MEMORANDUM

To: Kevin Norton, Vice President, Land Acquisitions and Development
EAH Acquisitions, LP
5775 Glenridge Drive, Building D, Suite 350
Atlanta, Georgia 30328

Mike Price, PE
MAP Engineers, LLC
7380 Applegate Lane
Chattanooga, Tennessee 37421

From: Alainie Sawtelle, EI
Christopher D. Rhodes, PE
Kimley-Horn and Associates, Inc.
10 Lea Avenue, Suite 400
Nashville, Tennessee 37210

Date: September 26, 2022

Subject: Chastain Tract Residential Development
Edgmon Road / Lee Highway, Collegedale, Tennessee
Traffic Assessment Memorandum
Kimley-Horn Project Number: 014581004

Chastain Tract Residential Development is a proposed single-family housing development consisting of approximately 512 single-family detached units. To accommodate traffic from the proposed development, a roundabout is proposed to be installed with the east and west legs providing access to the development, and the north and south legs on Edgmon Road. **Appendix A** depicts the conceptual site plan for this development.

This summary memorandum has been prepared to summarize the transportation impacts of the proposed development for future year 2030.

INTRODUCTION

This memorandum presents the analysis of the anticipated traffic impacts associated with the *Chastain Tract Residential Development* which is expected to be completed in 2030 (referred to herein as build-out year). As currently envisioned, the development will consist of approximately 512 single-family detached units. The approximate 427.5-acre site is located on both the east and west side of Edgmon Road, south of Lee highway within the City of Collegedale.

This memorandum will summarize the analyses of the following scenarios:

- Existing 2022 Conditions
- Projected 2030 No-Build Conditions
- Projected 2030 Build Conditions

The study network for this analysis includes the following intersections:

1. Lee Highway at Edgmon Road
2. Proposed roundabout intersection at development site and Edgmon Road

For the purposes of this traffic analysis Lee Highway, and the development driveways are considered to have an east-west orientation. Edgmon Road is considered to have north-south orientation.

EXISTING CONDITINS

Turning movement counts (TMCs) were collected for four (4) hours on Wednesday, September 14, 2022, from 7:00 am to 9:00 am and 4:00 pm to 6:00 pm at the Lee Highway and Edgmon Road intersection.

Historical traffic data from the TDOT count stations was used to evaluate historic traffic trends and determine an appropriate growth rate for the study area. Based on review of the TDOT historical data, an annual growth rate of 2.0 percent was applied to the existing traffic volumes.

The traffic volume tables are provided in **Appendix B**.

DAILY TRIP GENERATION AND DISTRIBUTION

Traffic generated by the proposed development was calculated using equations provided in the *Trip Generation Manual, 11th Edition*, published by the Institute of Transportation Engineers (ITE). These calculations result in the following trips generated by the site.

Table 1 provides the trip generation for the proposed development.

Table 1 – Trip Generation

ITE Land Use	Density	Daily Volumes	AM Peak Hour			PM Peak Hour		
			Total	Enter	Exit	Total	Enter	Exit
Single-Family Detached Housing (ITE Land Use 210)	512	4,534	329	86	243	461	290	171
New Trips		**4,534**	**329**	**86**	**243**	**461**	**290**	**171**

Based on the site plan, approximately 65% of the detached single-family units will be located east of Edgmon Road. It is proposed that 35% of the detached single-family units will be located west of Edgmon Road.

INTERSECTION CAPACITY ANALYSIS

The *Highway Capacity Manual (HCM) 6th Edition* provides insight and guidance on control delay, level of service (LOS), signalized intersection LOS, and unsignalized intersection LOS.

For existing roadways, municipalities typically consider LOS A through LOS D as the range of acceptable overall intersection operations, while LOS E and LOS F are generally considered unacceptable. Roadway laneage, traffic signalization, or other improvements are normally required at those intersections which operate within the range of unacceptable LOS.

The operating conditions for the signalized intersection were analyzed for the weekday AM and PM peak hours using the *Synchro 11* software which uses the methodologies contained in the *Highway Capacity Manual 6th Edition*.

The operating conditions for the proposed roundabout was analyzed for the weekday AM and PM peak hours using the *SIDRA Intersection 9* software which is a micro-analytical software tool used to analyze roundabout operations.

The intersection of Lee Highway at Edgmon road was analyzed with the Existing 2022, Projected 2030 No-Build Conditions and the Projected 2030 Build Conditions. The proposed roundabout intersection at the development and Edgmon Road was analyzed using Projected 2030 Build Conditions (as it does not exist today or during future no-build conditions).

