CiorbaGroup
CONSULTING ENGINEERS

June 28, 2023

Technical Memorandum

Maple Leaf Boulevard Traffic Signal Study

Munster, Indiana

TOWN OF MUNSTER

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.

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

Street	Direction	Turn	Traffic	
			AM	PM
Calumet Ave	NB	Left	49	39
	SB	Right	12	10
Maple Leaf Blvd	EB	Left	30	75
	EB	Right	5	12

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 (95th-percentile) for the intersection. Traffic signal timings for the adjacent traffic signal on Calumet Avenue and 45th 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.

Table 2. LOS Criteria for Signalized Intersections

Level of Service (LOS)	Average Delay
A	≤ 10.0 seconds
B	> 10.0 and ≤ 20.0 seconds
C	> 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 Service (LOS)	
	AM	PM
Calumet Ave	A	A
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

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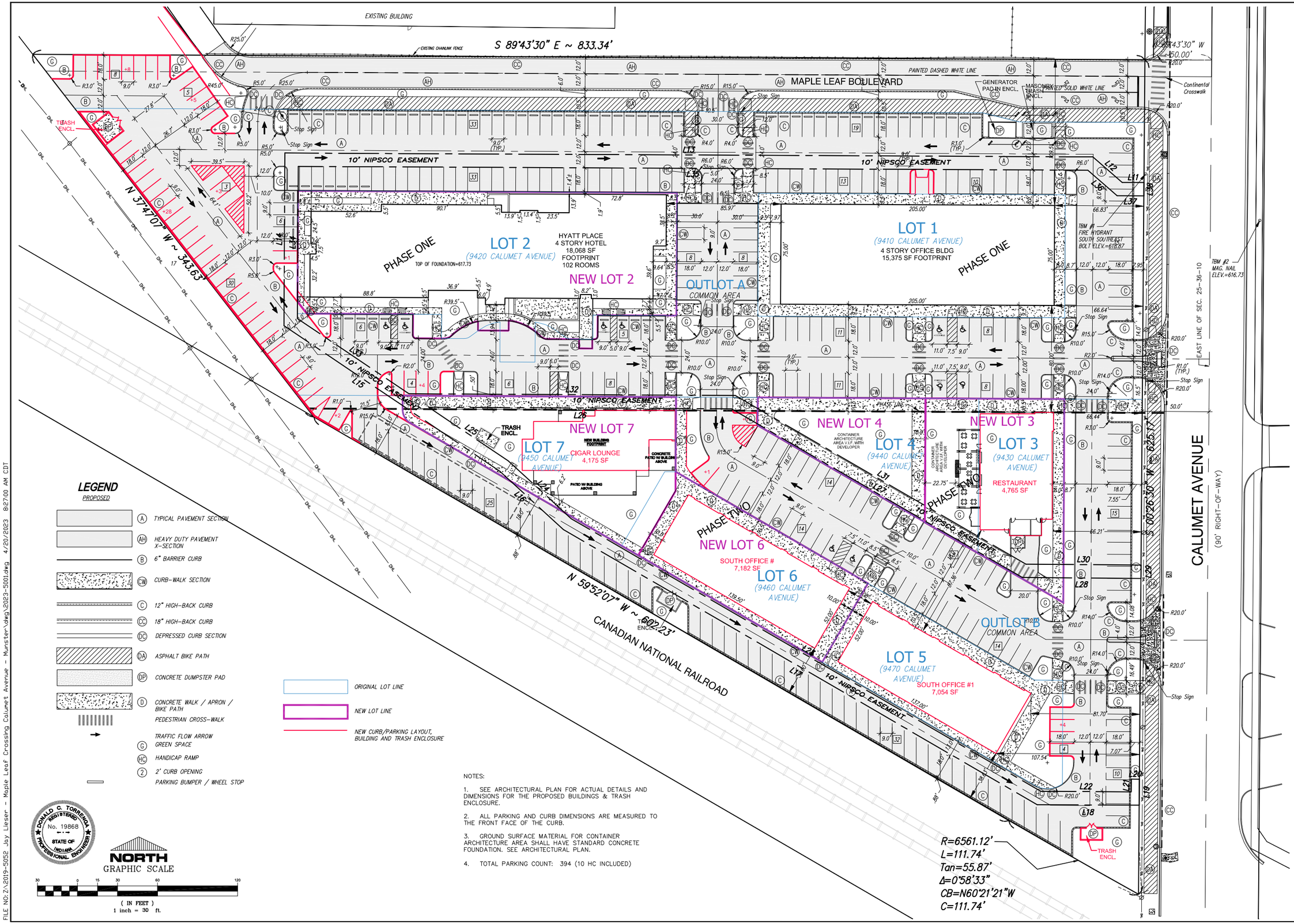


