8:30 AM	6	6	7	19	19	246	10	275	95	6	17	118	20	108	88	216	628
8:45 AM	7	9	5	21	14	216	5	235	83	7	13	103	13	142	73	228	587
Total	21	26	32	79	70	962	51	1083	355	24	65	444	68	484	358	910	2516
9:00 AM	4	6	3	13	17	180	9	206	80	1	16	97	11	126	52	189	505
9:15 AM	5	1	5	11	18	149	11	178	81	6	13	100	15	133	65	213	502
9:30 AM	8	6	3	17	21	179	8	208	68	2	17	87	13	123	48	184	496
9:45 AM	7	2	10	19	9	157	9	175	94	2	15	111	14	106	67	187	492
Total	24	15	21	60	65	665	37	767	323	11	61	395	53	488	232	773	1995
10:00 AM	5	1	3	9	13	146	7	166	72	1	9	82	14	118	96	228	485
10:15 AM	4	3	8	15	18	176	9	203	91	3	20	114	15	106	50	171	503
10:30 AM	6	1	9	16	17	152	4	173	90	4	19	113	16	114	74	204	506
10:45 AM	9	1	5	15	13	164	5	182	66	3	16	85	17	127	64	208	490
Total	24	6	25	55	61	638	25	724	319	11	64	394	62	465	284	811	1984
11:00 AM	10	6	15	31	13	137	7	157	83	2	12	97	15	146	63	224	509
11:15 AM	2	3	9	14	10	139	5	154	94	3	13	110	18	111	76	205	483
11:30 AM	18	4	10	32	17	134	7	158	75	7	11	93	17	116	69	202	485
11:45 AM	11	2	7	20	15	152	9	176	92	2	14	108	16	135	74	225	529
Total	41	15	41	97	55	562	28	645	344	14	50	408	66	508	282	856	2006
4:00 PM	10	11	9	30	22	221	5	248	132	7	34	173	21	260	102	383	834
4:15 PM	14	7	10	31	15	164	8	187	120	3	33	156	14	270	114	398	772
4:30 PM	13	4	12	29	28	184	6	218	146	5	34	185	30	291	112	433	865
4:45 PM	14	9	17	40	22	173	3	198	146	4	31	181	20	312	98	430	849
Total	51	31	48	130	87	742	22	851	544	19	132	695	85	1133	426	1644	3320
5:00 PM	16	12	15	43	20	165	3	188	146	6	27	179	11	335	90	436	846
5:15 PM	13	7	11	31	22	171	7	200	131	3	37	171	15	355	90	460	862
5:30 PM	21	3	12	36	13	189	1	203	108	2	35	145	11	328	113	452	836
5:45 PM	10	2	20	32	14	159	3	176	125	3	25	153	11	262	75	348	709
Total	60	24	58	142	69	684	14	767	510	14	124	648	48	1280	368	1696	3253
6:00 PM	12	7	9	28	11	195	8	214	96	2	18	116	12	225	87	324	682
6:15 PM	12	3	20	35	11	141	5	157	82	2	12	96	7	189	88	284	572
6:30 PM	8	3	11	22	12	122	1	135	93	5	13	111	16	195	67	278	546
6:45 PM	9	6	4	19	8	84	2	94	48	1	9	58	7	151	58	216	387
Total	41	19	44	104	42	542	16	600	319	10	52	381	42	760	300	1102	2187
Grand Total	284	151	296	731	536	5944	263	6743	3138	119	620	3877	473	5675	2738	8886	20237
Approach %	38.9	20.7	40.5		7.9	88.2	3.9		80.9	3.1	16.0		5.3	63.9	30.8		
Total %	1.4	0.7	1.5	3.6	2.6	29.4	1.3	33.3	15.5	0.6	3.1	19.2	2.3	28.0	13.5	43.9	

Project: 377.030 Asheville Highway Commercial Development
Intersection: Asheville Highway at River Turn Road / E Governor John Sevier Highway
Date Conducted: Tuesday December 4, 2024 & Wednesday December 5, 2024

AM Peak Hour	7:15 AM - 8:15 AM	3002
PM Peak Hour	4:30 PM - 5:30 PM	3422

	River Turn Road Southbound				Asheville Highway Westbound				E Gov. John Sevier Hwy Northbound				Asheville Highway Eastbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM																	
AM Peak Hour begins at 7:15 AM																	
7:15 AM	5	3	6	14	18	292	**23**	333	**130**	**7**	**21**	158	12	113	124	249	754
7:30 AM	5	**7**	**13**	25	22	298	19	339	96	3	19	118	**17**	**171**	**134**	322	**804**
7:45 AM	**8**	4	7	19	20	**301**	13	334	99	6	14	119	11	167	127	305	777
8:00 AM	4	7	7	18	**23**	254	18	295	94	7	21	122	17	110	105	232	667
Total Volume	22	21	33	76	83	1145	73	1301	419	23	75	517	57	561	490	1108	3002
Future (1.0% over 5 yrs)	23	22	35		87	1203	77		440	24	79		60	590	515		3155
PHF	0.69	0.75	0.63		0.90	0.95	0.79		0.81	0.82	0.89		0.84	0.82	0.91		0.93
Peak Hour Analysis from 3:00 PM to 6:00 PM																	
PM Peak Hour begins at 4:30 PM																	
4:30 PM	13	4	12	29	**28**	**184**	6	218	**146**	5	34	185	**30**	291	**112**	433	**865**
4:45 PM	14	9	**17**	40	22	173	3	198	146	4	31	181	20	312	98	430	849
5:00 PM	**16**	**12**	15	43	20	165	3	188	146	**6**	27	179	11	335	90	436	846
5:15 PM	13	7	11	31	22	171	**7**	200	131	3	**37**	171	15	**355**	90	460	862
Total Volume	56	32	55	143	92	693	19	804	569	18	129	716	76	1293	390	1759	3422
Future (1.0% over 5 yrs)	59	34	58		97	728	20		598	19	136		80	1359	410		3597
PHF	0.88	0.67	0.81		0.82	0.94	0.68		0.97	0.75	0.87		0.63	0.91	0.87		0.99

Project: 377.030 Asheville Highway Commercial Development
Intersection: Asheville Highway at Holston Ferry Road
Date Conducted: Wednesday December 4, 2024

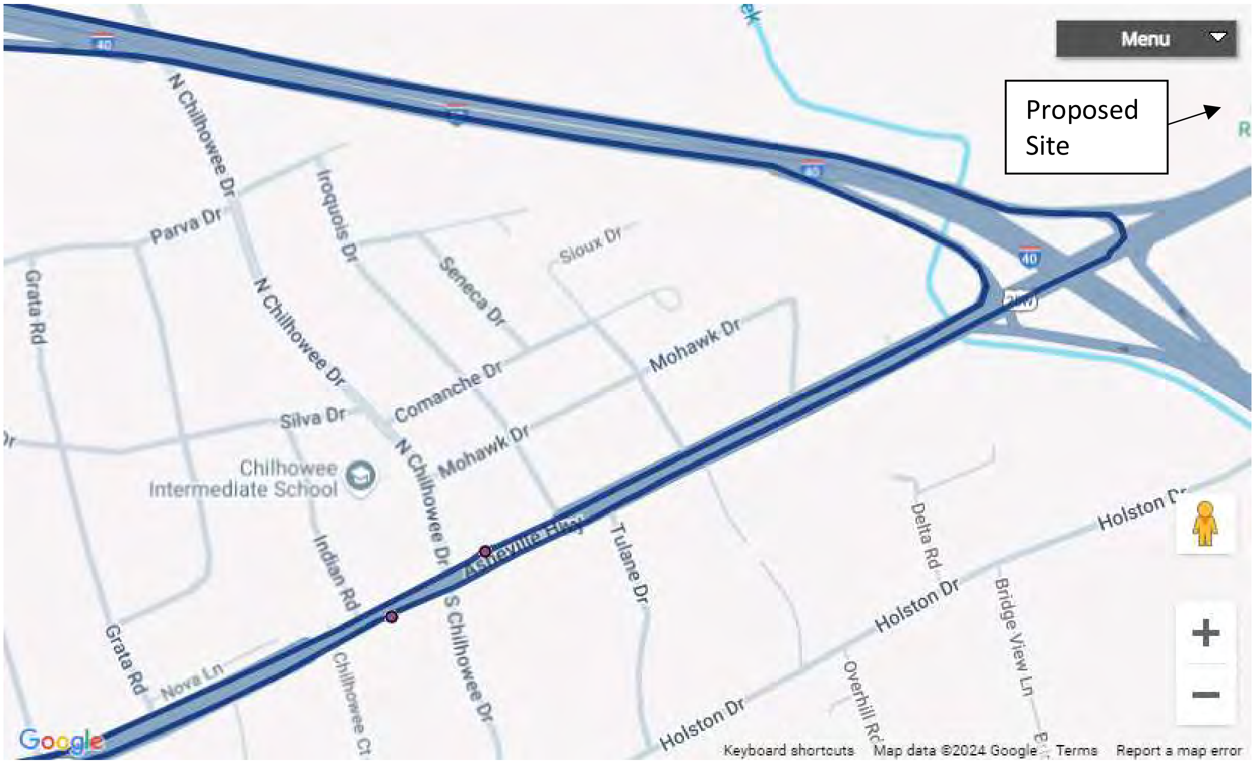
	Holston Ferry Road Southbound					Asheville Highway Westbound				Driveway Northbound					Asheville Highway Eastbound				
Start	Left	Thru	Right	Total	U-Turn	Left	Thru	Right	Total	Left	Thru	Right	Total	U-Turn	Left	Thru	Right	Total	Int. Total
7:00 AM	0	0	1	1	0	4	335	2	341	0	0	1	1	0	2	125	0	127	470
7:15 AM	0	0	0	0	0	3	348	8	359	0	0	0	0	2	3	135	0	140	499
7:30 AM	0	0	1	1	0	3	352	5	360	0	0	1	1	2	3	193	0	198	560
7:45 AM	0	0	0	0	0	6	366	4	376	0	0	1	1	1	1	192	0	194	571
Total	0	0	2	2	0	16	1401	19	1436	0	0	3	3	5	9	645	0	659	2100
8:00 AM	0	0	5	5	0	1	289	0	290	0	0	0	0	1	3	134	0	138	433
8:15 AM	0	0	2	2	0	1	283	5	289	0	0	0	0	1	1	137	0	139	430
8:30 AM	0	0	0	0	1	4	275	1	281	0	0	0	0	4	2	129	0	135	416
8:45 AM	0	0	5	5	0	3	233	6	242	0	0	0	0	3	3	156	0	162	409
Total	0	0	12	12	1	9	1080	12	1102	0	0	0	0	9	9	556	0	574	1688
9:00 AM	0	0	10	10	0	2	207	9	218	0	0	0	0	1	5	145	0	151	379
9:15 AM	0	0	3	3	0	2	186	2	190	0	0	0	0	0	5	142	0	147	340
9:30 AM	0	0	5	5	1	0	206	5	212	0	0	2	2	1	3	138	0	142	361
9:45 AM	0	0	2	2	0	1	183	4	188	0	0	1	1	0	4	122	0	126	317
Total	0	0	20	20	1	5	782	20	808	0	0	3	3	2	17	547	0	566	1397
10:00 AM	0	0	1	1	0	0	190	3	193	0	0	1	1	2	2	131	0	135	330
10:15 AM	0	0	2	2	0	1	179	2	182	0	0	0	0	2	6	117	0	125	309
10:30 AM	0	0	6	6	0	2	170	7	179	0	0	0	0	1	6	139	0	146	331
10:45 AM	0	0	5	5	0	0	175	2	177	0	0	1	1	0	5	146	0	151	334
Total	0	0	14	14	0	3	714	14	731	0	0	2	2	5	19	533	0	557	1304
11:00 AM	0	0	6	6	0	2	166	5	173	0	0	1	1	2	2	164	0	168	348
11:15 AM	0	0	2	2	0	1	155	9	165	0	0	0	0	0	5	129	0	134	301
11:30 AM	0	0	6	6	1	1	148	6	156	0	0	0	0	4	4	140	0	148	310
11:45 AM	0	0	9	9	0	1	170	9	180	0	0	1	1	1	4	159	0	164	354
Total	0	0	23	23	1	5	639	29	674	0	0	2	2	7	15	592	0	614	1313
12:00 PM	0	0	7	7	0	3	180	14	197	0	0	2	2	2	3	191	0	196	402
12:15 PM	0	0	7	7	1	3	186	3	193	0	0	2	2	2	5	157	0	164	366
12:30 PM	0	0	8	8	0	1	193	7	201	0	0	1	1	2	8	180	0	190	400
12:45 PM	0	0	5	5	0	1	160	3	164	0	0	0	0	5	9	166	0	180	349
Total	0	0	27	27	1	8	719	27	755	0	0	5	5	11	25	694	0	730	1517
1:00 PM	0	0	5	5	1	3	175	8	187	0	0	2	2	3	9	175	0	187	381
1:15 PM	0	0	7	7	0	3	177	10	190	0	0	1	1	2	7	191	0	200	398
1:30 PM	0	0	9	9	1	1	209	5	216	0	0	0	0	0	3	203	0	206	431
1:45 PM	0	0	1	1	0	5	173	6	184	0	0	0	0	3	3	185	0	191	376
Total	0	0	22	22	2	12	734	29	777	0	0	3	3	8	22	754	0	784	1586
2:00 PM	0	0	8	8	1	1	160	2	164	0	0	1	1	3	7	188	0	198	371
2:15 PM	0	0	5	5	0	2	175	6	183	0	0	0	0	4	4	214	0	222	410
2:30 PM	0	0	8	8	0	1	154	4	159	0	0	0	0	1	5	243	0	249	416
2:45 PM	0	0	7	7	0	2	218	3	223	0	0	2	2	1	5	236	0	242	474
Total	0	0	28	28	1	6	707	15	729	0	0	3	3	9	21	881	0	911	1671
3:00 PM	0	0	7	7	0	3	168	3	174	0	0	1	1	1	5	255	0	261	443
3:15 PM	0	0	4	4	0	1	168	5	174	0	0	0	0	3	4	266	0	273	451
3:30 PM	0	0	4	4	0	1	199	5	205	0	0	0	0	1	2	275	0	278	487
3:45 PM	0	0	5	5	0	1	221	6	228	0	0	1	1	2	2	297	0	301	535
Total	0	0	20	20	0	6	756	19	781	0	0	2	2	7	13	1093	0	1113	1916
4:00 PM	0	0	3	3	1	2	209	5	217	0	0	0	0	4	5	308	0	317	537
4:15 PM	0	0	4	4	0	0	188	2	190	0	0	0	0	2	9	342	0	353	547
4:30 PM	0	0	7	7	1	0	192	5	198	0	0	0	0	4	8	290	0	302	507
4:45 PM	0	0	4	4	0	1	201	14	216	0	0	2	2	2	8	334	0	344	566
Total	0	0	18	18	2	3	790	26	821	0	0	2	2	12	30	1274	0	1316	2157
5:00 PM	0	0	8	8	0	2	206	3	211	0	0	1	1	2	7	371	0	380	600
5:15 PM	0	0	5	5	0	3	183	2	188	0	0	3	3	1	3	356	0	360	556
5:30 PM	0	0	4	4	0	2	188	5	195	0	0	0	0	1	4	332	0	337	536
5:45 PM	0	0	5	5	0	1	206	12	219	0	0	3	3	6	2	273	0	281	508
Total	0	0	22	22	0	8	783	22	813	0	0	7	7	10	16	1332	0	1358	2200
Grand Total	0	0	208	208	9	81	9105	232	9427	0	0	32	32	85	196	8901	0	9182	18849
Approach %	0.0	0.0	100.0		1E-03	0.9	96.6	2.5		0.0	0.0	100.0		0.0	2.1	96.9	0.0		
Total %	0.0	0.0	1.1	1.1	0.0	0.4	48.3	1.2	50.0	0.0	0.0	0.2	0.2	0.0	1.0	47.2	0.0	48.7	