Table 2 provides a summary of the level-of-service results.

Table 2: Level-of-Service Summary
LOS (Delay in Seconds)

Intersection	Approach/ Movement	Existing 2022		Projected 2030 No-Build		Projected 2030 Build	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Lee Highway at Edgmon Road	Overall	A (7.8)	A (8.6)	A (8.3)	A (9.1)	A (10.0)	B (10.5)
Proposed Roundabout	Overall	-	-	-	-	A (4.8)	A (6.5)
	v/c[1]	-	-	-	-	0.220	0.443

1. Volume to capacity ratio

As summarized above the signalized intersection operates well within acceptable levels of service during future traffic build conditions and the roundabout projects to do the same with volume-to-capacity ratios well under capacity.

QUEUING ANALYSIS

The *Highway Capacity Manual 6th Edition* provides insight and guidance regarding the back of queue for signalized intersections.

"The back-of-queue position is the position of the vehicle stopped farthest from the stop line during the cycle as a consequence of the display of a red signal indication. The back-of-queue size depends on the arrival pattern of vehicles and on the number of vehicles that do not clear the intersection during the previous cycle." (Source: *Highway Capacity Manual 6th Edition*, Chapter 19)

Table 3 summarizes the queueing length results for the signalized intersection.

Table 3 – Queue Length Results
Intersection of Lee Highway at Edgmon Road

Turn Movement		Existing Storage Length	AM (95th Percentile)			PM (95th Percentile)		
			Existing 2022	No-Build 2030	Build 2030	Existing 2022	No-Build 2030	Build 2030
Eastbound	Through	--	91	112	132	243	323	352
	Right-Turn	138	9	10	11	11	11	14
Westbound	Left-Turn	237	22	27	38	13	15	28
	Through	--	132	180	231	84	112	122
Northbound	Left-Turn	--	87	107	187	87	118	192
	Right-Turn	148	12	14	17	19	23	27

NOTE: All numbers represent distance in feet

The eastbound through movement does queue past the taper opening of the eastbound right-turn lane. This condition occurs today as an existing condition and projects to continue in the future No-Build 2030 and Build 2030 scenarios. Due to the proximity of the existing railroad right-of-way that is adjacent to the intersection, there is not existing right-of-way available to extend the existing right-turn lane. In conversations with City staff, we understand that the Railroad did not assist in providing right-of-way to extend the right-turn lane during the recently constructed TDOT-funded traffic signal and turn lane improvements. Therefore, it is also anticipated that they would also not assist the City and/or a private developer with a similar request. Hence, the existing situation is expected to remain which is: when the eastbound through movement receives a green indication at the signal, the queue will release, thereby providing right-turners access to the right-turn lane.

For the northbound Edgmon Road approach the northbound left-turn movement does queue past the taper opening for the northbound right-turn lane. This condition occurs during future build conditions. In order to provide access to the right-turn lane a two-lane northbound approach would need to be extended further south to provide 250' of storage for both the left-turn lane and the right-turn lane. To

accommodate this storage depth it would require widening the existing bridge to a 3-lane section. Just south of the bridge, the road could taper back down to a 2-lane section.

CONCLUSION

The intersection capacity analysis with Projected Build 2030 Conditions provides acceptable levels of service for both the signalized intersection and the proposed roundabout. However, the northbound approach of Edgmon Road is recommended to be widened to a 3-lane section (two (2) northbound lanes, one (1) southbound lane) across the existing bridge, thereby necessitating the widening of the existing bridge to a 3-lane section. The road would then taper back to a 2-lane section directly south of the existing bridge.

It is also important to reiterate and have the review agency understand the following:

- **The recommended improvement to widen the Edmon Road approach to a 3-lane section will be needed in future years even without this proposed development being built. The queues associated with the left-turn lane project to block access to the right-turn lane shortly after 2030 with the growth of other traffic volumes not associated with this development. This improvement will be needed whether or not this proposed development is built. However, it is recommended that the 3-lane section be constructed at approximately 45-55 percent buildout of this development. This is recommended to equate to the 275th Certificate of Occupancy (CO) for residential units in the development.**
- **The need for a longer eastbound right-turn lane at the intersection of Lee Highway / Edgmon Road exists today. The Railroad did not assist TDOT with additional right-of-way needs associated with the intersection improvements recently completed at Lee Highway / Edgmon Road, hence this improvement was not incorporated into that recently completed project. Therefore, it is also anticipated that they would also not assist the City and/or a private developer with a similar request.**

Please do not hesitate to call if anything further is needed. Respectfully Submitted,

