

June 28, 2023

Technical Memorandum Maple Leaf Boulevard Traffic Signal Study Munster, Indiana



115 South Court Street, Suite E Crown Point, IN 46307 P 844.271.5923 ciorba.com

Introduction

A new development called Maple Leaf Crossing is being proposed in the Town of Munster, Indiana. It will be located on the west side of Calumet Avenue just north of 45th Street. A traffic and parking study was previously done to determine the site traffic demand generated by the development. The goal of this study is to analyze the performance of the proposed traffic signal at the intersection of Calumet Avenue and the new Maple Leaf Parkway based on the existing traffic and the site generated traffic. The intersection capacity analysis was completed utilizing the Highway Capacity Analysis (HCS) 7 Software. See Appendix A-1 for the Site Location Map and the Proposed Site Plan.

Existing Traffic Volumes

The existing traffic volumes along Calumet Avenue were taken on June 8, 2023. Calumet Avenue is a principal arterial with two lanes in each direction and a two-way left turn lane (TWLTL). The 24-hr counts were provided through Miovision for the northbound/southbound traffic. The morning peak hour occurred at 7:45 a.m. and the afternoon peak hour occurred at 3:45 p.m. See Appendix A-2 for the Calumet Avenue Existing Peak Hour Traffic exhibit.

Projected Site Traffic Volumes

The site traffic volumes indicated in Appendix A-2 are based on the original memo. Peak hour traffic volumes on the proposed road are generated from the Maple Leaf development. Our understanding was that there would be no traffic from the Pepsi-Cola Bottlers Company located north of the development. The site generated turning movements are summarized in the table below.

Street	Direction	Turn	Tra	ffic
Sileei	Direction	Turri	AM	PM
Calumat Ava	NB	Left	49	39
Calumet Ave	SB	Right	12	10
Maple Leaf Dlud	EB	Left	30	75
Maple Leaf Blvd	EB	Right	5	12

Table 1. Traffic Volumes at Intersection of Calumet Avenue and Maple Leaf Boulevard

The existing traffic volume counts were projected to 2024 as it is anticipated that construction for the development will be completed by this year.

Intersection Capacity Analysis

The intersection capacity analysis was completed utilizing the HCS 7 Software. Capacity analysis results from HCS provide volume-to-capacity (v/c) ratios, average vehicle delays, level of service (LOS), and queue lengths (95^{th} -percentile) for the intersection. Traffic signal timings for the adjacent traffic signal on Calumet Avenue and 45^{th} Avenue were obtained from Midwestern Electric on June 27, 2023. The cycle length for this intersection was used to develop the proposed cycle length for the signal at the Calumet Avenue and Maple Leaf Boulevard intersection. This consists of a 100 second cycle in the morning peak hour and a 110 second cycle in the evening peak hour.

The LOS of a signalized intersection is defined in terms of control delay per vehicle (seconds per vehicle), and control delay is the portion of total delay experienced by a motorist that is attributed to the traffic signal. For signalized intersections, LOS A describes operations with minimal delays (up to

10 seconds per vehicle), while LOS F describes operations with delays in excess of 80 seconds per vehicle. In general, delays experienced at LOS D or better are generally considered "acceptable" operating conditions, while LOS E and F are generally considered "unacceptable" operating conditions. The LOS criteria for signalized intersections, as defined in the 7th Edition of the Highway Capacity Manual (HCM), are provided in Table 2.

Level of Service (LOS)	Average Delay
А	≤ 10.0 seconds
В	> 10.0 and ≤ 20.0 seconds
С	> 20.0 and ≤ 35.0 seconds
D	> 35.0 and ≤ 55.0 seconds
E	> 55.0 and ≤ 80.0 seconds
F	> 80.0

The projected traffic volumes on Calumet Avenue were combined with the site generated traffic to complete the analysis. Maple Leaf Boulevard was analyzed as a left-turn lane and a 70' right right-turn lane. The southbound direction of Calumet Avenue was analyzed as a thru lane and a thru-right lane. The northbound direction of Calumet Avenue was analyzed as two thru lanes and the TWLTL was converted to an 80' left-turn lane. The intersection capacity analysis LOS results for the proposed intersection are shown in Table 3. See Appendix A-3 for the HCS Reports.

Table 3.	Proposed	Intersection	LOS Results
----------	----------	--------------	-------------

Street	Level of Se	rvice (LOS)
	AM	PM
Calumet Ave	А	А
Maple Leaf Blvd	D	D

The Indiana Department of Transportation (INDOT) has a minimum LOS D design guideline for a built up, urban arterial (IDM Figure 53-6).

The largest 95th-percentile queue for the left-turn lane on Calumet Avenue is 37.1' in the PM peak hour. The largest 95th-percentile queue for the left-turn lane on Maple Leaf Boulevard is 102.9' in the PM peak hour.

Conclusion

Based on the findings of the study, the intersection meets the minimum LOS design guideline for INDOT. A northbound 80' left-turn lane would provide sufficient storage for the queue on Calumet Avenue during the peak hour. The queue for the left turning vehicles on Maple Leaf Boulevard is greater than the right-turn lane length which may occasionally cause right turning vehicles to be blocked from making the right turn onto Calumet Avenue.