Project: 377.030 Asheville Highway Commercial Development
Intersection: Asheville Highway at Holston Ferry Road
Date Conducted: Wednesday December 4, 2024

AM Peak Hour	7:00 AM - 8:00 AM	2100
PM Peak Hour	4:45 PM - 5:45 PM	2258

	Holston Ferry Road Southbound				Asheville Highway Westbound					Driveway Northbound				Asheville Highway Eastbound					
Start	Left	Thru	Right	Total	U-Turn	Left	Thru	Right	Total	Left	Thru	Right	Total	U-Turn	Left	Thru	Right	Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM																			
AM Peak Hour begins at 7:45 AM																			
7:45 AM	0	0	**1**	1	0	4	335	2	341	0	0	**1**	1	0	2	125	0	127	470
8:00 AM	0	0	0	0	0	3	348	**8**	359	0	0	0	0	**2**	**3**	135	0	140	499
8:15 AM	0	0	1	1	0	3	352	5	360	0	0	1	1	2	3	**193**	0	198	560
8:30 AM	0	0	0	0	0	**6**	**366**	4	376	0	0	1	1	1	1	192	0	194	**571**
Total Volume	0	0	2	2	0	16	1401	19	1436	0	0	3	3	5	9	645	0	659	2100
Future (1.0% over 5 yrs)	0	0	2		0	17	1472	20		0	0	3		5	9	678	0		2207
PHF	-	-	0.50		-	0.67	0.96	0.59		-	-	0.75		0.63	0.75	0.84	-		0.92
Peak Hour Analysis from 3:00 PM to 6:00 PM																			
PM Peak Hour begins at 5:00 PM																			
5:00 PM	0	0	4	4	0	1	201	**14**	216	0	0	2	2	**2**	**8**	334	0	344	566
5:15 PM	0	0	**8**	8	0	2	**206**	3	211	0	0	1	1	2	7	**371**	0	380	**600**
5:30 PM	0	0	5	5	0	**3**	183	2	188	0	0	**3**	3	1	3	356	**0**	360	556
5:45 PM	0	0	4	4	0	2	188	5	195	0	0	0	0	1	4	332	0	337	536
Total Volume	0	0	21	21	0	8	778	24	810	0	0	6	6	6	22	1393	0	1421	2258
Future (1.0% over 5 yrs)	0	0	22		0	8	818	25		0	0	6		6	23	1464	0		2373
PHF	-	-	0.66		-	0.67	0.94	0.43		-	-	0.50		0.75	0.69	0.94	-		0.94

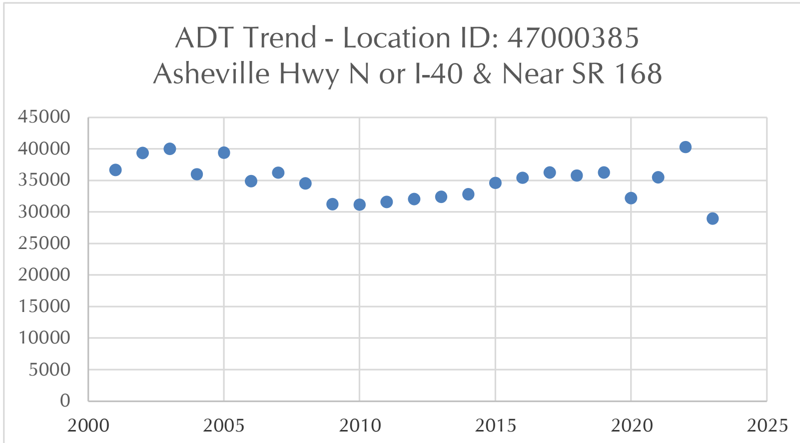
Attachment 3
Transit Networks



KAT Route 34 (Burlington Shopper)

Attachment 4
ADT Trends

	Year	Adjusted Average Daily Traffic
1	2001	36626
2	2002	39337
3	2003	39984
4	2004	35975
5	2005	39355
6	2006	34847
7	2007	36193
8	2008	34495
9	2009	31188
10	2010	31145
11	2011	31581
12	2012	32016
13	2013	32390
14	2014	32770
15	2015	34571
16	2016	35401
17	2017	36244
18	2018	35762
19	2019	36225
20	2020	32168
21	2021	35477
22	2022	40265
23	2023	28930



Most Recent Trend Line Growth

Year	ADT
2001	36626
2022	40265

Annual Percent Growth **0.90%**

Attachment 5
Trip Generation

Project: Asheville Highway Property
Date Conducted: 2/13/2025

Soccer Complex (LUC 488)
10 Fields

Average Daily Traffic
Average Rate = 71.33
T = 10 * (71.33)
T = 713

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 0.99
T = 0.99 * (10)
T = 10

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 16.43
T = 16.43 * (10)
T = 164

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	713	50%	50%	357	357
AM Peak Hour	10	61%	39%	6	4
PM Peak Hour	164	66%	34%	108	56

Project: Asheville Highway Property
Date Conducted: 1/16/2025

Campground/Recreational Vehicle Park (LUC 416)
200 RV Pads

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
T = 0.16*(X) + 2.93
T = 0.16*(200) + 2.93
T = 35

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 0.27
T = 0.27 * (200)
T = 54

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
AM Peak Hour	35	36%	64%	13	22
PM Peak Hour	54	65%	35%	35	19

Project: Asheville Highway Property
Date Conducted: 1/8/2025

Heath/Fitness Club (LUC 492)
20,000 SF (Estimate)

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 1.31
T = 1.31 * (20)
T = 26

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 5.19
T = 3.45 * (20)
T = 69

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
AM Peak Hour	26	51%	49%	13	13
PM Peak Hour	69	57%	43%	39	30

Project: Asheville Highway Property
Date Conducted: 1/16/2025

Fast Food Restaurant w/ Drive - Through Window (LUC 934)
4,000 SF (Estimate)

Average Daily Traffic
Average Rate = 467.48
T = 467.48 * (4)
T = 1870

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 44.61
T = 44.61 * (4)
T = 178

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 33.03
T = 33.03 * (4)
T = 132

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	1870	50%	50%	935	935
AM Peak Hour	178	51%	49%	91	87
PM Peak Hour	132	52%	48%	69	63

Project: Asheville Highway Property
Date Conducted: 4/22/2025

Shopping Plaza (LUC 821) (40-150K) No Supermarket
90,000 SF (Estimate)

Average Daily Traffic
Average Rate = 67.52
T = 67.52 * (90)
T = 6077

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 1.73
T = 1.73 * (90)
T = 156

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 5.19
T = 5.19 * (90)
T = 467

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	6077	50%	50%	3039	3039
AM Peak Hour	156	62%	38%	97	59
PM Peak Hour	467	49%	51%	229	238

Trip Generation							
			Daily	AM Peak Hour		PM Peak Hour	
ITE Code	Land Use	Density	Total	Enter	Exit	Enter	Exit
488	Soccer Complex	10 Fields	713	6	4	108	56
416	RV Park	200 RV Pads	35	13	22	35	19
492	Health/Fitness Club	20,000 SF	-	13	13	39	30
934	Fast-Food Restaurant with Drive-Through Window	4,000 SF	1870	91	87	69	63
Pass-By Reduction 40%			-748	-36	-35	-28	-25
821	Shopping Plaza (40-150K) - No Supermarket	90,000 SF	6077	97	59	229	238
Pass-By Reduction 30%			-1823	-29	-18	-69	-71
		New Trips	**6124**	**155**	**133**	**384**	**309**
		Pass-By Trips	**2571**	**66**	**53**	**96**	**97**

KNOXVILLE•KNOX COUNTY

MPC

METROPOLITAN PLANNING COMMISSION

TENNESSEE

MEMORANDUM

RECEIVED
MAR 12 1997
ALLEN & HOSHALL, INC.
Knoxville, Tenn.

TO: Traffic Impact Study Reviewers and Preparers

FROM: Cindy Pionke

DATE: March 10, 1997

SUBJECT: Minutes from October 11, 1996 Meeting

Two items were presented for discussion at our last meeting. Hollis Loveday did a presentation on pass-by rates for a few specific land uses and Darcy Sullivan did a presentation on auxiliary lane issues. These specific matters seemed to cause some problems over the past year.

Percentage of pass-by trips for fast-food restaurants, supermarkets, convenience markets and shopping centers were discussed. The following percentages were agreed upon.

LAND USE	PERCENTAGE
Fast-food Restaurant	40
Supermarket	
> 50,000 SF	10
25,000 - 50,000 SF	35
< 25,000 SF	55
Convenience Market	
< 10,000 ADT	60
10,000 - 20,000 ADT	65
20,000 - 30,000 ADT	70
30,000 - 40,000 ADT	75
> 40,000 ADT	80
Shopping Center	
Use GLA formula up to 30%	

Attached is the draft "Procedure for Determining Need for and Design of Auxiliary Lanes on Uncontrolled Approaches to Intersections and Driveways". **Please note that the bay taper rates have changed since we met.** The proposed 15:1 and 20:1 taper rates were previously 14:1 and 16:1, respectively. This procedure is for left and right turn lanes on two-lane roadways. The recommendation for four-lane roadways was to exercise judgment because no particular quantification method leads to consistent results.