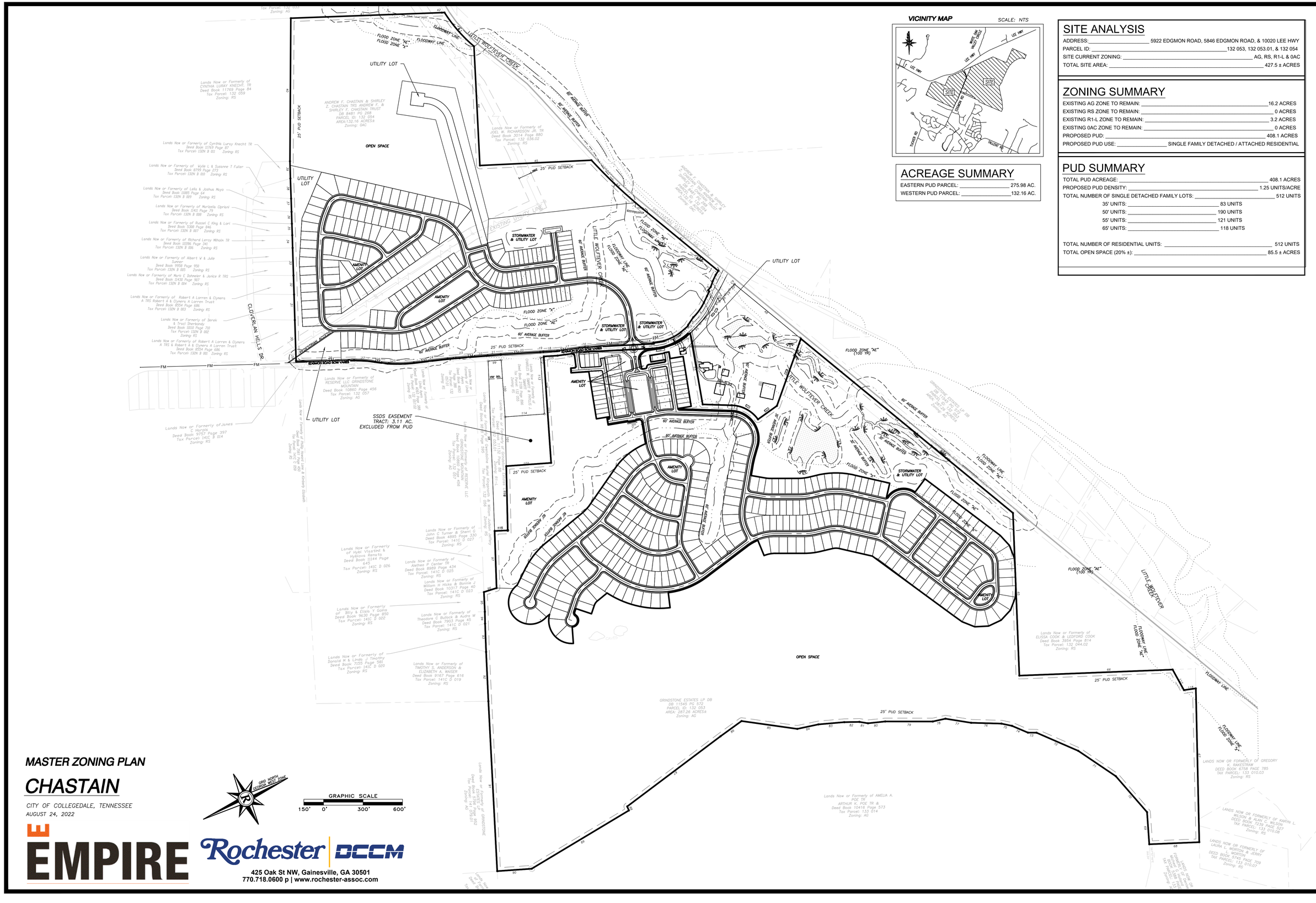
KIMLEY-HORN AND ASSOCIATES, INC.

Alainie Sawtelle, EI
Project Analyst

Christopher D. Rhodes, PE
Project Manager

Attachments: Appendix A – Site Plan
Appendix B – Trip Generation and Volume Worksheets
Appendix C – Synchro Results
Appendix D – SIDRA Results

APPENDIX A: SITE PLAN



VICINITY MAP

SCALE: NTS

ACREAGE SUMMARY

EASTERN PUD PARCEL:	275.98 AC.
WESTERN PUD PARCEL:	132.16 AC.