LEGEND

PROPOSED

- (A) TYPICAL PAVEMENT SECTION
- (AH) HEAVY DUTY PAVEMENT X-SECTION
- (B) 6" BARRIER CURB
- (CW) CURB-WALK SECTION
- (C) 12" HIGH-BACK CURB
- (CC) 18" HIGH-BACK CURB
- (DC) DEPRESSED CURB SECTION
- (DA) ASPHALT BIKE PATH
- (DP) CONCRETE DUMPSTER PAD
- (D) CONCRETE WALK / APRON / BIKE PATH
- PEDESTRIAN CROSS-WALK
- TRAFFIC FLOW ARROW
- (G) GREEN SPACE
- (HC) HANDICAP RAMP
- (2) 2' CURB OPENING
- PARKING BUMPER / WHEEL STOP

ORIGINAL LOT LINE

NEW LOT LINE

NEW CURB/PARKING LAYOUT, BUILDING AND TRASH ENCLOSURE

NOTES:

1. SEE ARCHITECTURAL PLAN FOR ACTUAL DETAILS AND DIMENSIONS FOR THE PROPOSED BUILDINGS & TRASH ENCLOSURE.
2. ALL PARKING AND CURB DIMENSIONS ARE MEASURED TO THE FRONT FACE OF THE CURB.
3. GROUND SURFACE MATERIAL FOR CONTAINER ARCHITECTURE AREA SHALL HAVE STANDARD CONCRETE FOUNDATION. SEE ARCHITECTURAL PLAN.
4. TOTAL PARKING COUNT: 394 (10 HC INCLUDED)

DONALD C. TORRENGA REGISTERED No. 19868 STATE OF INDIANA PROFESSIONAL ENGINEER

NORTH

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

TORRENGA ENGINEERING, INC.
CONSULTING ENGINEERS & LAND SURVEYORS
907 RIDGE ROAD, MUNSTER, INDIANA 46321
Tel. No.: (219) 836-8918
website: www.torrenga.com

MAPLE LEAF CROSSING
A PLANNED UNIT DEVELOPMENT TO THE TOWN OF MUNSTER, LAKE CO., INDIANA
SITE PLAN

REVISIONS:	DATE: 05-11-2020
04-20-2023	
03-30-2023	
03-01-2022	
05-28-2021	
06-26-2020	
06-05-2020	

CLIENT:
Maple Leaf Crossing, LLC
400 Fisher Avenue
Munster, Indiana 46321

JOB NO: 2019-5052

SCALE: 1" = 30'