Attachment 6
Signal Timing Worksheets

Intersection Name : Asheville Hwy I-40EB 360								
Basic Timing (seconds)	**Phase 1**	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**	**Phase 7**	**Phase 8**
Min Green	10	6	6					
Gap / Extension	4	2	4					
Max 1	24	12	45					
Max 2	50	50	50					
Yellow Clearance	4	4	4					
Red Clearance	1	1	3					
Walk								
Pedestrian Clearance								
Max Recall	x	X	X					
Active (Enable) Phases		X						

Coordination Timing/(seconds)									
Split #	**Coord. Phase**	**Phase 1**	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**	**Phase 7**	**Phase 8**
Split 1	**1**	**28**	**14**	**48**					
Split 2	**1**	**27**	**14**	**59**					
Split 3									
Split 4									
Split 5									
Split 6									

Pattern Table					Lead / Lag		Notes
Pattern#	**Cycle**	**Offset**	**Split**	**Seq. #**	**Phase #**		
1	**90**	**49**	**1**				
2	**100**	**31**	**2**				
3							
4							
5							
6							

Day Plan Events					
Day Plan	**HH:MM**	**Pattern**	**Day Plan**	**HH:MM**	**Pattern**
1	**0000**	**Free**			
1	**0630**	**1**			
1	**1300**	**2**			
1	**2030**	**Free**			

Week Day Plan							
Plan	**Sun**	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
1	**x**	**x**	**x**	**x**	**x**	**x**	**x**

Notes :OVLA 1 and 2

Intersection Name :Ashville Hwy I 40WB				362				
Basic Timing (seconds)	**Phase 1**	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**	**Phase 7**	**Phase 8**
Min Green	6	12		5				
Gap / Extension	3	3		3				
Max 1	51	22		12				
Max 2	50	50		50				
Yellow Clearance	4	4		4				
Red Clearance	1	1		1				
Walk								
Pedestrian Clearance								
Max Recall		X						
Active (Enable) Phases	x	x		X				

Coordination Timing/(seconds)

Split #	Coord. Phase	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Split 1		41	28		21				
Split 2	2	56	27		17				
Split 3									
Split 4									
Split 5									
Split 6									

Pattern Table					Lead / Lag		Notes
Pattern#	Cycle	Offset	Split	Seq. #	Phase #		
1	90	49	1				
2	100	31	2				
3							
4							
5							
6							

Day Plan Events

Day Plan	HH:MM	Pattern	Day Plan	HH:MM	Pattern
1	0000	Free			
1	0630	1			
1	1300	2			
1	2030	free			

Week Day Plan

Plan	Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	x	x	x	x	x	x	x

Notes :OVLA is 1 and 2

Intersection Name : Asheville Hwy and John Sevier 366

Basic Timing (seconds)	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Min Green	6	15	6	6	6	15		
Gap / Extension	2	3	2	5	2	3		
Max 1	20	55	20	25	20	55		
Max 2	25	55	25	30	25	55		
Yellow Clearance	4	4	4	4	4	4		
Red Clearance	1	1	1	1	1	1		
Walk								
Pedestrian Clearance								
Max Recall		x				X		
Active (Enable) Phases	x	x	x	x	x	X		

Coordination Timing/(seconds)

Split #	Coord. Phase	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Split 1	2	16	57	16	41	16	57	16	41
Split 2	2	14	52	17	27	14	52	17	27
Split 3	2	14	52	17	27	14	52	17	27
Split 4	2	14	62	15	34	14	62	15	34
Split 5									
Split 6									

Pattern Table					Lead / Lag		Notes
Pattern#	Cycle	Offset	Split	Seq. #	Phase #		
1	130	0	1				
2	110	0	2				
3	110	105	3				
4	125	115	4				
5							
6							

Day Plan Events

Day Plan	HH:MM	Pattern	Day Plan	HH:MM	Pattern
1	0000	Free	2	0000	Free
1	0600	1	2	0800	2
1	0900	2	2	1300	3
1	1200	3	2	2000	free
1	1300	4			
1	1830	3	3	0000	Free
1	2030	free	3	0900	2
			3	1100	3
			3	2000	Free

Week Day Plan

Plan	Sun	Mon	Tue	Wed	Thu	Fri	Sat
1		x	x	x	x	X	
2							x
3	x						

Notes :

Max 3 on phase 4 85 seconds with 20 second adjsut

Attachment 7
Intersection Worksheets – Existing AM/PM Peaks

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	432	79	16	384	0	0	0	0	780	0	112
Future Volume (vph)	0	432	79	16	384	0	0	0	0	780	0	112
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Lane Util. Factor		0.95		1.00	0.95					0.95	0.95	1.00
Frt		0.98		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3358		1719	3438					1633	1633	1538
Flt Permitted		1.00		0.20	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3358		361	3438					1633	1633	1538
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	491	90	18	436	0	0	0	0	886	0	127
RTOR Reduction (vph)	0	24	0	0	0	0	0	0	0	0	0	56
Lane Group Flow (vph)	0	557	0	18	436	0	0	0	0	443	443	71
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type		NA		pm+pt	NA					Perm	NA	Perm
Protected Phases		4		3	8						6	
Permitted Phases				8						6		6
Actuated Green, G (s)		22.6		28.0	28.0					50.0	50.0	50.0
Effective Green, g (s)		22.6		28.0	28.0					50.0	50.0	50.0
Actuated g/C Ratio		0.25		0.31	0.31					0.56	0.56	0.56
Clearance Time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Vehicle Extension (s)		4.0		2.0	4.0					4.0	4.0	4.0
Lane Grp Cap (vph)		843		148	1069					907	907	854
v/s Ratio Prot		c0.17		0.00	c0.13							
v/s Ratio Perm				0.03						c0.27	0.27	0.05
v/c Ratio		0.66		0.12	0.41					0.49	0.49	0.08
Uniform Delay, d1		30.3		22.7	24.5					12.2	12.2	9.3
Progression Factor		1.00		1.29	1.26					1.00	1.00	1.00
Incremental Delay, d2		2.1		0.1	0.2					1.9	1.9	0.2
Delay (s)		32.4		29.4	31.1					14.1	14.1	9.5
Level of Service		C		C	C					B	B	A
Approach Delay (s)		32.4			31.0			0.0			13.5	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	22.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	581	18	436	443	443	127
v/c Ratio	0.67	0.09	0.46	0.46	0.46	0.13
Control Delay	32.0	22.8	33.1	15.2	15.2	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.0	22.8	33.1	15.2	15.2	3.2
Queue Length 50th (ft)	148	9	127	116	116	0
Queue Length 95th (ft)	178	m10	m101	294	294	29
Internal Link Dist (ft)	1034		501		466	
Turn Bay Length (ft)		70				350
Base Capacity (vph)	1621	244	2101	960	960	957
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.07	0.21	0.46	0.46	0.13

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	141	1109	0	0	311	1531	72	0	19	0	0	0
Future Volume (vph)	141	1109	0	0	311	1531	72	0	19	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			1.00				
Frt	1.00	1.00			0.88			0.97				
Flt Protected	0.95	1.00			1.00			0.96				
Satd. Flow (prot)	1719	3438			3009			1692				
Flt Permitted	0.08	1.00			1.00			0.96				
Satd. Flow (perm)	139	3438			3009			1692				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	150	1180	0	0	331	1629	77	0	20	0	0	0
RTOR Reduction (vph)	0	0	0	0	371	0	0	70	0	0	0	0
Lane Group Flow (vph)	150	1180	0	0	1589	0	0	27	0	0	0	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4						2					
Actuated Green, G (s)	64.0	64.0			47.2			16.0				
Effective Green, g (s)	64.0	64.0			47.2			16.0				
Actuated g/C Ratio	0.71	0.71			0.52			0.18				
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)	306	2444			1578			300				
v/s Ratio Prot	0.06	c0.34			c0.53							
v/s Ratio Perm	0.29							0.02				
v/c Ratio	0.49	0.48			1.37dr			0.09				
Uniform Delay, d1	19.4	5.7			21.4			30.9				
Progression Factor	1.41	1.23			1.00			1.00				
Incremental Delay, d2	1.1	0.1			24.4			0.6				
Delay (s)	28.6	7.2			45.8			31.5				
Level of Service	C	A			D			C				
Approach Delay (s)		9.6			45.8			31.5			0.0	
Approach LOS		A			D			C			A	

Intersection Summary			
HCM 2000 Control Delay	31.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT
Lane Group Flow (vph)	150	1180	1960	97
v/c Ratio	0.49	0.48	1.37dr	0.26
Control Delay	20.9	7.8	36.7	11.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	20.9	7.8	36.7	11.5
Queue Length 50th (ft)	32	74	~414	6
Queue Length 95th (ft)	111	272	#662	47
Internal Link Dist (ft)		501	2132	462
Turn Bay Length (ft)	50			
Base Capacity (vph)	502	2444	1947	370
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	0.30	0.48	1.01	0.26

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.

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	561	490	83	1145	73	419	23	75	22	21	33
Future Volume (vph)	57	561	490	83	1145	73	419	23	75	22	21	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.98	1.00
Satd. Flow (prot)	1719	3438	1538	1719	3438	1538	1559	1571	1468		1816	1583
Flt Permitted	0.08	1.00	1.00	0.32	1.00	1.00	0.95	0.96	1.00		0.98	1.00
Satd. Flow (perm)	150	3438	1538	583	3438	1538	1559	1571	1468		1816	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	61	603	527	89	1231	78	451	25	81	24	23	35
RTOR Reduction (vph)	0	0	309	0	0	44	0	0	58	0	0	32
Lane Group Flow (vph)	61	603	218	89	1231	34	239	237	23	0	47	3
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	10%	10%	2%	2%	2%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases	2		2	6		6			8			4
Actuated Green, G (s)	58.8	53.0	53.0	63.2	55.2	55.2	36.0	36.0	36.0		11.0	11.0
Effective Green, g (s)	58.8	53.0	53.0	63.2	55.2	55.2	36.0	36.0	36.0		11.0	11.0
Actuated g/C Ratio	0.46	0.41	0.41	0.49	0.43	0.43	0.28	0.28	0.28		0.09	0.09
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	5.0	5.0	5.0		5.0	5.0
Lane Grp Cap (vph)	140	1423	636	358	1482	663	438	441	412		156	136
v/s Ratio Prot	c0.02	0.18		0.02	c0.36		c0.15	0.15			c0.03	
v/s Ratio Perm	0.18		0.14	0.11		0.02			0.02			0.00
v/c Ratio	0.44	0.42	0.34	0.25	0.83	0.05	0.55	0.54	0.06		0.30	0.02
Uniform Delay, d1	24.6	26.6	25.6	18.1	32.3	21.2	39.1	38.9	33.6		54.9	53.6
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	0.8	0.9	1.5	0.1	4.1	0.0	4.8	4.6	0.3		4.9	0.3
Delay (s)	25.4	27.6	27.1	18.2	36.4	21.2	43.9	43.6	33.8		59.8	53.9
Level of Service	C	C	C	B	D	C	D	D	C		E	D
Approach Delay (s)		27.2			34.4			42.3			57.3	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	128.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	61	603	527	89	1231	78	239	237	81	47	35
v/c Ratio	0.39	0.43	0.56	0.25	0.82	0.11	0.54	0.53	0.17	0.30	0.15
Control Delay	23.4	28.2	4.6	17.8	38.1	2.6	44.2	43.9	4.7	60.4	1.4
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	23.4	28.2	4.6	17.8	38.1	2.6	44.2	43.9	4.7	60.4	1.4
Queue Length 50th (ft)	25	183	0	37	474	0	174	173	0	37	0
Queue Length 95th (ft)	48	244	71	66	590	19	273	271	26	78	0
Internal Link Dist (ft)		1040			379			382		267	
Turn Bay Length (ft)	80		200	190		120			200		
Base Capacity (vph)	210	1407	940	392	1493	725	441	445	488	157	229
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	0.29	0.43	0.56	0.23	0.82	0.11	0.54	0.53	0.17	0.30	0.15

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	645	0	16	1401	19	0	0	3	0	0	2
Future Volume (Veh/h)	9	645	0	16	1401	19	0	0	3	0	0	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	10	701	0	17	1523	21	0	0	3	0	0	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		459										
pX, platoon unblocked				0.88			0.88	0.88	0.88	0.88	0.88	
vC, conflicting volume	1544			701			1518	2299	350	1930	2278	762
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1544			385			1315	2203	0	1783	2179	762
tC, single (s)	4.2			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			98			100	100	100	100	100	99
cM capacity (veh/h)	412			1010			98	37	953	44	38	348

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	10	467	234	17	762	762	21	3	2
Volume Left	10	0	0	17	0	0	0	0	0
Volume Right	0	0	0	0	0	0	21	3	2
cSH	412	1700	1700	1010	1700	1700	1700	953	348
Volume to Capacity	0.02	0.27	0.14	0.02	0.45	0.45	0.01	0.00	0.01
Queue Length 95th (ft)	2	0	0	1	0	0	0	0	0
Control Delay (s)	14.0	0.0	0.0	8.6	0.0	0.0	0.0	8.8	15.4
Lane LOS	B			A				A	C
Approach Delay (s)	0.2			0.1				8.8	15.4
Approach LOS								A	C