SITE ANALYSIS

ADDRESS:	5922 EDGMON ROAD, 5846 EDGMON ROAD, & 10020 LEE HWY
PARCEL ID:	132 053, 132 053.01, & 132 054
SITE CURRENT ZONING:	AG, RS, R1-L & 0AC
TOTAL SITE AREA:	427.5 ± ACRES

ZONING SUMMARY

EXISTING AG ZONE TO REMAIN:	16.2 ACRES
EXISTING RS ZONE TO REMAIN:	0 ACRES
EXISTING R1-L ZONE TO REMAIN:	3.2 ACRES
EXISTING 0AC ZONE TO REMAIN:	0 ACRES
PROPOSED PUD:	408.1 ACRES
PROPOSED PUD USE:	SINGLE FAMILY DETACHED / ATTACHED RESIDENTIAL

PUD SUMMARY

TOTAL PUD ACREAGE:	408.1 ACRES
PROPOSED PUD DENSITY:	1.25 UNITS/ACRE
TOTAL NUMBER OF SINGLE DETACHED FAMILY LOTS:	512 UNITS
35' UNITS:	83 UNITS
50' UNITS:	190 UNITS
55' UNITS:	121 UNITS
65' UNITS:	118 UNITS
TOTAL NUMBER OF RESIDENTIAL UNITS:	512 UNITS
TOTAL OPEN SPACE (20% ±):	85.5 ± ACRES

MASTER ZONING PLAN

CHASTAIN

CITY OF COLLEGEDALE, TENNESSEE
AUGUST 24, 2022

GRID NORTH GEORGIA WEST ZONE

GRAPHIC SCALE
150' 0' 300' 600'

EMPIRE
Rochester | DCCM
425 Oak St NW, Gainesville, GA 30501
770.718.0600 p | www.rochester-assoc.com

APPENDIX B: TRIP GENERATION AND VOLUME WORKSHEETS

Trip Generation - Edgmon Development

ITE Code	Land Use	Setting/Location	Density		Daily	AM Peak Hour			PM Peak Hour		
						Total	Enter	Exit	Total	Enter	Exit
210	Single-Family Detached Housing	General Urban/Suburban	512	d.u.	4,534	329	86	243	461	290	171
NEW TRIPS					4,534	329	86	243	461	290	171

INTERSECTION VOLUME WORKSHEET

Intersection 1

Lee Highway at Edgmon Road

AM PEAK HOUR

	Lee Highway Eastbound				Lee Highway Westbound				Edgmon Road Northbound				- Southbound			
	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right
Existing Traffic																
Existing 2022 AM Volumes			185	83		63	440			173		61				
Existing 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	0.94	0.94	0.94	0.94
Conflicting Pedestrians																
Heavy Vehicles			13	2		5	11			0		0				
Heavy Vehicle %	2	2	7	2	2	8	3	2	2	2	2	2	2	2	2	2
Background Traffic																
Annual Growth Rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Growth Factor	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172
Growth Trips	0	0	32	14	0	11	76	0	0	30	0	10	0	0	0	0
No-Build 2030 AM Volumes	0	0	217	97	0	74	516	0	0	203	0	71	0	0	0	0
Project Traffic																
Detached Housing Trip Distribution IN				56%		14%										
Detached Housing Trip Distribution OUT										56%		14%				
Detached Housing Project Trips	0	0	0	48	0	12	0	0	0	136	0	34	0	0	0	0
Attached Housing Trip Distribution IN				56%		14%										
Attached Housing Trip Distribution OUT										56%		14%				
Attached Housing Project Trips	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project Trips	0	0	0	48	0	12	0	0	0	136	0	34	0	0	0	0
Build 2030 AM Volumes	0	0	217	145	0	86	516	0	0	339	0	105	0	0	0	0

PM PEAK HOUR

	Lee Highway Eastbound				Lee Highway Westbound				Edgmon Road Northbound				- Southbound			
	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right
Existing Traffic																
Existing 2022 AM Volumes			522	230		37	339			123		48				
Existing Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Conflicting Pedestrians																
Heavy Vehicles			13	1		1	3			0		1				
Heavy Vehicle %	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
Background Traffic																
Annual Growth Rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Growth Factor	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172
Growth Trips	0	0	90	40	0	6	58	0	0	21	0	8	0	0	0	0
No-Build 2030 PM Volumes	0	0	612	270	0	43	397	0	0	144	0	56	0	0	0	0
Project Traffic																
Detached Housing Trip Distribution IN				56%		14%										
Detached Housing Trip Distribution OUT										56%		14%				
Detached Housing Project Trips	0	0	0	162	0	41	0	0	0	96	0	24	0	0	0	0
Attached Housing Trip Distribution IN				56%		14%										
Attached Housing Trip Distribution OUT										56%		14%				
Attached Housing Project Trips	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project Trips	0	0	0	162	0	41	0	0	0	96	0	24	0	0	0	0
Build 2030 PM Volumes	0	0	612	432	0	84	397	0	0	240	0	80	0	0	0	0