Appendix

Appendix 1 - Location Map and Proposed Site Plan

Appendix 2 - Site Peak Hour Traffic

Appendix 3 - Traffic Highway Capacity Software (HCS) Reports

APPENDIX A-1

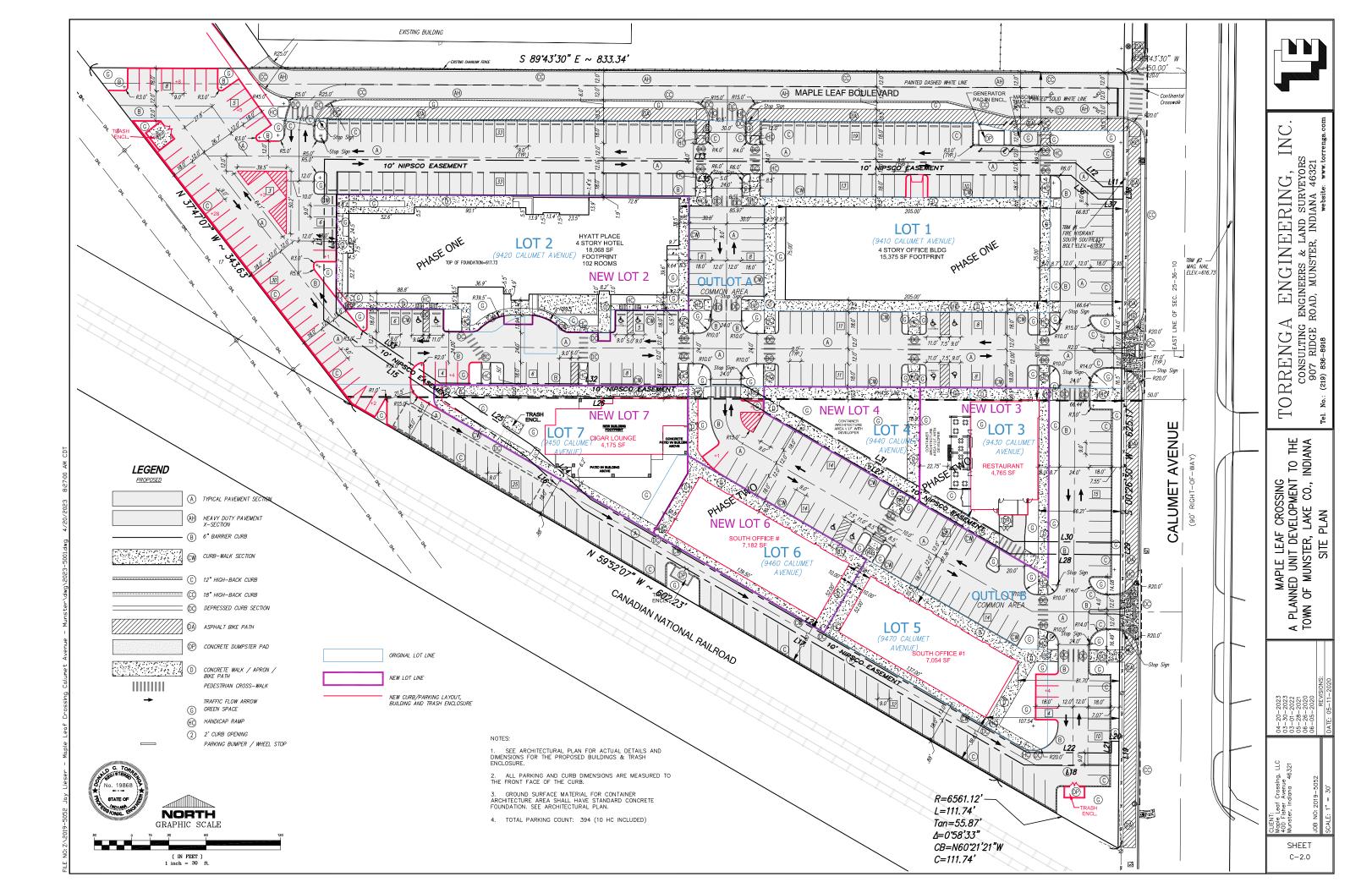
LOCATION MAP AND PROPOSED SITE PLAN



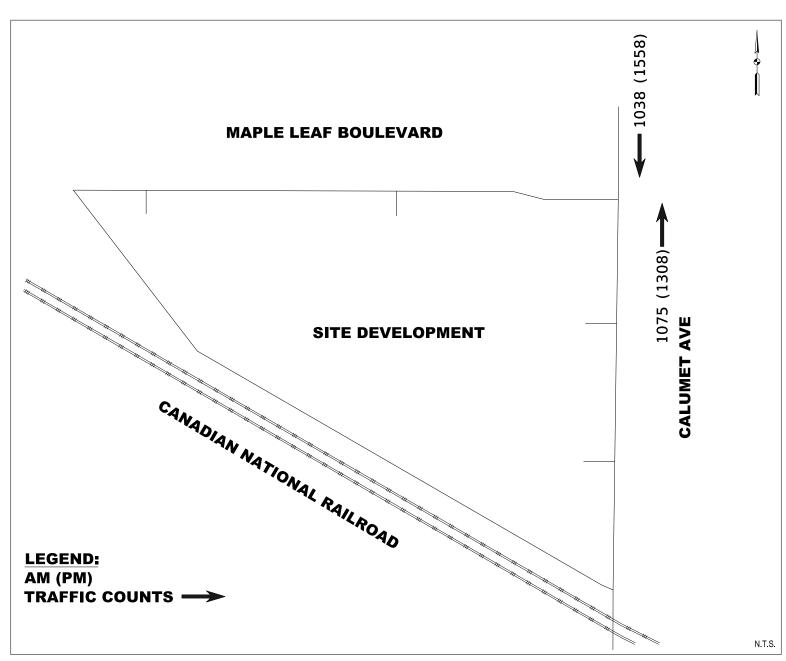
Project Location

Maple Leaf Crossing Calumet Ave and 45th St Munster, IN





APPENDIX A-2 SITE PEAK HOUR TRAFFIC

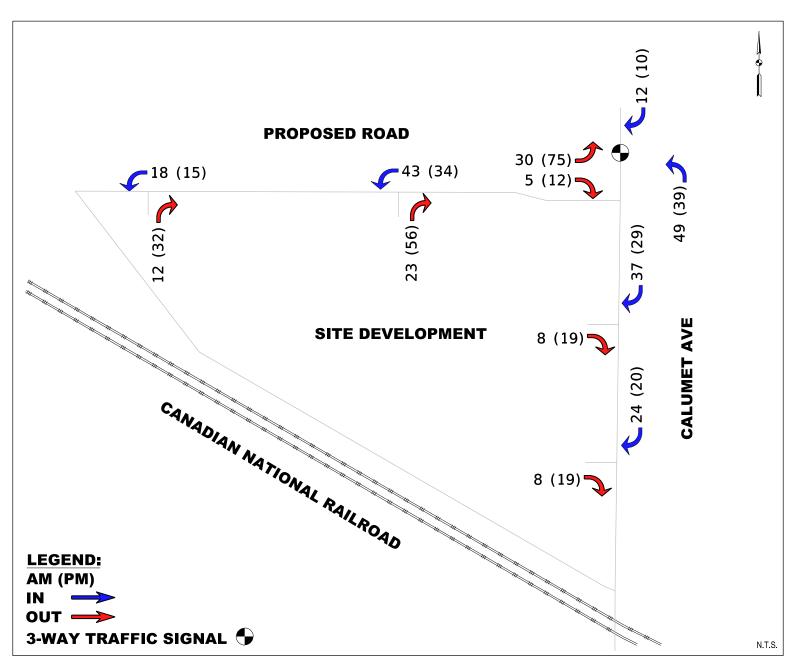


APPENDIX 2 - CALUMET AVENUE EXISTING PEAK HOUR TRAFFIC

Notes:

- Peak Hour Traffic Counts from Miovision

- Pepsi-Cola Bottlers Company will not utilize Maple Leaf Boulevard.