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	48.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	495	146	12	336	0	0	0	0	1364	0	224
Future Volume (vph)	0	495	146	12	336	0	0	0	0	1364	0	224
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Lane Util. Factor		0.95		1.00	0.95					0.95	0.95	1.00
Frt		0.97		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3320		1719	3438					1633	1633	1538
Flt Permitted		1.00		0.17	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3320		302	3438					1633	1633	1538
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	510	151	12	346	0	0	0	0	1406	0	231
RTOR Reduction (vph)	0	44	0	0	0	0	0	0	0	0	0	98
Lane Group Flow (vph)	0	617	0	12	346	0	0	0	0	703	703	133
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type		NA		pm+pt	NA					Perm	NA	Perm
Protected Phases		4		3	8						6	
Permitted Phases				8						6		6
Actuated Green, G (s)		27.0		31.2	31.2					56.8	56.8	56.8
Effective Green, g (s)		27.0		31.2	31.2					56.8	56.8	56.8
Actuated g/C Ratio		0.27		0.31	0.31					0.57	0.57	0.57
Clearance Time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Vehicle Extension (s)		4.0		2.0	4.0					4.0	4.0	4.0
Lane Grp Cap (vph)		896		111	1072					927	927	873
v/s Ratio Prot		c0.19		0.00	c0.10							
v/s Ratio Perm				0.03						c0.43	0.43	0.09
v/c Ratio		0.69		0.11	0.32					0.76	0.76	0.15
Uniform Delay, d1		32.7		25.4	26.3					16.4	16.4	10.2
Progression Factor		1.00		0.94	0.93					1.00	1.00	1.00
Incremental Delay, d2		2.4		0.1	0.2					5.8	5.8	0.4
Delay (s)		35.1		24.1	24.7					22.2	22.2	10.6
Level of Service		D		C	C					C	C	B
Approach Delay (s)		35.1			24.6			0.0			20.5	
Approach LOS		D			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	24.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	111.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	661	12	346	703	703	231
v/c Ratio	0.70	0.07	0.37	0.71	0.71	0.23
Control Delay	33.4	19.7	27.1	21.5	21.5	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.5	19.7	27.1	21.5	21.5	2.7
Queue Length 50th (ft)	181	6	91	282	282	1
Queue Length 95th (ft)	218	m8	99	#710	#710	43
Internal Link Dist (ft)	1034		501		466	
Turn Bay Length (ft)		70				350
Base Capacity (vph)	1820	215	2269	992	992	1023
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	54	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.06	0.15	0.71	0.71	0.23

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	98	1776	0	0	258	1107	100	0	28	0	0	0
Future Volume (vph)	98	1776	0	0	258	1107	100	0	28	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			1.00				
Frt	1.00	1.00			0.88			0.97				
Flt Protected	0.95	1.00			1.00			0.96				
Satd. Flow (prot)	1719	3438			3020			1690				
Flt Permitted	0.13	1.00			1.00			0.96				
Satd. Flow (perm)	235	3438			3020			1690				
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	99	1794	0	0	261	1118	101	0	28	0	0	0
RTOR Reduction (vph)	0	0	0	0	295	0	0	65	0	0	0	0
Lane Group Flow (vph)	99	1794	0	0	1084	0	0	64	0	0	0	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4						2					
Actuated Green, G (s)	76.1	76.1			65.1			13.9				
Effective Green, g (s)	76.1	76.1			65.1			13.9				
Actuated g/C Ratio	0.76	0.76			0.65			0.14				
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)	267	2616			1966			234				
v/s Ratio Prot	0.02	c0.52			0.36							
v/s Ratio Perm	0.26							0.04				
v/c Ratio	0.37	0.69			0.85dr			0.27				
Uniform Delay, d1	6.9	6.0			9.5			38.5				
Progression Factor	1.40	1.14			1.00			1.00				
Incremental Delay, d2	0.7	0.6			0.3			2.8				
Delay (s)	10.4	7.4			9.8			41.4				
Level of Service	B	A			A			D				
Approach Delay (s)		7.6			9.8			41.4			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	111.6%	ICU Level of Service	H
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT
Lane Group Flow (vph)	99	1794	1379	129
v/c Ratio	0.35	0.70	0.85dr	0.41
Control Delay	6.7	8.6	4.6	23.0
Queue Delay	0.0	0.4	0.0	0.0
Total Delay	6.7	9.0	4.6	23.0
Queue Length 50th (ft)	9	143	66	31
Queue Length 95th (ft)	m33	436	130	89
Internal Link Dist (ft)		501	2132	462
Turn Bay Length (ft)	50			
Base Capacity (vph)	502	2681	2260	316
Starvation Cap Reductn	0	370	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.20	0.78	0.61	0.41

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	1293	390	92	693	19	569	18	129	56	32	55
Future Volume (vph)	76	1293	390	92	693	19	569	18	129	56	32	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1719	3438	1538	1719	3438	1538	1559	1567	1468		1805	1583
Flt Permitted	0.30	1.00	1.00	0.08	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (perm)	548	3438	1538	152	3438	1538	1559	1567	1468		1805	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	77	1306	394	93	700	19	575	18	130	57	32	56
RTOR Reduction (vph)	0	0	165	0	0	11	0	0	103	0	0	50
Lane Group Flow (vph)	77	1306	229	93	700	8	293	300	27	0	89	6
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	10%	10%	2%	2%	2%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases	2		2	6		6			8			4
Actuated Green, G (s)	52.9	47.2	47.2	53.5	47.5	47.5	22.1	22.1	22.1		12.0	12.0
Effective Green, g (s)	52.9	47.2	47.2	53.5	47.5	47.5	22.1	22.1	22.1		12.0	12.0
Actuated g/C Ratio	0.49	0.44	0.44	0.50	0.44	0.44	0.21	0.21	0.21		0.11	0.11
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	5.0	5.0	5.0		5.0	5.0
Lane Grp Cap (vph)	332	1512	676	163	1521	680	321	322	302		201	177
v/s Ratio Prot	0.01	c0.38		c0.03	0.20		0.19	c0.19			c0.05	
v/s Ratio Perm	0.10		0.15	0.25		0.01			0.02			0.00
v/c Ratio	0.23	0.86	0.34	0.57	0.46	0.01	0.91	0.93	0.09		0.44	0.04
Uniform Delay, d1	15.0	27.1	19.8	20.3	20.9	16.8	41.7	41.9	34.5		44.5	42.5
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	0.1	6.8	1.4	3.0	0.2	0.0	32.2	35.4	0.6		6.9	0.4
Delay (s)	15.1	33.9	21.1	23.3	21.1	16.8	73.9	77.3	35.0		51.5	42.9
Level of Service	B	C	C	C	C	B	E	E	D		D	D
Approach Delay (s)		30.3			21.3			68.3			48.1	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	36.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	107.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	77	1306	394	93	700	19	293	300	130	89	56
v/c Ratio	0.22	0.86	0.47	0.51	0.46	0.03	0.91	0.92	0.32	0.44	0.20
Control Delay	13.3	34.2	7.6	24.1	22.2	0.1	74.1	76.8	8.8	52.6	1.5
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	13.3	34.2	7.6	24.1	22.2	0.1	74.1	76.8	8.8	52.6	1.5
Queue Length 50th (ft)	24	425	41	29	175	0	211	217	0	59	0
Queue Length 95th (ft)	47	#550	118	66	235	0	#392	#403	50	112	0
Internal Link Dist (ft)		1040			379			382		267	
Turn Bay Length (ft)	80		200	190		120			200		
Base Capacity (vph)	379	1525	846	211	1536	753	323	325	407	204	284
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	0.20	0.86	0.47	0.44	0.46	0.03	0.91	0.92	0.32	0.44	0.20

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	1393	0	8	778	24	0	0	6	0	0	21
Future Volume (Veh/h)	22	1393	0	8	778	24	0	0	6	0	0	21
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	23	1482	0	9	828	26	0	0	6	0	0	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		459										
pX, platoon unblocked				0.65			0.65	0.65	0.65	0.65	0.65	
vC, conflicting volume	854			1482			1982	2400	741	1639	2374	414
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	854			675			1441	2081	0	916	2041	414
tC, single (s)	4.2			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			98			100	100	99	100	100	96
cM capacity (veh/h)	762			583			57	33	708	142	35	587

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	23	988	494	9	414	414	26	6	22
Volume Left	23	0	0	9	0	0	0	0	0
Volume Right	0	0	0	0	0	0	26	6	22
cSH	762	1700	1700	583	1700	1700	1700	708	587
Volume to Capacity	0.03	0.58	0.29	0.02	0.24	0.24	0.02	0.01	0.04
Queue Length 95th (ft)	2	0	0	1	0	0	0	1	3
Control Delay (s)	9.9	0.0	0.0	11.3	0.0	0.0	0.0	10.1	11.4
Lane LOS	A			B				B	B
Approach Delay (s)	0.2			0.1				10.1	11.4
Approach LOS								B	B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		

Attachment 8
Intersection Worksheets – Background AM/PM Peaks

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	454	83	17	404	0	0	0	0	820	0	118
Future Volume (vph)	0	454	83	17	404	0	0	0	0	820	0	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Lane Util. Factor		0.95		1.00	0.95					0.95	0.95	1.00
Frt		0.98		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3359		1719	3438					1633	1633	1538
Flt Permitted		1.00		0.19	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3359		349	3438					1633	1633	1538
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	516	94	19	459	0	0	0	0	932	0	134
RTOR Reduction (vph)	0	24	0	0	0	0	0	0	0	0	0	61
Lane Group Flow (vph)	0	586	0	19	459	0	0	0	0	466	466	73
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type		NA		pm+pt	NA					Perm	NA	Perm
Protected Phases		4		3	8						6	
Permitted Phases				8						6		6
Actuated Green, G (s)		23.6		29.0	29.0					49.0	49.0	49.0
Effective Green, g (s)		23.6		29.0	29.0					49.0	49.0	49.0
Actuated g/C Ratio		0.26		0.32	0.32					0.54	0.54	0.54
Clearance Time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Vehicle Extension (s)		4.0		2.0	4.0					4.0	4.0	4.0
Lane Grp Cap (vph)		880		148	1107					889	889	837
v/s Ratio Prot		c0.17		0.00	c0.13							
v/s Ratio Perm				0.04						c0.29	0.29	0.05
v/c Ratio		0.67		0.13	0.41					0.52	0.52	0.09
Uniform Delay, d1		29.7		22.1	23.9					13.1	13.1	9.8
Progression Factor		1.00		1.29	1.26					1.00	1.00	1.00
Incremental Delay, d2		2.1		0.1	0.2					2.2	2.2	0.2
Delay (s)		31.8		28.6	30.3					15.3	15.3	10.0
Level of Service		C		C	C					B	B	B
Approach Delay (s)		31.8			30.2			0.0			14.6	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	22.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	610	19	459	466	466	134
v/c Ratio	0.68	0.10	0.46	0.49	0.49	0.14
Control Delay	31.6	22.1	32.3	16.3	16.3	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.6	22.1	32.3	16.3	16.3	3.2
Queue Length 50th (ft)	154	9	130	132	132	0
Queue Length 95th (ft)	185	m10	m100	322	322	30
Internal Link Dist (ft)	1034		501		466	
Turn Bay Length (ft)		70				350
Base Capacity (vph)	1621	245	2101	943	943	945
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.08	0.22	0.49	0.49	0.14

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	148	1166	0	0	327	1609	76	0	20	0	0	0
Future Volume (vph)	148	1166	0	0	327	1609	76	0	20	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			1.00				
Frt	1.00	1.00			0.88			0.97				
Flt Protected	0.95	1.00			1.00			0.96				
Satd. Flow (prot)	1719	3438			3010			1692				
Flt Permitted	0.08	1.00			1.00			0.96				
Satd. Flow (perm)	139	3438			3010			1692				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	157	1240	0	0	348	1712	81	0	21	0	0	0
RTOR Reduction (vph)	0	0	0	0	368	0	0	70	0	0	0	0
Lane Group Flow (vph)	157	1240	0	0	1692	0	0	32	0	0	0	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4						2					
Actuated Green, G (s)	64.0	64.0			47.0			16.0				
Effective Green, g (s)	64.0	64.0			47.0			16.0				
Actuated g/C Ratio	0.71	0.71			0.52			0.18				
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)	309	2444			1571			300				
v/s Ratio Prot	0.07	c0.36			c0.56							
v/s Ratio Perm	0.29							0.02				
v/c Ratio	0.51	0.51			1.44dr			0.11				
Uniform Delay, d1	20.0	5.9			21.5			31.0				
Progression Factor	1.34	1.24			1.00			1.00				
Incremental Delay, d2	1.2	0.2			46.6			0.7				
Delay (s)	28.0	7.4			68.1			31.7				
Level of Service	C	A			E			C				
Approach Delay (s)		9.7			68.1			31.7			0.0	
Approach LOS		A			E			C			A	

Intersection Summary			
HCM 2000 Control Delay	44.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT
Lane Group Flow (vph)	157	1240	2060	102
v/c Ratio	0.51	0.51	1.44dr	0.28
Control Delay	21.2	8.1	55.2	12.3
Queue Delay	0.0	0.1	0.0	0.0
Total Delay	21.2	8.3	55.2	12.3
Queue Length 50th (ft)	36	79	~565	8
Queue Length 95th (ft)	113	293	#731	51
Internal Link Dist (ft)		501	2132	462
Turn Bay Length (ft)	50			
Base Capacity (vph)	502	2444	1939	370
Starvation Cap Reductn	0	329	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.31	0.59	1.06	0.28

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.