INTERSECTION VOLUME WORKSHEET

Intersection 2

Roundabout

AM PEAK HOUR

	Townhouses+Detached Eastbound				Detached only Westbound				Edgmon Road Northbound				Edgmon Road Southbound			
	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right
Existing Traffic																
Existing 2022 AM Volumes											234				146	
Existing Peak Hour Factor		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Vehicles															7	
Heavy Vehicle %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	7	2
Background Traffic																
Annual Growth Rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Growth Factor	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172
Growth Trips	0	0	0	0	0	0	0	0	0	0	40	0	0	0	25	0
No-Build 2030 AM Volumes	0	0	0	0	0	0	0	0	0	0	274	0	0	0	171	0
Project Traffic																
Detached Housing Trip Distribution IN										10%		25%		45%		20%
Detached Housing Trip Distribution OUT		25%		10%		20%		45%								
Detached Housing Project Trips	0	61	0	24	0	49	0	109	0	9	0	22	0	39	0	17
Project Trips	0	61	0	24	0	49	0	109	0	9	0	22	0	39	0	17
Build 2030 AM Volumes	0	61	0	24	0	49	0	109	0	9	274	22	0	39	171	17

PM PEAK HOUR

	Townhouses+Detached Eastbound				Detached only Westbound				Edgmon Road Northbound				Edgmon Road Southbound			
	U-Turn	Left	Through	interse	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right	U-Turn	Left	Through	Right
Existing Traffic																
Existing 2022 AM Volumes											234				146	
Existing Peak Hour Factor		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conflicting Pedestrians																
Heavy Vehicles											2				4	
Heavy Vehicle %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2.739726	2
Background Traffic																
Annual Growth Rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Growth Factor	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172	1.172
Growth Trips	0	0	0	0	0	0	0	0	0	0	40	0	0	0	25	0
No-Build 2030 PM Volumes	0	0	0	0	0	0	0	0	0	0	274	0	0	0	171	0
Project Traffic																
Detached Housing Trip Distribution IN										10%		25%		45%		20%
Detached Housing Trip Distribution OUT		25%		10%		20%		45%								
Detached Housing Project Trips	0	43	0	17	0	34	0	77	0	29	0	73	0	131	0	58
Project Trips	0	43	0	17	0	34	0	77	0	29	0	73	0	131	0	58
Build 2030 PM Volumes	0	43	0	17	0	34	0	77	0	29	274	73	0	131	171	58

APPENDIX C: SYNCHRO RESULTS

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	185	83	63	440	173	61
Future Volume (veh/h)	185	83	63	440	173	61
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1796	1870	1781	1856	1870	1870
Adj Flow Rate, veh/h	197	88	67	468	184	66
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.92
Percent Heavy Veh, %	7	2	8	3	2	2
Cap, veh/h	365	578	656	981	287	525
Arrive On Green	0.20	0.20	0.17	0.53	0.16	0.16
Sat Flow, veh/h	1796	1585	1697	1856	1781	1585
Grp Volume(v), veh/h	197	88	67	468	184	66
Grp Sat Flow(s),veh/h/ln	1796	1585	1697	1856	1781	1585
Q Serve(g_s), s	2.8	1.1	0.7	4.6	2.8	0.8
Cycle Q Clear(g_c), s	2.8	1.1	0.7	4.6	2.8	0.8
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	365	578	656	981	287	525
V/C Ratio(X)	0.54	0.15	0.10	0.48	0.64	0.13
Avail Cap(c_a), veh/h	1239	1349	1420	2719	1136	1281
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	10.3	6.2	5.1	4.3	11.4	6.8
Incr Delay (d2), s/veh	1.2	0.1	0.1	0.4	2.4	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.3	0.1	0.2	0.9	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	11.6	6.3	5.2	4.7	13.8	6.9
LnGrp LOS	B	A	A	A	B	A
Approach Vol, veh/h	285			535	250	
Approach Delay, s/veh	10.0			4.7	11.9	
Approach LOS	A			A	B	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.4	10.4		9.2		19.8
Change Period (Y+Rc), s	4.5	4.5		4.5		4.5
Max Green Setting (Gmax), s	18.0	20.0		18.5		42.5
Max Q Clear Time (g_c+I1), s	2.7	4.8		4.8		6.6
Green Ext Time (p_c), s	0.1	1.1		0.6		2.8