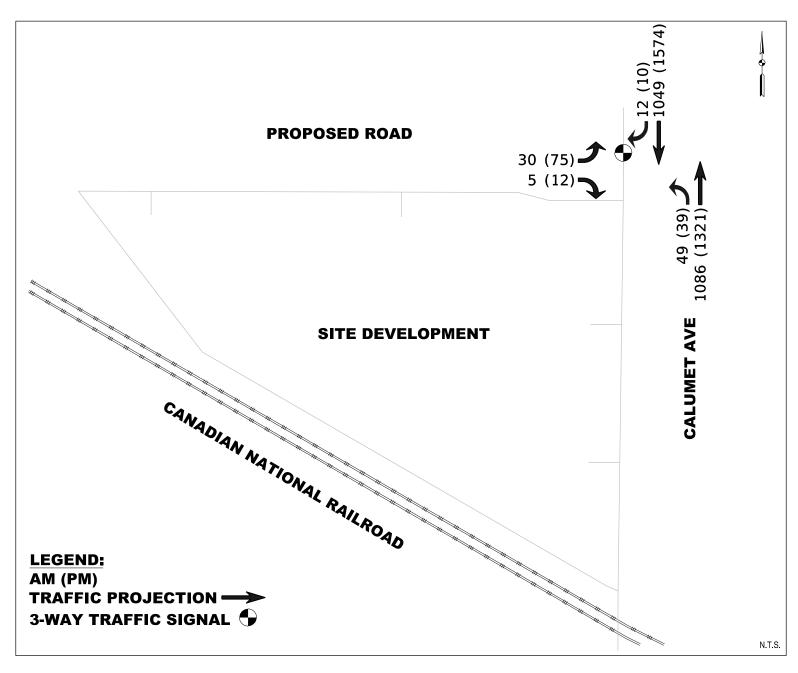


APPENDIX 2 - SITE PEAK HOUR TRAFFIC

Assumptions:

- The traffic distributions assume 60% of site traffic will be from the north and 40% will be from the south.
- Pepsi-Cola Bottlers Company will not impact traffic on Maple Leaf Boulevard.

APPENDIX 2 - PROPOSED INTERSECTION PEAK HOUR TRAFFIC



Notes:

- The traffic is projected to 2024

- Pepsi-Cola Bottlers Company will not impact traffic on Maple Leaf Boulevard.

APPENDIX A-3

HIGHWAY CAPACITY SOFTWARE (HCS) REPORTS

HCS7 Signalized Intersection Input Data

		HCS7	Signa	alized	l Inter	sectio	on Ir	nput Da	ata					
												<u> </u>		
General Information								Intersec	tion Inf	ormatio	on		┙╡┷╍┶╸┤╵	be la
Agency	Ciorba Group			Duration, h0.25Analysis DateJun 16, 2023Area TypeOther								_	~+ +	R.
Analyst	VZ		Analys	sis Date	Jun 16	6, 2023		Area Typ	be	Other	-			<u></u> ≱_
Jurisdiction	Munster, IN		Time F	Period	AM			PHF		0.95			W = E	
Urban Street	Calumet Ave		Analys	sis Year	2024			Analysis	Period	1> 7:0	00	۲ <u>م</u>		ت ۲
Intersection	Maple Leaf Boulev	ard	File Na	ame	AM_P	eak_Ca	lumet	_MapleL	eaf_202	4.xus			511	
Project Description	Maple Leaf Blvd Tr	affic Sig	nal Stud	ły									1414Y	ار ال
Demand Information				EB			W	В		NB			SB	
Approach Movement			L	Т	R	<u> </u>	Т	. R	L	Т	R	L	Т	R
Demand (<i>v</i>), veh/h			30		5				49	1086	6		1049	12
Signal Information						1								
Cycle, s 100.0	Reference Phase	2	-		14							st		~
Offset, s 0	Reference Point			l ≌î	1 51						1	2	3	≺ 4
Uncoordinated No	Simult. Gap E/W	Begin	Green		72.5	6.4	0.0		0.0					
Force Mode Fixed		On On	Yellow Red	0.0	4.5 1.5	4.5 1.5	0.0		0.0		<u>ੇ</u> [≺	ا		0
	Simult. Gap N/S	OII	Reu	0.0	1.5	1.5	0.0	0.0	0.0		3		· · · ·	0
Traffic Information				EB			WE	}		NB	_		SB	_
Approach Movement			L	Т	R	L	Т	R	L	Т	R	L	Т	R
Demand (<i>v</i>), veh/h			30		5				49	1086			1049	12
Initial Queue (Qb), veh	ı/h		0		0				0	0	1		0	0
Base Saturation Flow	Rate (<i>s</i> ₀), veh/h		1900		1900				1900	2000			2000	1900
Parking (Nm), man/h				None						None	1		None	1
Heavy Vehicles (PHV),	%		0		0				0	5			5	
Ped / Bike / RTOR, /h			0	0		0	0	1	0	0		0	0	0
Buses (Nb), buses/h			0	0	0				0	0	0	0	0	0
Arrival Type (AT)			3		3				4	4			4	4
Upstream Filtering (I)			1.00		1.00				1.00	1.00			1.00	1.00
Lane Width (<i>W</i>), ft			12.0		12.0				12.0	12.0			12.0	
Turn Bay Length, ft			300		70				80	0			0	
Grade (<i>Pg</i>), %				0			0			0			0	
Speed Limit, mi/h			35		35				35	35			35	35
Phase Information			EBL		EBT	WBI	_	WBT	NBI		NBT	SBL	_	SBT
Maximum Green (Gma	x) or Phase Split, s		51.0)	51.0				27.0	0	49.0			22.0
Yellow Change Interva	, , , , , , , , , , , , , , , , , , , ,		3.0		4.5				3.0		4.5			4.5
Red Clearance Interva			1.0		1.5				0.0		1.5			1.5
Minimum Green (Gmin	, ,		10		10				8		15			15
Start-Up Lost Time (It	!), s		2.0						2.0		2.0			2.0
Extension of Effective	Green (e), s		2.0						2.0		2.0			2.0
Passage (<i>PT</i>), s			5.0		5.0				3.0		2.0			2.0
Recall Mode			Off		Off				Off	-	Min			Min
Dual Entry			Yes		Yes				No		Yes			Yes
Walk (<i>Walk</i>), s					0.0			0.0						0.0
Pedestrian Clearance	Time (<i>PC</i>), s				0.0			0.0						0.0
Multimodal Informati	ion			EB			WB			NB			SB	
85th % Speed / Rest in	n Walk / Corner Rad	ius	0	No	25	0	No	25				0	No	25
Walkway / Crosswalk	Width / Length, ft		9.0	12	0	9.0	12	0				9.0	12	0
Street Width / Island /	Cumb		0	0	No		0		0		No	0	0	No
Olicet Width / Island /	Curb													
Width Outside / Bike L			12	5.0	2.0				12	5.0	2.0	12	5.0	2.0