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	590	515	87	1203	77	440	24	79	23	22	35
Future Volume (vph)	60	590	515	87	1203	77	440	24	79	23	22	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.98	1.00
Satd. Flow (prot)	1719	3438	1538	1719	3438	1538	1559	1571	1468		1816	1583
Flt Permitted	0.08	1.00	1.00	0.30	1.00	1.00	0.95	0.96	1.00		0.98	1.00
Satd. Flow (perm)	137	3438	1538	550	3438	1538	1559	1571	1468		1816	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	65	634	554	94	1294	83	473	26	85	25	24	38
RTOR Reduction (vph)	0	0	325	0	0	47	0	0	61	0	0	35
Lane Group Flow (vph)	65	634	229	94	1294	36	251	248	24	0	49	3
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	10%	10%	2%	2%	2%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases	2		2	6		6			8			4
Actuated Green, G (s)	58.9	53.0	53.0	63.5	55.3	55.3	36.0	36.0	36.0		11.0	11.0
Effective Green, g (s)	58.9	53.0	53.0	63.5	55.3	55.3	36.0	36.0	36.0		11.0	11.0
Actuated g/C Ratio	0.46	0.41	0.41	0.50	0.43	0.43	0.28	0.28	0.28		0.09	0.09
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	5.0	5.0	5.0		5.0	5.0
Lane Grp Cap (vph)	135	1421	635	347	1483	663	437	441	412		155	135
v/s Ratio Prot	c0.02	0.18		0.02	c0.38		c0.16	0.16			c0.03	
v/s Ratio Perm	0.20		0.15	0.12		0.02			0.02			0.00
v/c Ratio	0.48	0.45	0.36	0.27	0.87	0.05	0.57	0.56	0.06		0.32	0.02
Uniform Delay, d1	25.7	27.0	25.9	18.2	33.2	21.2	39.5	39.4	33.7		55.1	53.7
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	1.0	1.0	1.6	0.2	6.0	0.0	5.4	5.1	0.3		5.3	0.3
Delay (s)	26.7	28.1	27.5	18.4	39.2	21.3	44.9	44.5	34.0		60.3	54.0
Level of Service	C	C	C	B	D	C	D	D	C		E	D
Approach Delay (s)		27.7			36.9			43.1			57.6	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	35.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	128.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	65	634	554	94	1294	83	251	248	85	49	38
v/c Ratio	0.43	0.45	0.58	0.27	0.87	0.11	0.57	0.56	0.17	0.31	0.17
Control Delay	25.1	28.7	4.7	18.1	40.8	3.1	45.3	44.9	5.4	60.9	1.6
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	25.1	28.7	4.7	18.1	40.8	3.1	45.3	44.9	5.4	60.9	1.6
Queue Length 50th (ft)	26	196	0	39	515	0	186	183	0	38	0
Queue Length 95th (ft)	52	258	74	69	#675	23	288	285	30	82	0
Internal Link Dist (ft)		1040			379			382		267	
Turn Bay Length (ft)	80		200	190		120			200		
Base Capacity (vph)	204	1405	956	378	1493	725	441	444	488	156	229
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	0.32	0.45	0.58	0.25	0.87	0.11	0.57	0.56	0.17	0.31	0.17

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	678	0	17	1472	20	0	0	3	0	0	2
Future Volume (Veh/h)	9	678	0	17	1472	20	0	0	3	0	0	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	10	737	0	18	1600	22	0	0	3	0	0	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		459										
pX, platoon unblocked				0.87			0.87	0.87	0.87	0.87	0.87	
vC, conflicting volume	1622			737			1595	2415	368	2028	2393	800
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1622			401			1387	2328	0	1883	2303	800
tC, single (s)	4.2			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			98			100	100	100	100	100	99
cM capacity (veh/h)	384			986			86	30	944	36	32	328

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	10	491	246	18	800	800	22	3	2
Volume Left	10	0	0	18	0	0	0	0	0
Volume Right	0	0	0	0	0	0	22	3	2
cSH	384	1700	1700	986	1700	1700	1700	944	328
Volume to Capacity	0.03	0.29	0.14	0.02	0.47	0.47	0.01	0.00	0.01
Queue Length 95th (ft)	2	0	0	1	0	0	0	0	0
Control Delay (s)	14.6	0.0	0.0	8.7	0.0	0.0	0.0	8.8	16.0
Lane LOS	B			A				A	C
Approach Delay (s)	0.2			0.1				8.8	16.0
Approach LOS								A	C

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	520	153	13	353	0	0	0	0	1434	0	235
Future Volume (vph)	0	520	153	13	353	0	0	0	0	1434	0	235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Lane Util. Factor		0.95		1.00	0.95					0.95	0.95	1.00
Frt		0.97		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3321		1719	3438					1633	1633	1538
Flt Permitted		1.00		0.16	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3321		298	3438					1633	1633	1538
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	536	158	13	364	0	0	0	0	1478	0	242
RTOR Reduction (vph)	0	43	0	0	0	0	0	0	0	0	0	102
Lane Group Flow (vph)	0	651	0	13	364	0	0	0	0	739	739	140
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type		NA		pm+pt	NA					Perm	NA	Perm
Protected Phases		4		3	8						6	
Permitted Phases				8						6		6
Actuated Green, G (s)		28.6		32.8	32.8					55.2	55.2	55.2
Effective Green, g (s)		28.6		32.8	32.8					55.2	55.2	55.2
Actuated g/C Ratio		0.29		0.33	0.33					0.55	0.55	0.55
Clearance Time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Vehicle Extension (s)		4.0		2.0	4.0					4.0	4.0	4.0
Lane Grp Cap (vph)		949		114	1127					901	901	848
v/s Ratio Prot		c0.20		0.00	c0.11							
v/s Ratio Perm				0.04						c0.45	0.45	0.09
v/c Ratio		0.69		0.11	0.32					0.82	0.82	0.17
Uniform Delay, d1		31.7		24.4	25.3					18.3	18.3	11.0
Progression Factor		1.00		0.93	0.93					1.00	1.00	1.00
Incremental Delay, d2		2.3		0.1	0.2					8.3	8.3	0.4
Delay (s)		34.0		22.9	23.6					26.6	26.6	11.5
Level of Service		C		C	C					C	C	B
Approach Delay (s)		34.0			23.5			0.0			24.5	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	116.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	694	13	364	739	739	242
v/c Ratio	0.70	0.07	0.37	0.77	0.77	0.24
Control Delay	32.4	18.5	25.9	24.7	24.7	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.4	18.5	25.9	24.7	24.7	3.2
Queue Length 50th (ft)	191	6	94	318	318	3
Queue Length 95th (ft)	224	m8	100	#785	#785	50
Internal Link Dist (ft)	1034		501		466	
Turn Bay Length (ft)		70				350
Base Capacity (vph)	1820	219	2269	966	966	1003
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	123	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.06	0.16	0.77	0.77	0.24

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	103	1867	0	0	271	1163	105	0	29	0	0	0
Future Volume (vph)	103	1867	0	0	271	1163	105	0	29	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			1.00				
Frt	1.00	1.00			0.88			0.97				
Flt Protected	0.95	1.00			1.00			0.96				
Satd. Flow (prot)	1719	3438			3020			1691				
Flt Permitted	0.12	1.00			1.00			0.96				
Satd. Flow (perm)	215	3438			3020			1691				
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	104	1886	0	0	274	1175	106	0	29	0	0	0
RTOR Reduction (vph)	0	0	0	0	282	0	0	66	0	0	0	0
Lane Group Flow (vph)	104	1886	0	0	1167	0	0	69	0	0	0	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4						2					
Actuated Green, G (s)	77.4	77.4			66.1			12.6				
Effective Green, g (s)	77.4	77.4			66.1			12.6				
Actuated g/C Ratio	0.77	0.77			0.66			0.13				
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)	261	2661			1996			213				
v/s Ratio Prot	0.03	c0.55			0.39							
v/s Ratio Perm	0.28							0.04				
v/c Ratio	0.40	0.71			0.89dr			0.32				
Uniform Delay, d1	7.3	5.7			9.4			39.8				
Progression Factor	1.58	1.36			1.00			1.00				
Incremental Delay, d2	0.7	0.7			0.4			4.0				
Delay (s)	12.2	8.4			9.8			43.8				
Level of Service	B	A			A			D				
Approach Delay (s)		8.6			9.8			43.8			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	10.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	116.6%	ICU Level of Service	H
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT
Lane Group Flow (vph)	104	1886	1449	135
v/c Ratio	0.38	0.72	0.89dr	0.46
Control Delay	7.2	9.7	5.2	25.0
Queue Delay	0.0	0.6	0.0	0.0
Total Delay	7.2	10.3	5.2	25.0
Queue Length 50th (ft)	13	203	86	35
Queue Length 95th (ft)	m37	533	165	94
Internal Link Dist (ft)		501	2132	462
Turn Bay Length (ft)	50			
Base Capacity (vph)	495	2681	2277	295
Starvation Cap Reductn	0	379	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.82	0.64	0.46

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	1359	410	97	728	20	598	19	136	59	34	58
Future Volume (vph)	80	1359	410	97	728	20	598	19	136	59	34	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1719	3438	1538	1719	3438	1538	1559	1567	1468		1805	1583
Flt Permitted	0.30	1.00	1.00	0.08	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (perm)	535	3438	1538	146	3438	1538	1559	1567	1468		1805	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	81	1373	414	98	735	20	604	19	137	60	34	59
RTOR Reduction (vph)	0	0	165	0	0	11	0	0	109	0	0	53
Lane Group Flow (vph)	81	1373	249	98	735	9	308	315	28	0	94	6
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	10%	10%	2%	2%	2%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases	2		2	6		6			8			4
Actuated Green, G (s)	54.0	48.1	48.1	57.0	49.6	49.6	22.0	22.0	22.0		12.0	12.0
Effective Green, g (s)	54.0	48.1	48.1	57.0	49.6	49.6	22.0	22.0	22.0		12.0	12.0
Actuated g/C Ratio	0.49	0.44	0.44	0.52	0.45	0.45	0.20	0.20	0.20		0.11	0.11
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	5.0	5.0	5.0		5.0	5.0
Lane Grp Cap (vph)	327	1510	675	182	1557	696	313	314	294		197	173
v/s Ratio Prot	0.01	c0.40		c0.04	0.21		0.20	c0.20			c0.05	
v/s Ratio Perm	0.11		0.16	0.24		0.01			0.02			0.00
v/c Ratio	0.25	0.91	0.37	0.54	0.47	0.01	0.98	1.00	0.09		0.48	0.04
Uniform Delay, d1	15.3	28.7	20.5	21.1	20.8	16.5	43.6	43.8	35.6		45.8	43.6
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	0.1	9.7	1.6	1.5	0.2	0.0	47.0	51.6	0.6		8.1	0.4
Delay (s)	15.4	38.3	22.1	22.6	21.1	16.5	90.6	95.3	36.3		53.9	44.0
Level of Service	B	D	C	C	C	B	F	F	D		D	D
Approach Delay (s)		33.7			21.1			82.8			50.1	
Approach LOS		C			C			F			D	

Intersection Summary			
HCM 2000 Control Delay	41.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	109.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	81	1373	414	98	735	20	308	315	137	94	59
v/c Ratio	0.24	0.92	0.50	0.54	0.47	0.03	0.97	0.99	0.34	0.47	0.21
Control Delay	13.5	40.6	8.6	26.2	22.3	0.1	89.0	92.9	8.8	54.1	1.7
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	13.5	40.6	8.6	26.2	22.3	0.1	89.0	92.9	8.8	54.1	1.7
Queue Length 50th (ft)	25	463	50	31	187	0	225	231	0	62	0
Queue Length 95th (ft)	49	#632	135	73	250	0	#418	#429	51	118	0
Internal Link Dist (ft)		1040			379			382		267	
Turn Bay Length (ft)	80		200	190		120			200		
Base Capacity (vph)	375	1490	833	207	1571	767	316	318	407	199	281
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	0.22	0.92	0.50	0.47	0.47	0.03	0.97	0.99	0.34	0.47	0.21

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	23	1464	0	8	818	25	0	0	6	0	0	22
Future Volume (Veh/h)	23	1464	0	8	818	25	0	0	6	0	0	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	24	1557	0	9	870	27	0	0	6	0	0	23
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		459										
pX, platoon unblocked				0.62			0.62	0.62	0.62	0.62	0.62	
vC, conflicting volume	897			1557			2081	2520	778	1720	2493	435
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	897			680			1522	2228	0	943	2185	435
tC, single (s)	4.2			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			98			100	100	99	100	100	96
cM capacity (veh/h)	734			553			47	25	674	129	27	569

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	24	1038	519	9	435	435	27	6	23
Volume Left	24	0	0	9	0	0	0	0	0
Volume Right	0	0	0	0	0	0	27	6	23
cSH	734	1700	1700	553	1700	1700	1700	674	569
Volume to Capacity	0.03	0.61	0.31	0.02	0.26	0.26	0.02	0.01	0.04
Queue Length 95th (ft)	3	0	0	1	0	0	0	1	3
Control Delay (s)	10.1	0.0	0.0	11.6	0.0	0.0	0.0	10.4	11.6
Lane LOS	B			B				B	B
Approach Delay (s)	0.2			0.1				10.4	11.6
Approach LOS								B	B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