Intersection Summary	
HCM 6th Ctrl Delay	7.8
HCM 6th LOS	A

Notes

User approved pedestrian interval to be less than phase max green.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	522	230	37	339	123	48
Future Volume (veh/h)	522	230	37	339	123	48
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	549	242	39	357	129	53
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.91
Percent Heavy Veh, %	2	2	3	2	2	2
Cap, veh/h	754	818	550	1217	201	384
Arrive On Green	0.40	0.40	0.13	0.65	0.11	0.11
Sat Flow, veh/h	1870	1585	1767	1870	1781	1585
Grp Volume(v), veh/h	549	242	39	357	129	53
Grp Sat Flow(s),veh/h/ln	1870	1585	1767	1870	1781	1585
Q Serve(g_s), s	9.4	3.3	0.4	3.1	2.6	1.0
Cycle Q Clear(g_c), s	9.4	3.3	0.4	3.1	2.6	1.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	754	818	550	1217	201	384
V/C Ratio(X)	0.73	0.30	0.07	0.29	0.64	0.14
Avail Cap(c_a), veh/h	1499	1449	1157	2605	842	955
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.6	5.3	5.2	2.9	16.1	11.3
Incr Delay (d2), s/veh	1.4	0.2	0.1	0.1	3.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.8	0.0	0.1	1.1	1.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	11.0	5.5	5.2	3.0	19.5	11.5
LnGrp LOS	B	A	A	A	B	B
Approach Vol, veh/h	791			396	182	
Approach Delay, s/veh	9.3			3.2	17.2	
Approach LOS	A			A	B	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.4	19.8		8.8		29.3
Change Period (Y+Rc), s	4.5	4.5		4.5		4.5
Max Green Setting (Gmax), s	18.0	30.5		18.0		53.0
Max Q Clear Time (g_c+I1), s	2.4	11.4		4.6		5.1
Green Ext Time (p_c), s	0.0	3.9		0.4		2.1

Intersection Summary	
HCM 6th Ctrl Delay	8.6
HCM 6th LOS	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	217	97	74	516	203	71
Future Volume (veh/h)	217	97	74	516	203	71
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1796	1870	1781	1856	1870	1870
Adj Flow Rate, veh/h	231	103	79	549	216	77
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.92
Percent Heavy Veh, %	7	2	8	3	2	2
Cap, veh/h	395	640	620	976	327	546
Arrive On Green	0.22	0.22	0.16	0.53	0.18	0.18
Sat Flow, veh/h	1796	1585	1697	1856	1781	1585
Grp Volume(v), veh/h	231	103	79	549	216	77
Grp Sat Flow(s),veh/h/ln	1796	1585	1697	1856	1781	1585
Q Serve(g_s), s	3.6	1.3	0.8	6.2	3.5	1.0
Cycle Q Clear(g_c), s	3.6	1.3	0.8	6.2	3.5	1.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	395	640	620	976	327	546
V/C Ratio(X)	0.58	0.16	0.13	0.56	0.66	0.14
Avail Cap(c_a), veh/h	1159	1314	1332	2544	1063	1200
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	10.8	5.9	5.5	4.9	11.8	7.0
Incr Delay (d2), s/veh	1.4	0.1	0.1	0.5	2.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.4	0.1	0.5	1.2	1.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	12.2	6.0	5.6	5.5	14.0	7.1
LnGrp LOS	B	A	A	A	B	A
Approach Vol, veh/h	334			628	293	
Approach Delay, s/veh	10.3			5.5	12.2	
Approach LOS	B			A	B	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.5	11.3		10.2		20.8
Change Period (Y+Rc), s	4.5	4.5		4.5		4.5
Max Green Setting (Gmax), s	18.0	20.0		18.5		42.5
Max Q Clear Time (g_c+I1), s	2.8	5.6		5.5		8.2
Green Ext Time (p_c), s	0.1	1.3		0.7		3.5