HCS7 Signalized Intersection Results Summary

		HCS	or Sig	nalize	a ir	nterseo		Res	suit	s Sur	nmar	у					
General Inform	nation								In	torsoc	tion Inf	ormatio	<u>n</u>		╡┵┿╷	يا ط	
Agency	ation	Ciorba Group								uration		0.25	<i>,</i> ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		44		
Analyst		VZ		Analys		to lun (6, 2023	2		rea Typ		O.23 Other		_* _*		R.	
				Time F			10, 2023	0		HF		0.95		- <u>-</u> ,	w1 =	2	
Jurisdiction		Munster, IN Calumet Ave									Dariad		20			•	
Urban Street			l			ar 2024				nalysis		1> 7:0	00				
Intersection		Maple Leaf Bouleva		File Na													
Project Descrip	tion	Maple Leaf Blvd Tra	affic Sig	nal Stud	ly										4 4 Y	k. L.	
Demand Inform	nation				E	3		,	WB			NB			SB		
Approach Move	ement			L	Т	R	L		Т	R	L	Т	R	L	Т	R	
Demand (v), v	veh/h			30		5					49	1086	;		1049	12	
)i						_	_						
Signal Informa	Ir.					- 11								rt			
Cycle, s	100.0	Reference Phase	2		5	n I M	E.						1	2	3	\prec	
Offset, s	0	Reference Point	Begin	Green		72.5			0.0	0.0	0.0						
Uncoordinated	No	Simult. Gap E/W	On	Yellow		4.5	4.5		0.0	0.0	0.0		$ \leq < $	l _	╱		
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	1.5	1.5	(0.0	0.0	0.0		5	6	7	8	
Timer Results			_	EBL		EBT	W	31		WBT	NBI		NBT	SBI		SBT	
Assigned Phas	e				-	4			<u> </u>		5		2	30		6	
Case Number				<u> </u>	-	9.0	-		-		1.0		4.0			8.3	
Phase Duration				<u> </u>	-	12.4			-		9.1		87.6		-	78.5	
Change Period		c) S		<u> </u>	-	6.0	-		-		3.0		6.0			6.0	
Max Allow Hea	•				-	6.1	-		-		4.0		0.0			0.0	
Queue Clearan	- 1	·			+	3.7					2.6						
Green Extensio		1 = 7				0.2					0.2		0.0			0.0	
Phase Call Pro						0.64					0.76	3					
Max Out Proba	bility					0.00					0.00)					
	_														0.5		
Movement Gro	-	sults			EE	1	<u> </u>	_	VB T			NB	D	<u> </u>	SB		
Approach Move				L	Т	R	L		Т	R	L	Т	R	L	T	R	
Assigned Move		<u> </u>		7		14		-			5	2		<u> </u>	6	16	
Adjusted Flow				32		5					52	1143			560	557	
-		w Rate (s), veh/h/	In	1810		1610					1810	1830			1922	1914	
Queue Service		- /		1.7		0.3	<u> </u>				0.6	0.0			34.5	1.6	
Cycle Queue C		e Time (<i>g c</i>), s		1.7		0.3	<u> </u>				0.6	0.0	<u> </u>		34.5	1.6	
Green Ratio (g	· ·			0.06		0.06					0.81	0.82			0.73	0.73	
Capacity (c), v				116		103					377	2986			1393	1388	
Volume-to-Cap		· · /	<u> </u>	0.272		0.051		-			0.137	0.383			0.402	0.402	
		In (95 th percentile		36.9		6		-			18.5	7.2		<u> </u>	30.6	29.4	
	, ,	eh/In (95 th percent		1.5		0.2		-			0.7	0.3			1.2	1.2	
-		RQ) (95 th percen	uie)	0.12		0.09		-			0.23	0.00			0.00	0.00	
Uniform Delay Incremental De	· ,			44.6 2.7		43.9	-	-			9.1 0.2	0.0 0.4			0.5 0.9	0.5	
Initial Queue D	2 1	,		0.0		0.4	-	-			0.2	0.4			0.9	0.9	
Control Delay (•		47.2		44.4		-			9.3	0.0			1.3	1.4	
Level of Service	•			47.2 D		44.4 D	-	-			9.3 A	0.4 A			1.3 A	1.4 A	
	oach Delay, s/veh / LOS			46.8	3	D	0.	0			0.8		A	1.4		A	
Intersection De				-0.0			1.8	5	1		0.0			A 1.4		~	
	.ay, 0,70													, ,			
Multimodal Re	sults				EB	3		V	VB			NB			SB		
Pedestrian LOS	S Score	/LOS		2.32	2	В	2.1	5		В	0.62	2	А	1.85	5	В	
	Bicycle LOS Score / LOS					F					1.47	7	А	1.41	1	А	