Attachment 9
Intersection Worksheets – Full Buildout AM/PM Peaks

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	477	83	24	424	0	0	0	0	874	0	118
Future Volume (vph)	0	477	83	24	424	0	0	0	0	874	0	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Lane Util. Factor		0.95		1.00	0.95					0.95	0.95	1.00
Frt		0.98		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3362		1719	3438					1633	1633	1538
Flt Permitted		1.00		0.16	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3362		291	3438					1633	1633	1538
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	542	94	27	482	0	0	0	0	993	0	134
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	0	59
Lane Group Flow (vph)	0	619	0	27	482	0	0	0	0	496	497	75
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type		NA		pm+pt	NA					Perm	NA	Perm
Protected Phases		4		3	8						6	
Permitted Phases				8						6		6
Actuated Green, G (s)		22.4		27.8	27.8					50.2	50.2	50.2
Effective Green, g (s)		22.4		27.8	27.8					50.2	50.2	50.2
Actuated g/C Ratio		0.25		0.31	0.31					0.56	0.56	0.56
Clearance Time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Vehicle Extension (s)		4.0		2.0	4.0					4.0	4.0	4.0
Lane Grp Cap (vph)		836		127	1061					910	910	857
v/s Ratio Prot		c0.18		0.01	c0.14							
v/s Ratio Perm				0.06						0.30	0.30	0.05
v/c Ratio		0.74		0.21	0.45					0.55	0.55	0.09
Uniform Delay, d1		31.1		23.2	25.0					12.6	12.7	9.3
Progression Factor		1.00		0.90	0.89					1.00	1.00	1.00
Incremental Delay, d2		3.8		0.2	0.3					2.3	2.4	0.2
Delay (s)		34.9		21.1	22.6					15.0	15.0	9.5
Level of Service		C		C	C					B	B	A
Approach Delay (s)		34.9			22.5			0.0			14.3	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	636	27	482	496	497	134
v/c Ratio	0.74	0.15	0.51	0.51	0.52	0.14
Control Delay	35.6	18.0	24.7	15.3	15.3	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.6	18.0	24.7	15.3	15.3	2.8
Queue Length 50th (ft)	165	10	116	145	146	0
Queue Length 95th (ft)	216	m11	m103	309	309	27
Internal Link Dist (ft)	1034		501		632	
Turn Bay Length (ft)		70				350
Base Capacity (vph)	949	181	1298	964	964	963
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.15	0.37	0.51	0.52	0.14

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	148	1243	0	0	354	1655	76	0	28	0	0	0
Future Volume (vph)	148	1243	0	0	354	1655	76	0	28	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			1.00				
Frt	1.00	1.00			0.88			0.96				
Flt Protected	0.95	1.00			1.00			0.96				
Satd. Flow (prot)	1719	3438			3013			1682				
Flt Permitted	0.06	1.00			1.00			0.96				
Satd. Flow (perm)	112	3438			3013			1682				
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	157	1322	0	0	377	1761	81	0	30	0	0	0
RTOR Reduction (vph)	0	0	0	0	227	0	0	77	0	0	0	0
Lane Group Flow (vph)	157	1322	0	0	1911	0	0	34	0	0	0	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4						2					
Actuated Green, G (s)	71.9	71.9			59.9			8.1				
Effective Green, g (s)	71.9	71.9			59.9			8.1				
Actuated g/C Ratio	0.80	0.80			0.67			0.09				
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)	214	2746			2005			151				
v/s Ratio Prot	c0.06	0.38			c0.63							
v/s Ratio Perm	0.53							0.02				
v/c Ratio	0.73	0.48			1.39dr			0.22				
Uniform Delay, d1	26.0	3.0			13.8			38.0				
Progression Factor	1.06	1.42			1.00			1.00				
Incremental Delay, d2	10.3	0.1			11.0			3.4				
Delay (s)	37.9	4.3			24.8			41.4				
Level of Service	D	A			C			D				
Approach Delay (s)		7.9			24.8			41.4			0.0	
Approach LOS		A			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.0%	ICU Level of Service	E
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT
Lane Group Flow (vph)	157	1322	2138	111
v/c Ratio	0.73	0.48	1.39dr	0.48
Control Delay	34.9	4.8	22.0	21.2
Queue Delay	0.0	0.2	0.0	0.0
Total Delay	34.9	5.0	22.0	21.2
Queue Length 50th (ft)	46	186	390	14
Queue Length 95th (ft)	m#117	102	#706	65
Internal Link Dist (ft)		501	2132	462
Turn Bay Length (ft)	50			
Base Capacity (vph)	214	2750	2234	229
Starvation Cap Reductn	0	574	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.73	0.61	0.96	0.48

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	613	515	94	1207	108	440	48	79	62	35	101
Future Volume (vph)	122	613	515	94	1207	108	440	48	79	62	35	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1719	3438	1538	1719	3438	1538	1559	1578	1468		1805	1583
Flt Permitted	0.07	1.00	1.00	0.35	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (perm)	128	3438	1538	625	3438	1538	1559	1578	1468		1805	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	131	659	554	101	1298	116	473	52	85	67	38	109
RTOR Reduction (vph)	0	0	290	0	0	55	0	0	65	0	0	95
Lane Group Flow (vph)	131	659	264	101	1298	61	260	265	20	0	105	14
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	10%	10%	2%	2%	2%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases	2		2	6		6			8			4
Actuated Green, G (s)	71.0	62.0	62.0	65.0	59.0	59.0	30.0	30.0	30.0		12.0	12.0
Effective Green, g (s)	71.0	62.0	62.0	65.0	59.0	59.0	30.0	30.0	30.0		12.0	12.0
Actuated g/C Ratio	0.55	0.48	0.48	0.50	0.45	0.45	0.23	0.23	0.23		0.09	0.09
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	5.0	5.0	5.0		5.0	5.0
Lane Grp Cap (vph)	180	1639	733	362	1560	698	359	364	338		166	146
v/s Ratio Prot	c0.05	0.19		0.01	c0.38		0.17	c0.17			c0.06	
v/s Ratio Perm	0.35		0.17	0.13		0.04			0.01			0.01
v/c Ratio	0.73	0.40	0.36	0.28	0.83	0.09	0.72	0.73	0.06		0.63	0.09
Uniform Delay, d1	25.3	22.0	21.5	17.6	31.2	20.2	46.2	46.2	39.0		56.9	54.0
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	11.7	0.7	1.4	0.2	4.0	0.1	12.0	12.1	0.3		16.9	1.3
Delay (s)	37.0	22.7	22.9	17.7	35.1	20.2	58.2	58.3	39.3		73.8	55.3
Level of Service	D	C	C	B	D	C	E	E	D		E	E
Approach Delay (s)		24.2			32.8			55.6			64.4	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	35.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	131	659	554	101	1298	116	260	265	85	105	109
v/c Ratio	0.73	0.40	0.54	0.28	0.83	0.15	0.72	0.73	0.20	0.63	0.45
Control Delay	45.4	22.9	3.7	15.8	37.2	5.8	59.0	59.3	6.2	74.4	17.4
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	45.4	22.9	3.7	15.8	37.2	5.8	59.0	59.3	6.2	74.4	17.4
Queue Length 50th (ft)	53	184	0	38	503	7	214	218	0	87	3
Queue Length 95th (ft)	#139	233	60	67	604	42	#322	#327	32	#161	60
Internal Link Dist (ft)		1040			379			382		267	
Turn Bay Length (ft)	80		200	190		120			200		
Base Capacity (vph)	193	1639	1023	362	1560	753	359	363	416	166	241
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	0.68	0.40	0.54	0.28	0.83	0.15	0.72	0.73	0.20	0.63	0.45

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	32	720	0	17	1500	35	0	0	3	0	0	14
Future Volume (Veh/h)	32	720	0	17	1500	35	0	0	3	0	0	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	783	0	18	1630	38	0	0	3	0	0	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)		459										
pX, platoon unblocked				0.88			0.88	0.88	0.88	0.88	0.88	
vC, conflicting volume	1668			783			1719	2557	392	2130	2519	815
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1668			483			1546	2497	38	2013	2454	815
tC, single (s)	4.2			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	90			98			100	100	100	100	100	95
cM capacity (veh/h)	368			929			60	22	903	28	24	321

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	35	522	261	18	815	815	38	3	15
Volume Left	35	0	0	18	0	0	0	0	0
Volume Right	0	0	0	0	0	0	38	3	15
cSH	368	1700	1700	929	1700	1700	1700	903	321
Volume to Capacity	0.10	0.31	0.15	0.02	0.48	0.48	0.02	0.00	0.05
Queue Length 95th (ft)	8	0	0	1	0	0	0	0	4
Control Delay (s)	15.8	0.0	0.0	8.9	0.0	0.0	0.0	9.0	16.8
Lane LOS	C			A				A	C
Approach Delay (s)	0.7			0.1				9.0	16.8
Approach LOS								A	C

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	33	691	1522	33	28	28
Future Volume (Veh/h)	33	691	1522	33	28	28
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	751	1654	36	30	30
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1690				2120	845
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1690				2120	845
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	90				23	90
cM capacity (veh/h)	374				39	306

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	286	501	1103	587	60
Volume Left	36	0	0	0	30
Volume Right	0	0	0	36	30
cSH	374	1700	1700	1700	69
Volume to Capacity	0.10	0.29	0.65	0.35	0.87
Queue Length 95th (ft)	8	0	0	0	105
Control Delay (s)	3.5	0.0	0.0	0.0	172.3
Lane LOS	A				F
Approach Delay (s)	1.3		0.0		172.3
Approach LOS					F

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	578	153	29	399	0	0	0	0	1568	0	235
Future Volume (vph)	0	578	153	29	399	0	0	0	0	1568	0	235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Lane Util. Factor		0.95		1.00	0.95					0.95	0.95	1.00
Frt		0.97		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3330		1719	3438					1633	1633	1538
Flt Permitted		1.00		0.14	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3330		262	3438					1633	1633	1538
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	596	158	30	411	0	0	0	0	1616	0	242
RTOR Reduction (vph)	0	23	0	0	0	0	0	0	0	0	0	88
Lane Group Flow (vph)	0	731	0	30	411	0	0	0	0	808	808	154
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type		NA		pm+pt	NA					Perm	NA	Perm
Protected Phases		4		3	8						6	
Permitted Phases				8						6		6
Actuated Green, G (s)		24.6		31.2	31.2					56.8	56.8	56.8
Effective Green, g (s)		24.6		31.2	31.2					56.8	56.8	56.8
Actuated g/C Ratio		0.25		0.31	0.31					0.57	0.57	0.57
Clearance Time (s)		5.0		5.0	7.0					5.0	5.0	5.0
Vehicle Extension (s)		4.0		2.0	4.0					4.0	4.0	4.0
Lane Grp Cap (vph)		819		134	1072					927	927	873
v/s Ratio Prot		c0.22		0.01	c0.12							
v/s Ratio Perm				0.06						c0.49	0.49	0.10
v/c Ratio		0.89		0.22	0.38					0.87	0.87	0.18
Uniform Delay, d1		36.4		26.4	26.9					18.5	18.5	10.4
Progression Factor		1.00		0.98	0.97					1.00	1.00	1.00
Incremental Delay, d2		12.3		0.2	0.2					11.1	11.1	0.4
Delay (s)		48.7		26.0	26.3					29.5	29.5	10.8
Level of Service		D		C	C					C	C	B
Approach Delay (s)		48.7			26.3			0.0			27.1	
Approach LOS		D			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	32.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	127.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	754	30	411	808	808	242
v/c Ratio	0.89	0.18	0.41	0.84	0.84	0.25
Control Delay	50.0	23.9	28.1	28.0	28.0	3.1
Queue Delay	0.2	0.0	0.0	47.6	47.6	0.0
Total Delay	50.2	23.9	28.1	75.6	75.6	3.1
Queue Length 50th (ft)	241	13	112	444	444	11
Queue Length 95th (ft)	#363	m19	146	#733	#733	45
Internal Link Dist (ft)	1034		501		632	
Turn Bay Length (ft)		70				350
Base Capacity (vph)	843	169	1100	959	959	987
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	3	0	0	222	222	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.90	0.18	0.37	1.10	1.10	0.25

Intersection Summary

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	103	2059	0	0	333	1271	105	0	48	0	0	0
Future Volume (vph)	103	2059	0	0	333	1271	105	0	48	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0			5.0				
Lane Util. Factor	1.00	0.95			0.95			1.00				
Frt	1.00	1.00			0.88			0.96				
Flt Protected	0.95	1.00			1.00			0.97				
Satd. Flow (prot)	1719	3438			3029			1676				
Flt Permitted	0.08	1.00			1.00			0.97				
Satd. Flow (perm)	154	3438			3029			1676				
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	104	2080	0	0	336	1284	106	0	48	0	0	0
RTOR Reduction (vph)	0	0	0	0	298	0	0	65	0	0	0	0
Lane Group Flow (vph)	104	2080	0	0	1322	0	0	89	0	0	0	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	7	4			8			2				
Permitted Phases	4						2					
Actuated Green, G (s)	76.0	76.0			65.2			14.0				
Effective Green, g (s)	76.0	76.0			65.2			14.0				
Actuated g/C Ratio	0.76	0.76			0.65			0.14				
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)	207	2612			1974			234				
v/s Ratio Prot	0.03	c0.60			0.44							
v/s Ratio Perm	0.35							0.05				
v/c Ratio	0.50	0.80			0.97dr			0.38				
Uniform Delay, d1	10.9	7.3			10.7			39.1				
Progression Factor	1.15	1.47			1.00			1.00				
Incremental Delay, d2	0.9	0.9			0.9			4.6				
Delay (s)	13.5	11.6			11.6			43.7				
Level of Service	B	B			B			D				
Approach Delay (s)		11.7			11.6			43.7			0.0	
Approach LOS		B			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	127.1%	ICU Level of Service	H
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT
Lane Group Flow (vph)	104	2080	1620	154
v/c Ratio	0.46	0.81	0.97dr	0.49
Control Delay	9.8	13.6	7.1	26.0
Queue Delay	0.0	47.1	0.0	0.0
Total Delay	9.8	60.7	7.1	26.0
Queue Length 50th (ft)	13	623	145	45
Queue Length 95th (ft)	m16	697	233	107
Internal Link Dist (ft)		501	2132	462
Turn Bay Length (ft)	50			
Base Capacity (vph)	240	2578	2272	316
Starvation Cap Reductn	0	705	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.43	1.11	0.71	0.49