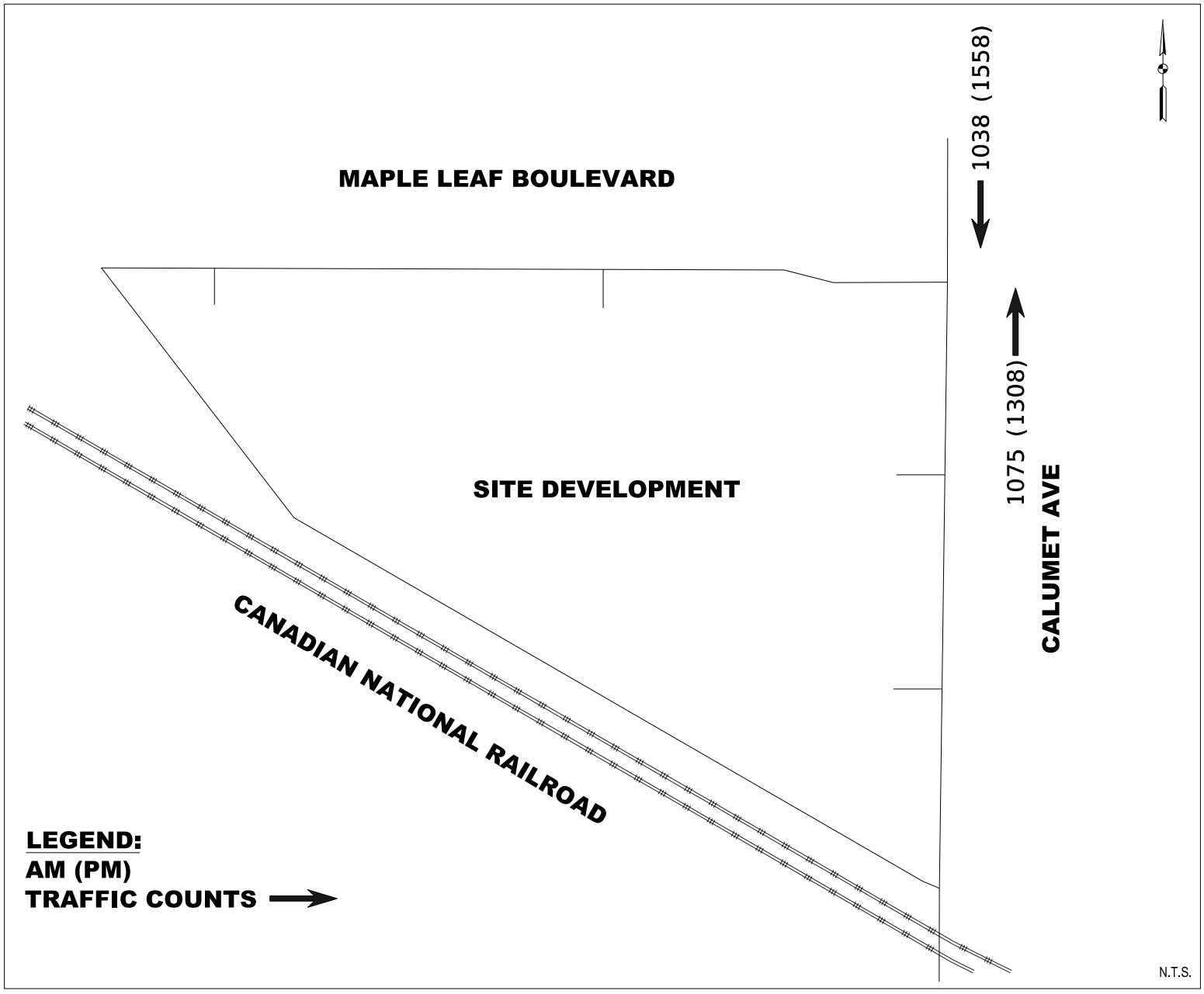
SHEET
C-2.0

FILE NO:Z:\2019-5052 Jay Lieser - Maple Leaf Crossing Calumet Avenue - Munster\dwg\2023-5001.dwg 4/20/2023 8:27:00 AM CDT