HCS7 Signalized Intersection Intermediate Values

		HCS7	Sign	alı	zed	Inters	sectio	n Inte	erm	edia	ate Val	ues				
General Inform	ation									Intor	section	nform	tion		یا با پایانی	4 4× 14
	ation	Ciarba Craun									tion, h	0.2			4	
Agency		Ciorba Group VZ		۸.	- alvaia	Data	Jun 16, 1	2022				O.2		-		
Analyst					nalysis			2023		Area PHF	туре			×	, W Î e	
Jurisdiction		Munster, IN			me Pe		AM				vaia Daria	0.9			8	
Urban Street		Calumet Ave			nalysis		2024		1		sis Perio		7:00	<u>م</u>		
Intersection		Maple Leaf Bouleva			le Nan	าย	AM_Pea	ak_Calu	imet_	_Мар	leLeaf_2	024.xu	3	_ 4	<u> </u>	1
Project Descript	lion	Maple Leaf Blvd Tra	affic Sig	nal	Study										<u>ነ ጎ ተ</u> ቀ	<u> </u>
Demand Inform	nation					EB			WE	3		N	IB		SE	}
Approach Move	ment				L	Т	R	L	Т		R	L	T R	L	Т	R
Demand (v), v	eh/h				30		5				4	9 10	86		104	9 12
Signal Informa	tion						1								-	
Cycle, s	100.0	Reference Phase	2											st		
Offset, s	0	Reference Point	Begin			- ÎÎ	<u></u> 1	2					1	2	;	
Uncoordinated	No	Simult. Gap E/W	On			5.1		6.4	0.0			.0	F		_	
Force Mode	Fixed	Simult. Gap L/W	On			3.0).0		4.5 1.5	0.0			.0 .0	``` ["	(†		,
Force Mode	Fixed	Simult. Gap 14/5	On		eu T	5.0	1.5	1.5	0.0		0_0	.0	5	0		
Saturation Flow	w / Dela	ay	L		Т	R	L	T		R	L	Т	R	L	Т	R
Lane Width Adju	ustment	Factor (<i>f</i> _w)	1.0	00	1.000	1.000)				1.000	1.000	1.000	1.000	1.000) 1.000
Heavy Vehicles	and Gr	ade Factor (<i>f</i> _{HVg})	1.0	00	1.000	1.000)				1.000	0.961	1.000	1.000	0.96	I 1.000
Parking Activity	Adjustn	nent Factor (f _p)	1.0	00	1.000	1.000	0.000	0.000) 0.	.000	1.000	1.000	1.000	1.000	1.000) 1.000
Bus Blockage A	djustme	ent Factor (fbb)	1.0	00	1.000	1.000	0.000	0.000) ().	.000	1.000	1.000	1.000	1.000	1.000	0 1.000
Area Type Adjus	stment I	Factor (fa)	1.0	00	1.000	1.000)				1.000	1.000	1.000	1.000	1.000	0 1.000
Lane Utilization		. ,	1.0	00	1.000	1.000	1.000	1.000) 1.	.000	1.000	0.952	1.000	1.000	1.000	0 1.000
Left-Turn Adjust	ment Fa	actor (<i>f</i> LT)	0.9	52	0.000		<u> </u>				0.952	0.000	<u> </u>	1.000	1.000)
Right-Turn Adju		, ,			0.000	0.847	·					1.000	1.000		0.996	6 0.996
		djustment Factor (fLp	b) 1.0	00							1.000			1.000		-
		justment Factor (f _R	·			1.000			+				1.000			1.000
Work Zone Adju		•	, 1.0	00	1.000				-		1.000	1.000	1.000	1.000	1.000	
DDI Factor (foor		. ,	1.0		1.000		_		1		1.000	1.000		1.000	1.000	
	,	low Rate (<i>s</i>), veh/h	18		0	1610					1810	3752	0	0	3793	
		Arriving on Green (F			0.00	0.06	0.00	0.00	0	0.00	0.08	1.00	0.00	0.00	0.97	_
Incremental Del			0.2			0.23					0.11	0.50			0.50	
Signal Timing	Mover	ment Groups		EBL	-	EBT/R	WE	3L	WB	T/R	NBI		NBT/R	SBI	-	SBT/R
Lost Time (<i>t</i> _L)	()		_		\rightarrow	4.0					3.0		6.0		\rightarrow	6.0
Green Ratio (g/	,					0.06					0.81		0.82			0.73
		ow Rate (<i>s</i> _p), veh/h/				1810					512		0			500
		/ Rate (<i>s</i> sh), veh/h/In					<u> </u>									0
Permitted Effect						0.0					74.5		0.0			0.0
Permitted Servi		(=)				0.0					38.0		0.0			0.0
Permitted Queu		1= 7		_							4.0					
Time to First Blo	-	12 /				0.0					0.0		0.0			72.5
		efore Blockage (<i>g</i> _{fs}),		_												
-		tion Flow (<i>s</i> _R), veh/h				0										
Protected Right	Effectiv	ve Green Time (<i>g</i> _R),	s			0.0										
Multimodal					EB			WB				NB			SB	
Pedestrian Fw/	Fv		1	.55	7	0.000	1.38	39	0.00	00	0.00	0	0.000	1.19	8	0.000
Pedestrian <i>F</i> s /			0	.000	0	0.162	0.00	00	0.16	61	0.00	0	0.021	0.00	0	0.053
Pedestrian Mcorr	ner / Mcw	,														
Bicycle cb / db						57.25			55.´	13	1631.	85	1.69	1450.	02	3.78
Bicycle Fw / Fv			-	3.64	1		-3.6	64			-3.64	4	0.99	-3.64	4	0.92

HCS7 Signalized Intersection Results Graphical Summary

		HCS7 Sig	nanze	,a mie	13601		esuita	s Gra	pnica	i Sun	inar	y			
General Informati	ion							In	tersect	ion Info	ormatic	on	k	***	<u>له</u> لړ
Agency	1/	Ciorba Group							uration,		0.25		┤▁┛	-↓↓	
Analyst		 /Z		Analys	is Date	Jun 16	, 2023		еа Тур		Other		4		
Jurisdiction	1	Munster, IN		Time P		AM			HF		0.95			w ∔ E	2 4
Urban Street		Calumet Ave		Analys	is Year	2024		Ar	nalysis l	Period	1> 7:0	00			÷
Intersection	n I	Maple Leaf Bouleva	ard	File Na			eak_Cal				1.xus			5.11	
Project Description		Maple Leaf Blvd Tra		nal Stud	у									 ↓ ↓	1 4
			_		-		14			14					
Demand Informati					EB			WB			NB			SB	1
Approach Moveme				L	Т	R	L	Т	R	L	Т	R	<u> </u>	Т	R
Demand (<i>v</i>), veh/l	′h			30		5				49	1086	;		1049	12
				ir											
Signal Information			0	e		1							st		×
		Reference Phase	2		l sr.	51	5					1	2	3	≺ ₄
		Reference Point	Begin	Green		72.5	6.4	0.0	0.0	0.0					
		Simult. Gap E/W	On	Yellow		4.5	4.5	0.0	0.0	0.0		\mathbf{Y}			
Force Mode Fix	xed	Simult. Gap N/S	On	Red	0.0	1.5	1.5	0.0	0.0	0.0		5	6	7	8
Movement Ores	Baa	ulto				1								00	
Movement Group		lits			EB	B	_	WB	B	L	NB T		1	SB	
Approach Moveme			<u> </u>	L	Т	R	L	Т	R	_		R	L	T	R
Back of Queue (Q		, ,		36.9		6			_	18.5	7.2			30.6	29.4
Back of Queue (Q		, .		1.5		0.2			_	0.7	0.3			1.2	1.2
Queue Storage Ra			tile)	0.12		0.09			_	0.23	0.00		<u> </u>	0.00	0.00
Control Delay (d),		1		47.2		44.4			_	9.3	0.4			1.3	1.4
Level of Service (L		1.00		D 10.0		D	0.0		_	A	Α	<u> </u>	- 1 1	A	A
Approach Delay, s/				46.8		D	0.0		_	0.8		A	1.4		Α
Intersection Delay,	s/ver	1/LOS				1.	8						A		
					1. 1.4	2 1.2 4 1.3						_			
		1.5		0.2	47.2										
			LOS A LOS B LOS C LOS D	0.2	9.3	³ 0.4 1 0.3		ſ	Queue —	- Di	slay	_			