Intersection Summary	
HCM 6th Ctrl Delay	8.3
HCM 6th LOS	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	612	270	43	397	144	56
Future Volume (veh/h)	612	270	43	397	144	56
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	644	284	45	418	152	62
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.91
Percent Heavy Veh, %	2	2	3	2	2	2
Cap, veh/h	845	918	492	1249	227	382
Arrive On Green	0.45	0.45	0.11	0.67	0.13	0.13
Sat Flow, veh/h	1870	1585	1767	1870	1781	1585
Grp Volume(v), veh/h	644	284	45	418	152	62
Grp Sat Flow(s),veh/h/ln	1870	1585	1767	1870	1781	1585
Q Serve(g_s), s	12.6	4.0	0.4	4.2	3.6	1.4
Cycle Q Clear(g_c), s	12.6	4.0	0.4	4.2	3.6	1.4
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	845	918	492	1249	227	382
V/C Ratio(X)	0.76	0.31	0.09	0.33	0.67	0.16
Avail Cap(c_a), veh/h	1724	1663	1016	2681	730	829
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	10.1	4.7	6.0	3.1	18.3	13.2
Incr Delay (d2), s/veh	1.5	0.2	0.1	0.2	3.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.4	1.1	0.1	0.3	1.5	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	11.5	4.9	6.1	3.3	21.7	13.4
LnGrp LOS	B	A	A	A	C	B
Approach Vol, veh/h	928			463	214	
Approach Delay, s/veh	9.5			3.6	19.3	
Approach LOS	A			A	B	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.5	24.4		10.1		33.8
Change Period (Y+Rc), s	4.5	4.5		4.5		4.5
Max Green Setting (Gmax), s	18.0	40.5		18.0		63.0
Max Q Clear Time (g_c+I1), s	2.4	14.6		5.6		6.2
Green Ext Time (p_c), s	0.1	5.2		0.5		2.5

Intersection Summary	
HCM 6th Ctrl Delay	9.1
HCM 6th LOS	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	217	145	86	516	339	105
Future Volume (veh/h)	217	145	86	516	339	105
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1796	1870	1781	1856	1870	1870
Adj Flow Rate, veh/h	231	154	91	549	361	114
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.92
Percent Heavy Veh, %	7	2	8	3	2	2
Cap, veh/h	382	771	527	884	488	654
Arrive On Green	0.21	0.21	0.14	0.48	0.27	0.27
Sat Flow, veh/h	1796	1585	1697	1856	1781	1585
Grp Volume(v), veh/h	231	154	91	549	361	114
Grp Sat Flow(s),veh/h/ln	1796	1585	1697	1856	1781	1585
Q Serve(g_s), s	4.2	2.0	1.2	7.9	6.6	1.6
Cycle Q Clear(g_c), s	4.2	2.0	1.2	7.9	6.6	1.6
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	382	771	527	884	488	654
V/C Ratio(X)	0.60	0.20	0.17	0.62	0.74	0.17
Avail Cap(c_a), veh/h	1097	1402	833	1958	1137	1232
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.8	5.3	7.3	7.0	11.9	6.7
Incr Delay (d2), s/veh	1.5	0.1	0.2	0.7	2.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.8	0.2	1.5	2.2	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	14.4	5.4	7.4	7.7	14.1	6.8
LnGrp LOS	B	A	A	A	B	A
Approach Vol, veh/h	385			640	475	
Approach Delay, s/veh	10.8			7.7	12.4	
Approach LOS	B			A	B	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.5	12.2		14.4		21.7
Change Period (Y+Rc), s	4.5	4.5		4.5		4.5
Max Green Setting (Gmax), s	11.5	22.0		23.0		38.0
Max Q Clear Time (g_c+I1), s	3.2	6.2		8.6		9.9
Green Ext Time (p_c), s	0.1	1.5		1.3		3.4

Intersection Summary						
HCM 6th Ctrl Delay			10.0			
HCM 6th LOS			A			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	612	432	84	397	240	80
Future Volume (veh/h)	612	432	84	397	240	80
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1856	1870	1870	1870
Adj Flow Rate, veh/h	644	455	88	418	253	88
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.91
Percent Heavy Veh, %	2	2	3	2	2	2
Cap, veh/h	836	1005	440	1188	333	453
Arrive On Green	0.45	0.45	0.10	0.64	0.19	0.19
Sat Flow, veh/h	1870	1585	1767	1870	1781	1585
Grp Volume(v), veh/h	644	455	88	418	253	88
Grp Sat Flow(s),veh/h/ln	1870	1585	1767	1870	1781	1585
Q Serve(g_s), s	14.7	7.4	1.1	5.3	6.8	2.1
Cycle Q Clear(g_c), s	14.7	7.4	1.1	5.3	6.8	2.1
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	836	1005	440	1188	333	453
V/C Ratio(X)	0.77	0.45	0.20	0.35	0.76	0.19
Avail Cap(c_a), veh/h	1499	1566	894	2332	634	721
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	11.8	4.7	7.7	4.3	19.5	13.7
Incr Delay (d2), s/veh	1.5	0.3	0.2	0.2	3.6	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.5	2.8	0.2	0.9	2.8	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	13.3	5.1	7.9	4.5	23.1	13.9
LnGrp LOS	B	A	A	A	C	B
Approach Vol, veh/h	1099			506	341	
Approach Delay, s/veh	9.9			5.1	20.7	
Approach LOS	A			A	C	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.5	27.1		13.9		36.6
Change Period (Y+Rc), s	4.5	4.5		4.5		4.5
Max Green Setting (Gmax), s	18.0	40.5		18.0		63.0
Max Q Clear Time (g_c+I1), s	3.1	16.7		8.8		7.3
Green Ext Time (p_c), s	0.1	5.9		0.7		2.5