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	1435	410	113	750	82	598	77	136	139	65	206
Future Volume (vph)	215	1435	410	113	750	82	598	77	136	139	65	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1719	3438	1538	1719	3438	1538	1559	1580	1468		1802	1583
Flt Permitted	0.21	1.00	1.00	0.10	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (perm)	379	3438	1538	176	3438	1538	1559	1580	1468		1802	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	217	1449	414	114	758	83	604	78	137	140	66	208
RTOR Reduction (vph)	0	0	160	0	0	52	0	0	107	0	0	168
Lane Group Flow (vph)	217	1449	254	114	758	31	338	344	30	0	206	40
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	10%	10%	2%	2%	2%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases	2		2	6		6			8			4
Actuated Green, G (s)	58.0	47.0	47.0	47.2	41.2	41.2	24.0	24.0	24.0		13.0	13.0
Effective Green, g (s)	58.0	47.0	47.0	47.2	41.2	41.2	24.0	24.0	24.0		13.0	13.0
Actuated g/C Ratio	0.53	0.43	0.43	0.43	0.37	0.37	0.22	0.22	0.22		0.12	0.12
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	5.0	5.0	5.0		5.0	5.0
Lane Grp Cap (vph)	343	1468	657	159	1287	576	340	344	320		212	187
v/s Ratio Prot	c0.07	c0.42		0.04	0.22		0.22	c0.22			c0.11	
v/s Ratio Perm	0.26		0.17	0.27		0.02			0.02			0.03
v/c Ratio	0.63	0.99	0.39	0.72	0.59	0.05	0.99	1.00	0.09		0.97	0.22
Uniform Delay, d1	16.7	31.2	21.6	25.5	27.6	22.0	42.9	43.0	34.3		48.3	43.9
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	2.8	20.6	1.7	12.1	0.7	0.0	47.4	48.5	0.6		54.9	2.6
Delay (s)	19.5	51.8	23.3	37.5	28.3	22.0	90.3	91.5	34.9		103.2	46.5
Level of Service	B	D	C	D	C	C	F	F	C		F	D
Approach Delay (s)		42.8			28.9			81.5			74.7	
Approach LOS		D			C			F			E	

Intersection Summary			
HCM 2000 Control Delay	50.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	217	1449	414	114	758	83	338	344	137	206	208
v/c Ratio	0.64	0.99	0.51	0.72	0.59	0.12	0.99	1.00	0.30	0.97	0.59
Control Delay	23.1	52.4	9.5	44.9	30.4	0.4	91.3	92.6	4.6	104.3	15.9
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	23.1	52.4	9.5	44.9	30.4	0.4	91.3	92.6	4.6	104.3	15.9
Queue Length 50th (ft)	79	522	59	39	224	0	252	257	0	147	12
Queue Length 95th (ft)	125	#691	145	#125	301	0	#449	#456	31	#295	85
Internal Link Dist (ft)		1040			379			382		267	
Turn Bay Length (ft)	80		200	190		120			200		
Base Capacity (vph)	382	1468	816	159	1287	681	340	344	452	212	354
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	0.57	0.99	0.51	0.72	0.59	0.12	0.99	1.00	0.30	0.97	0.59

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	75	1568	0	8	892	54	0	0	6	0	0	48
Future Volume (Veh/h)	75	1568	0	8	892	54	0	0	6	0	0	48
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	80	1668	0	9	949	57	0	0	6	0	0	51
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		459										
pX, platoon unblocked				0.59			0.59	0.59	0.59	0.59	0.59	
vC, conflicting volume	1006			1668			2372	2852	834	1967	2795	474
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1006			731			1930	2748	0	1241	2651	474
tC, single (s)	4.2			4.2			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	88			98			100	100	99	100	100	90
cM capacity (veh/h)	667			499			19	10	637	68	11	536

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	80	1112	556	9	474	474	57	6	51
Volume Left	80	0	0	9	0	0	0	0	0
Volume Right	0	0	0	0	0	0	57	6	51
cSH	667	1700	1700	499	1700	1700	1700	637	536
Volume to Capacity	0.12	0.65	0.33	0.02	0.28	0.28	0.03	0.01	0.10
Queue Length 95th (ft)	10	0	0	1	0	0	0	1	8
Control Delay (s)	11.1	0.0	0.0	12.4	0.0	0.0	0.0	10.7	12.4
Lane LOS	B			B				B	B
Approach Delay (s)	0.5			0.1				10.7	12.4
Approach LOS								B	B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	72	1502	894	72	61	60
Future Volume (Veh/h)	72	1502	894	72	61	60
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	78	1633	972	78	66	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1050				1984	525
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1050				1984	525
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	88				0	87
cM capacity (veh/h)	659				47	497

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	622	1089	648	402	131
Volume Left	78	0	0	0	66
Volume Right	0	0	0	78	65
cSH	659	1700	1700	1700	86
Volume to Capacity	0.12	0.64	0.38	0.24	1.53
Queue Length 95th (ft)	10	0	0	0	260
Control Delay (s)	3.1	0.0	0.0	0.0	374.4
Lane LOS	A				F
Approach Delay (s)	1.1		0.0		374.4
Approach LOS					F

Intersection Summary			
Average Delay	17.6		
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

Attachment 10
Turn Lane Warrant Analysis

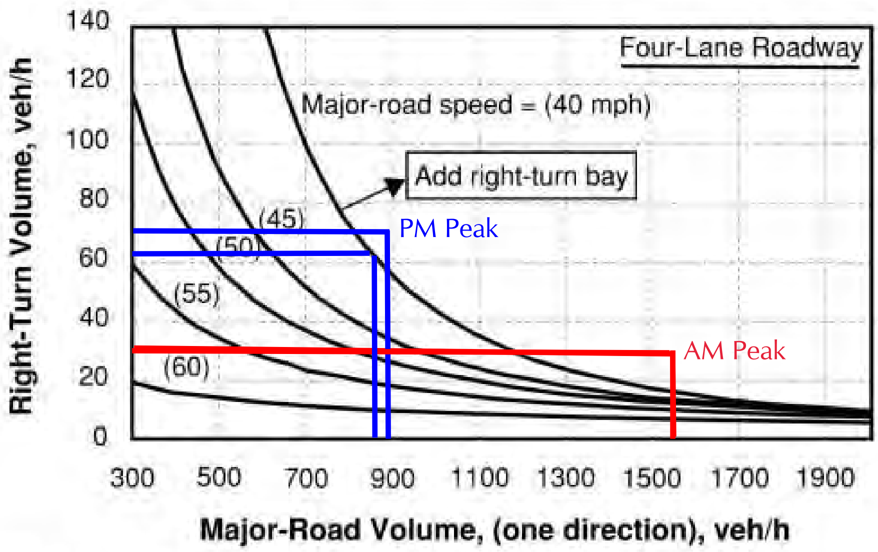


Figure 3-19: Right-Turn Lane Warrant along Four-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)[25]

Asheville Highway at Driveway

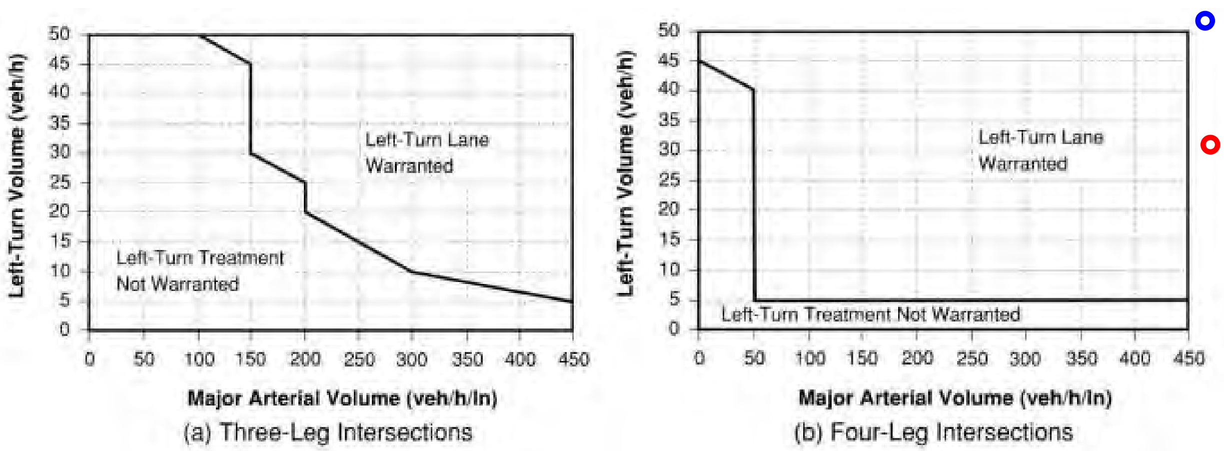


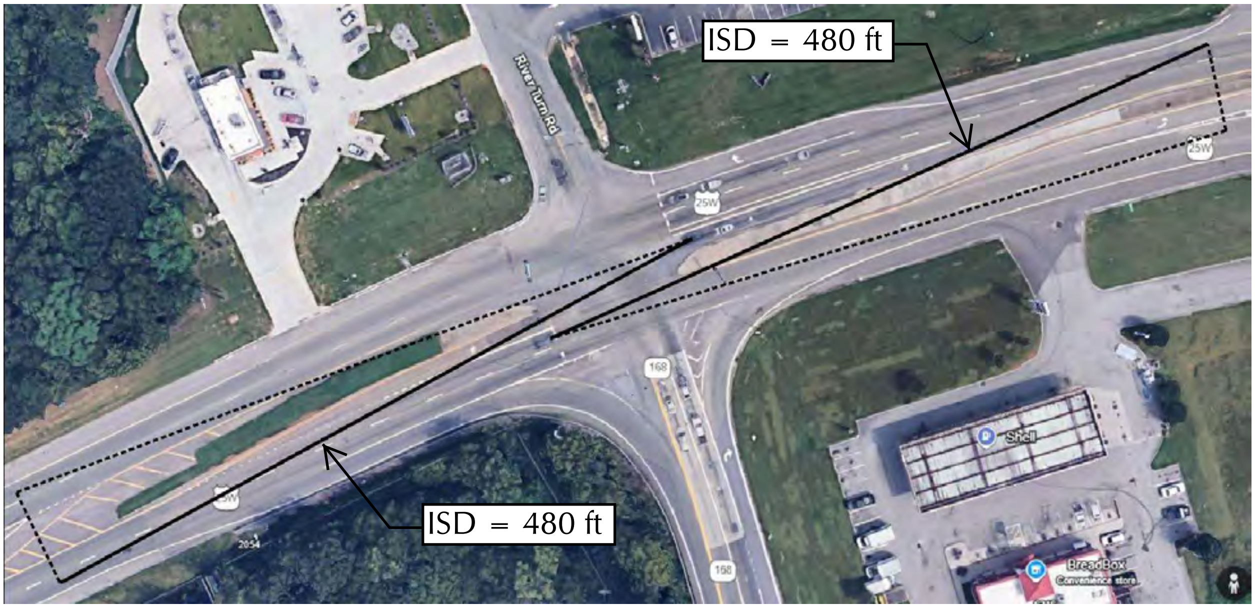
Figure 3-15: Left-Turn Lane Warrant for Urban and Suburban Arterials (Unsignalized)[20, 21]