No errors or warnings exist.

--- Comments ----

Copyright © 2023 University of Florida, All Rights Reserved.

HCS[™] Streets Version 7.8

Generated: 6/26/2023 4:47:26 PM

HCS7 Signalized Intersection Input Data

		1	HCS7	Signa	alizeo	l Inter	sectio	on lı	nput D	ata					
General Inforn	nation								Intersed	ction Inf	ormatio	on		14244	b⊧ l <u>u</u>
Agency		Ciorba Group							Duratior		0.25			-4↓	
Analyst		VZ		Analys	sis Date	e Jun 1	6. 2023		Area Ty		Other	-	 		<u>₹</u>
Jurisdiction		Munster, IN		Time F		PM	0, 2020		PHF		0.95		→ ++	w ^N ∈	2
Urban Street		Calumet Ave			sis Yea				Analysis	Period	1> 7:0	00			+ *
Intersection		Maple Leaf Bouleva	ard	File Na			eak Ca	alume	t MapleL					K # #	<u> </u>
Project Descrip	tion	Maple Leaf Blvd Tr				<u> </u>		lamo		.001_202	. 1.740		-	 ↓ ↓ ↓ ↓ ↓	ት / [*]
T TOJECT Descrip		Maple Lear Biva II	anie olg		лу										
Demand Inform	emand Information							W	Έ		NB			SB	
Approach Move	ement			L	Т	R	L	Т	R	L	Т	R	L	Т	R
Demand (v), v	/eh/h			75		12				39	1321	1		1574	10
				li.										<u> </u>	
Signal Informa	ir -					124	2						_		_
Cycle, s	110.0	Reference Phase	2		L SA	51	ĸ					1	N ₂	3	\prec
Offset, s	0	Reference Point	Begin	Green	5.7	79.9	9.4	0.0	0.0	0.0		· ·			
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.0	4.5	4.5	0.0	0.0	0.0		$\langle \langle \langle \rangle \rangle$			
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	1.5	1.5	0.0	0.0	0.0		5	6	7	8
			_	_			_								
Traffic Informa				<u> </u>	EB			WE	1	<u> </u>	NB		<u> </u>	SB	
Approach Move				L	Т	R	L	Т	R	L	Т	R	L	Т	R
Demand (<i>v</i>), ve				75		12				39	1321			1574	10
Initial Queue (G	-			0		0				0	0			0	0
Base Saturation		Rate (<i>s</i> ₀), veh/h		1900		1900				1900	2000			2000	1900
Parking (Nm), m					None	<u> </u>				<u> </u>	None	<u> </u>		None	
Heavy Vehicles	. ,	%		0		0				0	5			5	
Ped / Bike / RT				0	0		0	0		0	0	<u> </u>	0	0	0
Buses (Nb), bus				0	0	0				0	0	0	0	0	0
Arrival Type (A	,			3		3				4	4			4	4
Upstream Filter	• • • •			1.00		1.00				1.00	1.00			1.00	1.00
Lane Width (W	-			12.0		12.0				12.0	12.0			12.0	
Turn Bay Lengt	:h, ft			300		70				80	0			0	
Grade (<i>Pg</i>), %				<u> </u>	0			0		<u> </u>	0			0	
Speed Limit, m	i/h			35		35				35	35			35	35
Phase Informa	tion			EBL		EBT	WBI		WBT	NB		NBT	SBI		SBT
) or Phase Split, s		74.0		74.0		-		15.0		36.0			21.0
Yellow Change		<i>,</i>		3.0		4.5		-		3.0		4.5			4.5
Red Clearance				1.0		1.5		-		0.0		1.5			1.5
Minimum Greer				10		10		-		8		15			15
Start-Up Lost T	. ,			2.0						2.0		2.0			2.0
Extension of Ef	. ,			2.0						2.0		2.0			2.0
Passage (<i>PT</i>),				5.0		5.0				3.0		2.0			2.0
Recall Mode				Off		Off				Off		Min			Min
Dual Entry				Yes		Yes				No		Yes			Yes
Walk (<i>Walk</i>), s						0.0			0.0						0.0
Pedestrian Clea	arance ⁻	Time (<i>PC</i>), s				0.0			0.0						0.0
Multimodal Inf	ormatio	on			EB			WB	}		NB			SB	
		Walk / Corner Radi	ius	0	No	25	0	No	25				0	No	25
		Vidth / Length, ft		9.0	12	0	9.0	12					9.0	12	0
Street Width / Is		-		0	0	No		0		0		No	0	0	No
		ane / Shoulder, ft		12	5.0	2.0				12	5.0	2.0	12	5.0	2.0
Pedestrian Sigr				No		0.50	No				I	0.50	No		0.50