Intersection Summary	
HCM 6th Ctrl Delay	10.5
HCM 6th LOS	B

APPENDIX D: SIDRA RESULTS

LANE SUMMARY

Site: 101 [AM Peak (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Edgmon Road													
Lane 1[d]	183	3.0	993	0.184	100	5.3	LOS A	1.0	25.9	Full	1600	0.0	0.0
Approach	183	3.0		0.184		5.3	LOS A	1.0	25.9				
East: Development													
Lane 1[d]	178	2.0	1192	0.150	100	4.3	LOS A	0.8	21.3	Full	1600	0.0	0.0
Approach	178	2.0		0.150		4.3	LOS A	0.8	21.3				
North: Edgmon Road													
Lane 1[d]	95	2.0	1054	0.090	100	4.2	LOS A	0.5	11.5	Full	1600	0.0	0.0
Approach	95	2.0		0.090		4.2	LOS A	0.5	11.5				
West: Development													
Lane 1[d]	260	2.0	1183	0.220	100	5.0	LOS A	1.3	32.0	Full	1600	0.0	0.0
Approach	260	2.0		0.220		5.0	LOS A	1.3	32.0				
Intersection	715	2.3		0.220		4.8	LOS A	1.3	32.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Edgmon Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	73	1	109	183	3.0	993	0.184	100	NA	NA
Approach	73	1	109	183	3.0		0.184			

East: Development

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	41	117	20	178	2.0	1192	0.150	100	NA	NA
Approach	41	117	20	178	2.0		0.150			

North: Edgmon Road											
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	55	1	38	95	2.0	1054	0.090	100	NA	NA	
Approach	55	1	38	95	2.0		0.090				
West: Development											
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	13	220	27	260	2.0	1183	0.220	100	NA	NA	
Approach	13	220	27	260	2.0		0.220				

	Total	%HV	Deg.Satn (v/c)
Intersection	715	2.3	0.220

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Edgmon Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Development Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Edgmon Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Development Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

LANE SUMMARY

Site: 101 [PM Peak (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Edgmon Road													
Lane 1[d]	129	3.0	1000	0.129	100	4.8	LOS A	0.7	17.8	Full	1600	0.0	0.0
Approach	129	3.0		0.129		4.8	LOS A	0.7	17.8				
East: Development													
Lane 1[d]	523	2.0	1180	0.443	100	7.7	LOS A	3.3	83.4	Full	1600	0.0	0.0
Approach	523	2.0		0.443		7.7	LOS A	3.3	83.4				
North: Edgmon Road													
Lane 1[d]	65	2.0	822	0.079	100	5.2	LOS A	0.4	11.0	Full	1600	0.0	0.0
Approach	65	2.0		0.079		5.2	LOS A	0.4	11.0				
West: Development													
Lane 1[d]	305	2.0	1110	0.275	100	5.9	LOS A	1.7	42.2	Full	1600	0.0	0.0
Approach	305	2.0		0.275		5.9	LOS A	1.7	42.2				
Intersection	1023	2.1		0.443		6.6	LOS A	3.3	83.4				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Edgmon Road

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	51	1	77	129	3.0	1000	0.129	100	NA	NA
Approach	51	1	77	129	3.0		0.129			

East: Development

Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	123	335	65	523	2.0	1180	0.443	100	NA	NA
Approach	123	335	65	523	2.0		0.443			

North: Edgmon Road											
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	38	1	26	65	2.0	822	0.079	100	NA	NA	
Approach	38	1	26	65	2.0		0.079				
West: Development											
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	45	180	80	305	2.0	1110	0.275	100	NA	NA	
Approach	45	180	80	305	2.0		0.275				
	Total	%HV	Deg.Satn (v/c)								
Intersection	1023	2.1		0.443							

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Edgmon Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Development Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Edgmon Road Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Development Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										