Asheville Highway at Driveway

AM Peak
Left Turns 33 veh/h
Major Volume 553 veh/h/ln

PM Peak
Left Turns 72 veh/h
Major Volume 599 veh/h/ln

Attachment 11
Sight Distance / Alternative Analysis



Asheville Highway at E Governor John Sevier Highway

LT from Minor Approach – Sight Triangles

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	613	515	94	1207	108	440	48	79	62	35	101
Future Volume (vph)	122	613	515	94	1207	108	440	48	79	62	35	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1719	3438	1538	1719	3438	1538	1559	1578	1468		1805	1583
Flt Permitted	0.07	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (perm)	135	3438	1538	1719	3438	1538	1559	1578	1468		1805	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	131	659	554	101	1298	116	473	52	85	67	38	109
RTOR Reduction (vph)	0	0	320	0	0	56	0	0	65	0	0	99
Lane Group Flow (vph)	131	659	234	101	1298	60	260	265	20	0	105	10
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	10%	10%	2%	2%	2%
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases	2		2			6			8			4
Actuated Green, G (s)	62.8	53.8	53.8	11.4	56.2	56.2	30.0	30.0	30.0		12.0	12.0
Effective Green, g (s)	62.8	53.8	53.8	11.4	56.2	56.2	30.0	30.0	30.0		12.0	12.0
Actuated g/C Ratio	0.49	0.42	0.42	0.09	0.44	0.44	0.24	0.24	0.24		0.09	0.09
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	5.0	5.0	5.0		5.0	5.0
Lane Grp Cap (vph)	178	1454	650	154	1518	679	367	372	346		170	149
v/s Ratio Prot	0.05	0.19		c0.06	c0.38		0.17	c0.17			c0.06	
v/s Ratio Perm	0.31		0.15			0.04			0.01			0.01
v/c Ratio	0.74	0.45	0.36	0.66	0.86	0.09	0.71	0.71	0.06		0.62	0.07
Uniform Delay, d1	25.2	26.2	25.0	56.0	31.8	20.6	44.6	44.6	37.7		55.4	52.5
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	12.7	1.0	1.6	7.4	4.9	0.1	11.0	11.0	0.3		15.7	0.9
Delay (s)	37.9	27.2	26.5	63.4	36.8	20.7	55.6	55.7	38.0		71.1	53.4
Level of Service	D	C	C	E	D	C	E	E	D		E	D
Approach Delay (s)		28.0			37.3			53.2			62.1	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	38.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	127.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	131	659	554	101	1298	116	260	265	85	105	109
v/c Ratio	0.74	0.45	0.57	0.66	0.86	0.16	0.71	0.71	0.20	0.62	0.44
Control Delay	50.0	27.9	4.6	76.0	38.7	5.8	57.0	57.2	6.2	72.6	15.8
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	50.0	27.9	4.6	76.0	38.7	5.8	57.0	57.2	6.2	72.6	15.8
Queue Length 50th (ft)	55	202	0	83	503	7	213	218	0	87	0
Queue Length 95th (ft)	#150	267	72	142	604	42	#322	#327	32	#161	57
Internal Link Dist (ft)		1040			379			382		267	
Turn Bay Length (ft)	150		200	190		120			200		
Base Capacity (vph)	191	1452	969	202	1568	756	367	371	423	170	248
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	0.69	0.45	0.57	0.50	0.83	0.15	0.71	0.71	0.20	0.62	0.44

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	1435	410	113	750	82	598	77	136	139	65	206
Future Volume (vph)	215	1435	410	113	750	82	598	77	136	139	65	206
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1719	3438	1538	1719	3438	1538	1559	1580	1468		1802	1583
Flt Permitted	0.26	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (perm)	478	3438	1538	1719	3438	1538	1559	1580	1468		1802	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	217	1449	414	114	758	83	604	78	137	140	66	208
RTOR Reduction (vph)	0	0	160	0	0	47	0	0	110	0	0	172
Lane Group Flow (vph)	217	1449	254	114	758	36	338	344	27	0	206	36
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	10%	10%	2%	2%	2%
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases	2		2			6			8			4
Actuated Green, G (s)	55.8	47.0	47.0	8.8	47.0	47.0	22.0	22.0	22.0		12.0	12.0
Effective Green, g (s)	55.8	47.0	47.0	8.8	47.0	47.0	22.0	22.0	22.0		12.0	12.0
Actuated g/C Ratio	0.51	0.43	0.43	0.08	0.43	0.43	0.20	0.20	0.20		0.11	0.11
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	5.0	5.0	5.0		5.0	5.0
Lane Grp Cap (vph)	342	1471	658	137	1471	658	312	316	294		196	173
v/s Ratio Prot	0.05	c0.42		c0.07	0.22		0.22	c0.22			c0.11	
v/s Ratio Perm	0.27		0.17			0.02			0.02			0.02
v/c Ratio	0.63	0.99	0.39	0.83	0.52	0.05	1.08	1.09	0.09		1.05	0.21
Uniform Delay, d1	16.3	31.1	21.5	49.8	23.0	18.4	43.9	43.9	35.8		48.9	44.6
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	2.8	20.2	1.7	31.8	0.3	0.0	75.0	76.4	0.6		78.4	2.7
Delay (s)	19.1	51.2	23.2	81.6	23.3	18.4	118.9	120.3	36.4		127.3	47.3
Level of Service	B	D	C	F	C	B	F	F	D		F	D
Approach Delay (s)		42.3			29.9			105.7			87.1	
Approach LOS		D			C			F			F	

Intersection Summary			
HCM 2000 Control Delay	56.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	109.8	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	217	1449	414	114	758	83	338	344	137	206	208
v/c Ratio	0.64	0.99	0.51	0.83	0.51	0.11	1.08	1.09	0.34	1.05	0.60
Control Delay	22.5	51.8	9.5	93.0	24.6	1.7	117.8	117.9	8.8	125.7	16.4
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	22.5	51.8	9.5	93.0	24.6	1.7	117.8	117.9	8.8	125.7	16.4
Queue Length 50th (ft)	74	522	59	81	202	0	~282	~288	0	~159	10
Queue Length 95th (ft)	117	#691	145	#181	260	13	#471	#478	51	#308	83
Internal Link Dist (ft)		1040			379			382		267	
Turn Bay Length (ft)	150		200	190		120			200		
Base Capacity (vph)	345	1471	817	140	1472	726	312	317	403	196	344
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	0.99	0.51	0.81	0.51	0.11	1.08	1.09	0.34	1.05	0.60

Intersection Summary

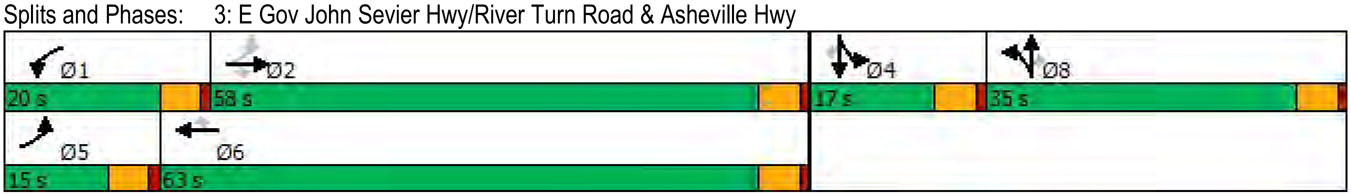
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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	NBR	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	122	613	515	94	1207	108	440	48	79	35	101
Future Volume (vph)	122	613	515	94	1207	108	440	48	79	35	101
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	Split	NA	Perm	NA	Perm
Protected Phases	5	2		1	6		8	8		4	
Permitted Phases	2		2			6			8		4
Detector Phase	5	2	2	1	6	6	8	8	8	4	4
Switch Phase											
Minimum Initial (s)	6.0	15.0	15.0	6.0	15.0	15.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	11.0	20.0	20.0	11.0	20.0	20.0	11.0	11.0	11.0	11.0	11.0
Total Split (s)	15.0	58.0	58.0	20.0	63.0	63.0	35.0	35.0	35.0	17.0	17.0
Total Split (%)	11.5%	44.6%	44.6%	15.4%	48.5%	48.5%	26.9%	26.9%	26.9%	13.1%	13.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	None	None	Max	Max	Max	Max	Max
Act Effct Green (s)	62.7	53.7	53.7	11.4	56.2	56.2	30.0	30.0	30.0	12.0	12.0
Actuated g/C Ratio	0.49	0.42	0.42	0.09	0.44	0.44	0.24	0.24	0.24	0.09	0.09
v/c Ratio	0.74	0.45	0.57	0.66	0.86	0.16	0.71	0.71	0.20	0.62	0.44
Control Delay	50.0	27.9	4.6	76.0	38.7	5.8	57.0	57.2	6.2	72.6	15.8
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	50.0	27.9	4.6	76.0	38.7	5.8	57.0	57.2	6.2	72.6	15.8
LOS	D	C	A	E	D	A	E	E	A	E	B
Approach Delay		20.4			38.7			50.0		43.7	
Approach LOS		C			D			D		D	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 127.2	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 34.2	Intersection LOS: C
Intersection Capacity Utilization 72.7%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 3: E Gov John Sevier Hwy/River Turn Road & Asheville Hwy

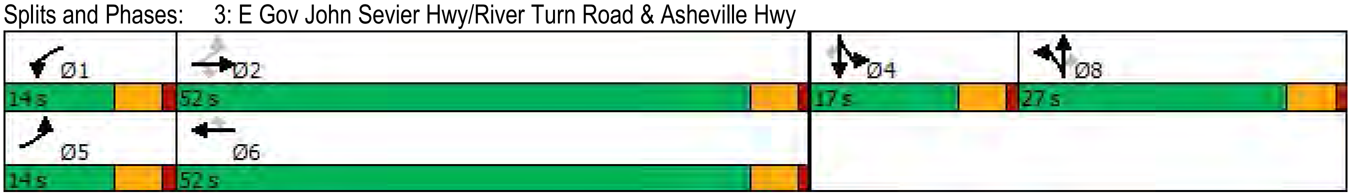


3: E Gov John Sevier Hwy/River Turn Road & Asheville Hwy

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	215	1435	410	113	750	82	598	77	136	65	206
Future Volume (vph)	215	1435	410	113	750	82	598	77	136	65	206
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	Split	NA	Perm	NA	Perm
Protected Phases	5	2		1	6		8	8		4	
Permitted Phases	2		2			6			8		4
Detector Phase	5	2	2	1	6	6	8	8	8	4	4
Switch Phase											
Minimum Initial (s)	6.0	15.0	15.0	6.0	15.0	15.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	14.0	52.0	52.0	14.0	52.0	52.0	27.0	27.0	27.0	17.0	17.0
Total Split (s)	14.0	52.0	52.0	14.0	52.0	52.0	27.0	27.0	27.0	17.0	17.0
Total Split (%)	12.7%	47.3%	47.3%	12.7%	47.3%	47.3%	24.5%	24.5%	24.5%	15.5%	15.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	Max	Max	None	None	None	Max	Max	Max	Max	Max
Act Effct Green (s)	55.8	47.0	47.0	8.8	47.0	47.0	22.0	22.0	22.0	12.0	12.0
Actuated g/C Ratio	0.51	0.43	0.43	0.08	0.43	0.43	0.20	0.20	0.20	0.11	0.11
v/c Ratio	0.64	0.99	0.51	0.83	0.51	0.11	1.08	1.09	0.34	1.05	0.60
Control Delay	22.5	51.8	9.5	93.0	24.6	1.7	117.8	117.9	8.8	125.7	16.4
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	22.5	51.8	9.5	93.0	24.6	1.7	117.8	117.9	8.8	125.7	16.4
LOS	C	D	A	F	C	A	F	F	A	F	B
Approach Delay		40.3			30.8			99.6		70.8	
Approach LOS		D			C			F		E	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 109.8	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.09	
Intersection Signal Delay: 52.5	Intersection LOS: D
Intersection Capacity Utilization 83.7%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 3: E Gov John Sevier Hwy/River Turn Road & Asheville Hwy



Attachment 12
Signal Warrant Analysis

Project: 377.030 - Asheville Highway Park
Intersection: Asheville Highway at Driveway Connection

	Existing Conditions		Warrant 1			Warrant 2	Warrant 3
	Major Street	Minor Street	Condition A	Condition B	Condition A/B		
Start	veh/hr	veh/hr					
7:00 a.m.	2081	0	NO	NO	NO	NO	NO
8:00 a.m.	1658	0	NO	NO	NO	NO	NO
12:00 p.m.	1449	0	NO	NO	NO	NO	NO
1:00 p.m.	1531	0	NO	NO	NO	NO	NO
2:00 p.m.	1610	0	NO	NO	NO	NO	NO
3:00 p.m.	1874	0	NO	NO	NO	NO	NO
4:00 p.m.	2095	0	NO	NO	NO	NO	NO
5:00 p.m.	2145	0	NO	NO	NO	NO	NO

	Background Conditions		Warrant 1			Warrant 2	Warrant 3
	Major Street	Minor Street	Condition A	Condition B	Condition A/B		
Start	veh/hr	veh/hr					
7:00 a.m.	2187	0	NO	NO	NO	NO	NO
8:00 a.m.	1743	0	NO	NO	NO	NO	NO
12:00 p.m.	1523	0	NO	NO	NO	NO	NO
1:00 p.m.	1609	0	NO	NO	NO	NO	NO
2:00 p.m.	1692	0	NO	NO	NO	NO	NO
3:00 p.m.	1970	0	NO	NO	NO	NO	NO
4:00 p.m.	2202	0	NO	NO	NO	NO	NO
5:00 p.m.	2254	0	NO	NO	NO	NO	NO

	Full Buildout		Warrant 1			Warrant 2	Warrant 3
	Major Street	Minor Street	Condition A	Condition B	Condition A/B		
Start	veh/hr	veh/hr					
7:00 a.m.	2187	107	NO	YES	NO	NO	NO
8:00 a.m.	1743	83	NO	NO	NO	NO	NO
12:00 p.m.	1523	74	NO	NO	NO	NO	NO
1:00 p.m.	1609	76	NO	NO	NO	NO	NO
2:00 p.m.	1692	85	NO	NO	NO	NO	NO
3:00 p.m.	1970	96	NO	NO	NO	NO	NO
4:00 p.m.	2202	108	NO	YES	NO	NO	NO
5:00 p.m.	2254	104	NO	YES	NO	NO	NO