HCS7 Signalized Intersection Results Summary

		HCS	7 Sig	nalize	a in	tersec	tion R	kesu	lits	Sun	nmar	у						
Conorol Inform	otion								Into		tion Inf	o rm oti c		1	╵╺╣╻╢╻╘╄╸↓	له ل		
General Inform	hation	Qianta Quarra									tion Inf	W	n	- 1	4			
Agency		Ciorba Group		A a h	:- D-	1. I.u. 44			<u> </u>	ation,		0.25		_#		N.		
Analyst		VZ		Analys			6, 2023		-	а Тур -	e	Other		×		*		
Jurisdiction		Munster, IN		Time F					PHF		<u> </u>	0.95			8 8	•		
Urban Street		Calumet Ave				ar 2024				•	Period	1> 7:(00					
Intersection		Maple Leaf Bouleva		File Name PM_Peak_Calumet_MapleLeaf_2024.xus										<u><u></u><u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u></u>				
Project Descrip	tion	Maple Leaf Blvd Tra	affic Sig	nal Stuc	l Study									14174187				
Demand Inform	Demand Information					3		W	/B			NB			SB			
	pproach Movement				Т	ii.	L	1	Г	R	L	Т	R	L	T	R		
Demand (v), v				75		12					39	1321	_	-	1574	10		
					1													
Signal Informa	tion					11	3									_		
Cycle, s	110.0	Reference Phase	2		5	r i st	ĸ						1	N	-	- ₹		
Offset, s	0	Reference Point	Begin	Green	57	79.9	9.4	0.0	<u>ר</u>	0.0	0.0	_	1		3	M 4		
Uncoordinated	No	Simult. Gap E/W	On	Yellow		4.5	4.5	0.0		0.0	0.0		< <					
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	1.5	1.5	0.0		0.0	0.0		5	6	7	8		
			_	1	_		1	_										
Timer Results				EBL		EBT	WB		WE	BT	NBI	_	NBT	SB		SBT		
Assigned Phase	e				_	4		\rightarrow		_	5		2			6		
Case Number					_	9.0					1.0		4.0			8.3		
Phase Duration					_	15.4					8.7		94.6			85.9		
Change Period	· ·				_	6.0					3.0		6.0			6.0		
Max Allow Head	2 1	·			\rightarrow	6.1		_			4.0		0.0			0.0		
Queue Clearan		, = ,			\rightarrow	6.6		\rightarrow		_	2.5							
Green Extensio		(ge), s			_	0.7		\rightarrow		_	0.1		0.0			0.0		
Phase Call Pro					\rightarrow	0.94		\rightarrow		_	0.71							
Max Out Proba	bility					0.00					0.00)						
Movement Gro	oup Res	ults			EB			WE	3			NB			SB			
Approach Move	-			L	Т	R	L	Т		R	L	Т	R	L	Т	R		
Assigned Move				7		14			+		5	2			6	16		
Adjusted Flow I), veh/h		79		13					41	1391			834	833		
-		ow Rate (<i>s</i>), veh/h/	In	1810		1610			+	_	1810	1830			1922	1918		
Queue Service		. ,		4.6		0.8			+	_	0.5	0.0			72.9	3.6		
Cycle Queue C		- ,		4.6		0.8			+	_	0.5	0.0			72.9	3.6		
Green Ratio (g		c mile (g t), 3		0.09		0.09		<u> </u>	+	_	0.80	0.81			0.73	0.73		
Capacity (c), v	,			155		138			+	_	179	2948			1396	1393		
Volume-to-Cap		tio (X)		0.511		0.092			+	_	0.230	0.472			0.598	0.598		
•	-	(In (95 th percentile))	102.9		15.3			+		37.1	10.472			59.5	57.3		
	. ,	eh/ln (95 th percent		4.1		0.6		-	+		1.5	0.4			2.3	2.3		
	, ,	RQ) (95 th percen		0.34		0.22			+		0.46	0.00			0.00	0.00		
Uniform Delay		,, ,		48.1		46.4				_	30.6	0.0			0.5	0.5		
Incremental De	. ,			5.5		0.6			+		0.6	0.5			1.9	1.9		
Initial Queue De	2 1	•		0.0		0.0			+		0.0	0.0			0.0	0.0		
Control Delay (• •	•		53.6		47.0			+		31.2	0.5			2.4	2.4		
	of Service (LOS)					D		-	+		C	A			A	A		
	pproach Delay, s/veh / LOS			D 52.7	7	D	0.0				1.4		A	2.4		A		
							.4		-		1.1			A 2.4				
Intersection Delay, s/veh / LOS														A				
Multimodal Re	sults				EB			WE	3			NB			SB			
Pedestrian LOS		/LOS		2.32		В	2.15		В	3	0.63		A	1.8	1	В		
Bicycle LOS Score / LOS						F					1.67		В	1.86		В		

HCS7 Signalized Intersection Intermediate Values

		HCS7	Sign	alı	zed	Inters	sectio	n Inte	erm	nedia	ate Val	ues				
General Inform	ation									Intor	section I	nforma	tion		_ل ا مل الم	4 4× 14
	ation	Ciarba Craup							_			0.2		- 1	4	
Agency		Ciorba Group VZ		۸.	alvaia	Data	Jun 16, 2	2022	_		ion, h	O.2				
Analyst					nalysis		PM	2023	_	Area PHF	туре			×	, wîr	
Jurisdiction		Munster, IN			me Pe				_		vaia Davia	0.9			8	
Urban Street		Calumet Ave			nalysis		2024			-	sis Peric	1	7:00			
Intersection		Maple Leaf Bouleva			le Nam	ne	PM_Pea	ik_Calu	ume	t_Map	leLeaf_2	024.xus	3	_ 4	<u> ነ †</u>	1
Project Descript	lion	Maple Leaf Blvd Tra	affic Sig	nal	Study										<u>ነ ላ ሰ</u> ቁ	
Demand Inform	nation					EB			W	/B		N	IB		SE	}
Approach Move	ment				L	Т	R	L	٦	Г	R I		T R	L	Т	R
Demand (v), v	eh/h				75		12				3	9 13	21		157	4 10
Signal Informa	tion					-	1				-					1
Cycle, s	110.0	Reference Phase	2				-	_7						- মা		
Offset, s	0	Reference Point	Begin	╘		<u> Î</u>		2					1	2	:	
Uncoordinated	No	Simult. Gap E/W	On					9.4	0.0		0.0		R .		-	
Force Mode	Fixed	Simult. Gap N/S	On					4.5 1.5	0.0).0 0).0 0		``] 5	÷ _	~ _,	,
T OFCE MODE	TIXCU	olindit. Cap N/O	On	IN		5.0	1.0	1.0	0.0	<u> </u>	.0 10	.0		Ũ		
Saturation Flow	w / Dela	ay	L		Т	R	L	Т		R	L	Т	R	L	Т	R
Lane Width Adju	ustment	Factor (<i>f</i> _w)	1.0	00	1.000	1.000					1.000	1.000	1.000	1.000	1.000) 1.000
Heavy Vehicles	and Gr	ade Factor (<i>f</i> _{HVg})	1.0	00	1.000	1.000			Т		1.000	0.961	1.000	1.000	0.961	I 1.000
Parking Activity	Adjustn	nent Factor (<i>f_p</i>)	1.0	00	1.000	1.000	0.000	0.00	0 (0.000	1.000	1.000	1.000	1.000	1.000) 1.000
Bus Blockage A	djustme	ent Factor (fbb)	1.0	00	1.000	1.000	0.000	0.00	0 (0.000	1.000	1.000	1.000	1.000	1.000) 1.000
Area Type Adjus	stment I	Factor (fa)	1.0	00	1.000	1.000					1.000	1.000	1.000	1.000	1.000	0 1.000
		nent Factor (<i>f</i> LU)	1.0	00	1.000	1.000	1.000	1.00	0	1.000	1.000	0.952	1.000	1.000	1.000	0 1.000
Left-Turn Adjust	ment Fa	actor (fLT)	0.9	52	0.000						0.952	0.000	1	1.000	1.000)
Right-Turn Adju		· · ·			0.000	0.847			+			1.000	1.000		0.998	3 0.998
		djustment Factor (fLp	b) 1.0	00							1.000			1.000		-
		justment Factor (f _R	-			1.000			+				1.000			1.000
Work Zone Adju		• •	, 1.0	00	1.000		-				1.000	1.000	1.000	1.000	1.000	
DDI Factor (foor		. ,	1.0		1.000				+		1.000	1.000	1.000	1.000	1.000	
	,	low Rate (<i>s</i>), veh/h	18		0	1610			+		1810	3752	0	0	3815	
		Arriving on Green (F	_		0.00	0.09	0.00	0.00	, –	0.00	0.07	1.00	0.00	0.00	0.97	_
Incremental Del		- ,	0.2			0.23					0.11	0.50			0.50	
													"			
Signal Timing	Mover	nent Groups		EBL	.	EBT/R	WE	3L	WE	BT/R	NBI		NBT/R	SBI	-	SBT/R
Lost Time (<i>t</i> _L)			_			4.0					3.0		6.0			6.0
Green Ratio (g/	,					0.09					0.80		0.81			0.73
		ow Rate (s _p), veh/h/				1810					302		0			395
		v Rate (ssh), veh/h/ln														0
Permitted Effect						0.0					81.9)	0.0			0.0
Permitted Servi		,				0.0					6.9		0.0			0.0
Permitted Queu		(=)									6.9					
Time to First Blo	-	(=)				0.0					0.0		0.0			79.9
		efore Blockage (g _{fs}),		_												
		tion Flow (<i>s</i> _R), veh/h				0										
	Effectiv	/e Green Time (<i>g</i> _R),	s			0.0										
Multimodal					EB			WE				NB			SB	
Pedestrian Fw /			1	.55		0.000	1.38			000	0.00		0.000	1.19		0.000
Pedestrian Fs /			0	.000	0	0.166	0.00	00	0.1	164	0.00	0	0.029	0.00	0	0.057
Pedestrian Mcon	ner / M cw	/														
Bicycle cb / db						62.22	-90.	91	60).11	1611.	04	2.08	1452.		4.12
Bicycle Fw / Fv			-	3.64	1		-3.6	64			-3.64	1	1.18	-3.64	4	1.38

HCS7 Signalized Intersection Results Graphical Summary

	HCS7 Sig	nalize	ed Inte	ersec	tion R	lesult	s G	raphic	al Sun	nmar	У			
General Information								Intersoc	tion Inf	ormatic	20	*	at aLater ↓	يا مل
Y								Intersection Information					44	
Agency Ciorba Group Analyst VZ			Analys	ic Data	lup 16	up 16, 2022		Duration, h		_	0.25			ار م
Jurisdiction Munster, IN				Jun 16, 2023 PM		Area Type		0.95	Other		W A E	2		
Urban Street Calumet Ave		Time Period Analysis Year					PHF Analysis Period		1> 7:00				+	
Intersection Maple Leaf Boulevard			1											· *
Project Description Maple Leaf Boulevard			File Name PM_Peak_Calumet_MapleLeaf_2024.xus									- 4	 ব ↑ ক প	1- 6
Project Description	Inaple Leal Blvd Th	anic Sig	nai Siud	iy										r 1
Demand Information				EB			W	В		NB			SB	
Approach Movement			L	Т	R	L		- R	L	Т	R	<u> </u>	Т	R
Demand (v), veh/h			75		12				39	1321			1574	10
Signal Information	1		-		14	a						-+		
Cycle, s 110.0		2		I ST	51	E.					1		3	\prec
Offset, s 0	Reference Point	Begin	Green	5.7	79.9	9.4	0.0	0.0	0.0					
Uncoordinated No	Simult. Gap E/W	On	Yellow	3.0	4.5	4.5	0.0	0.0	0.0		く 4		╱	
Force Mode Fixed	I Simult. Gap N/S	On	Red	0.0	1.5	1.5	0.0	0.0	0.0		5	6	7	8
Movement Group Re	esults			EB			WE			NB			SB	
Approach Movement			L	Т	R	L	Т	R	L	T	R	L	T	R
Back of Queue (Q), ft/ln (95 th percentile)			102.9		15.3				37.1	10.4			59.5	57.3
Back of Queue (Q), veh/In (95 th percentile)			4.1		0.6				1.5	0.4			2.3	2.3
Queue Storage Ratio (RQ) (95 th percentile)			0.34		0.22				0.46	0.00			0.00	0.00
Control Delay (d), s/veh			53.6		47.0				31.2	0.5			2.4	2.4
Level of Service (LOS)			D		D				С	А			A	A
Approach Delay, s/veh / LOS			52.7		D	0.0			1.4		А	2.4		А
Intersection Delay, s/veh / LOS					3.	4						4		
				2	2.3 2.3						_			
	=	LOS A LOS B LOS C LOS D	0.6	[1.2 0.5 1 0.4		ſ	Queue =		elay	_			



No errors or warnings exist.

--- Comments ----

Copyright © 2023 University of Florida, All Rights Reserved.

HCS[™] Streets Version 7.8

Generated: 6/26/2023 4:29:54 PM