APPENDIX A-2

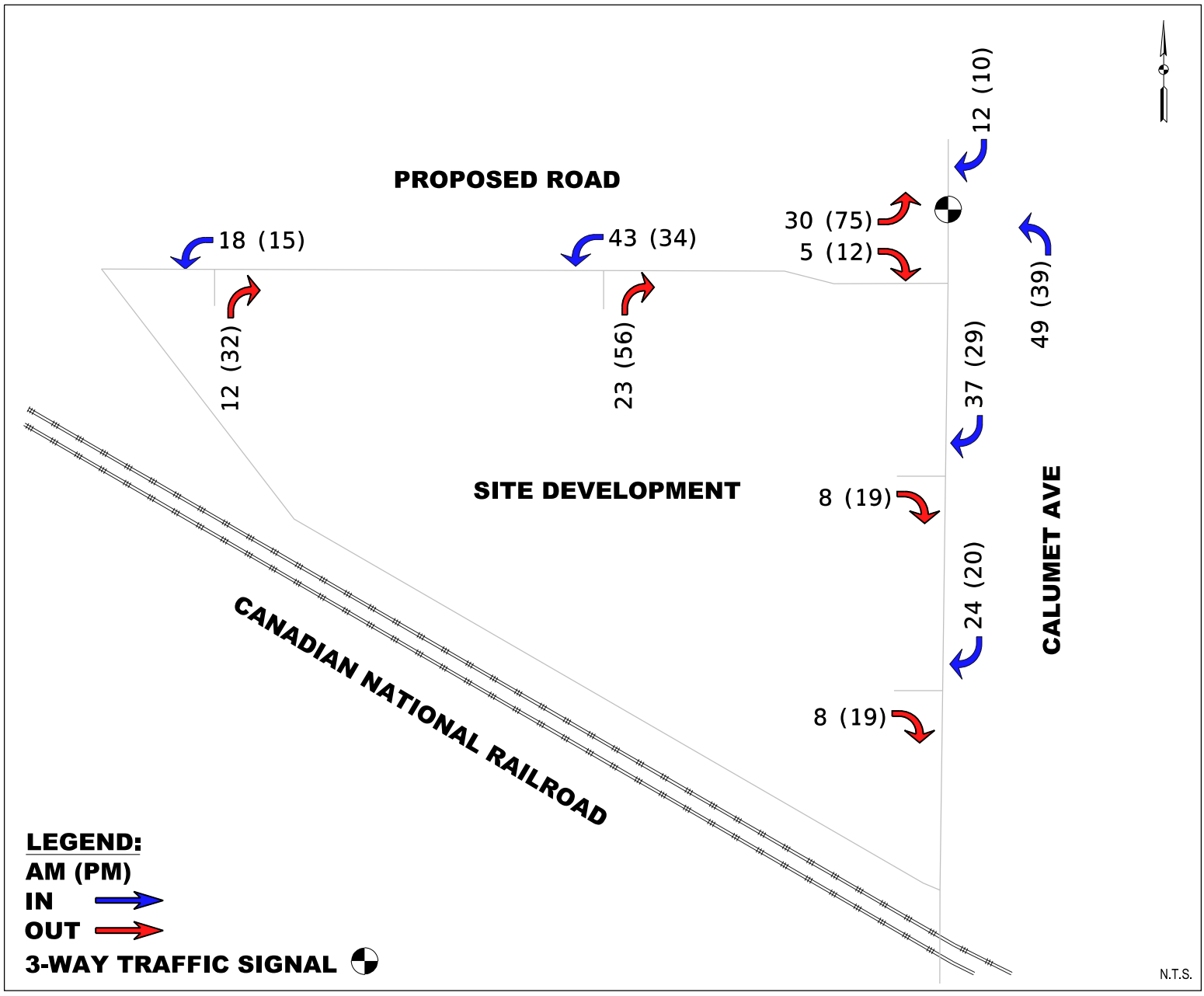
SITE PEAK HOUR TRAFFIC

APPENDIX 2 - CALUMET AVENUE EXISTING PEAK HOUR TRAFFIC



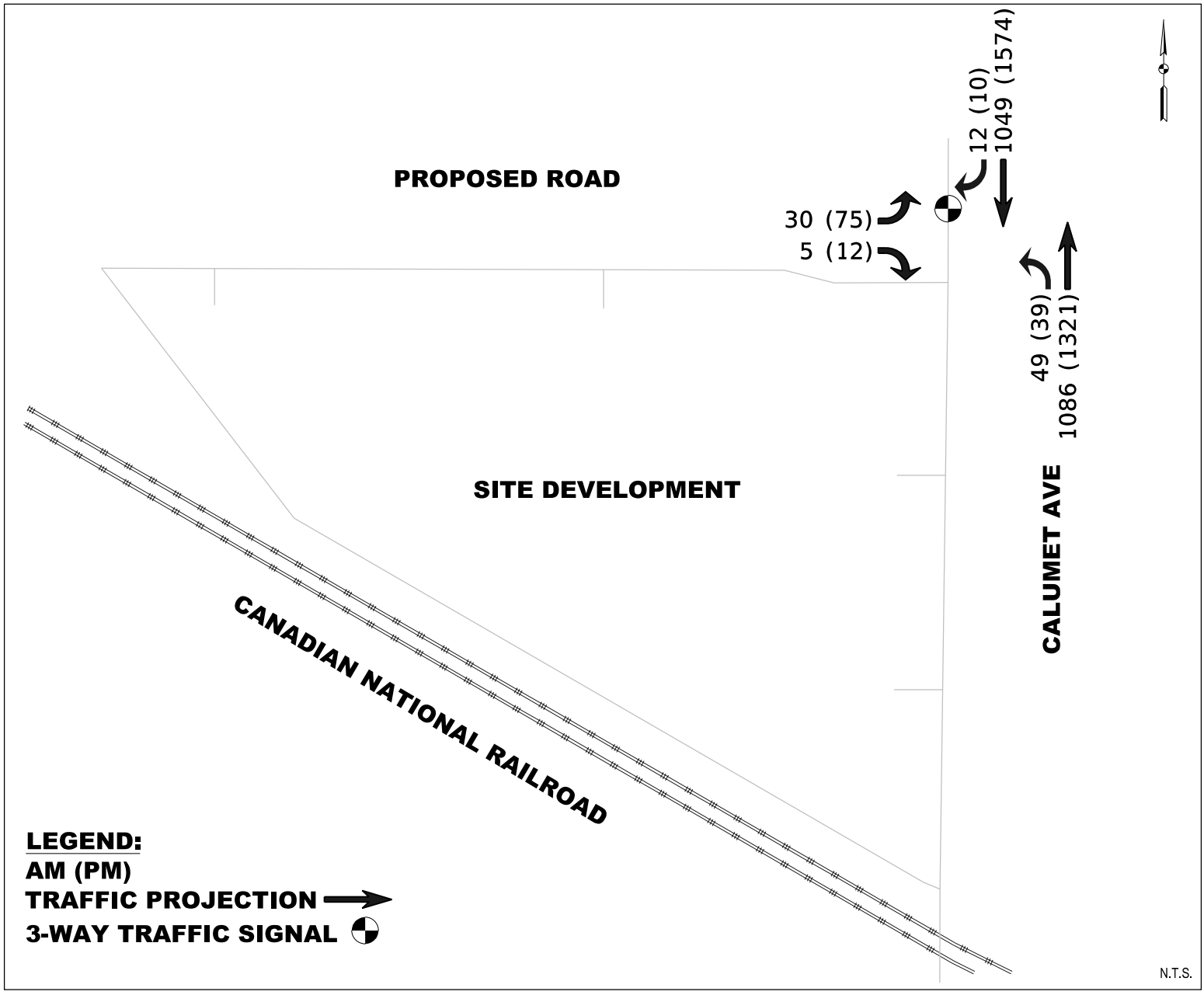
Notes:
- Peak Hour Traffic Counts from Miovision
- Pepsi-Cola Bottlers Company will not utilize Maple Leaf Boulevard.

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



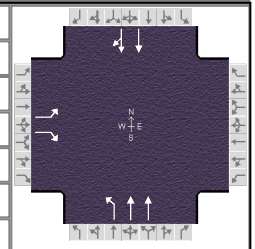
Notes:
- The traffic is projected to 2024
- Pepsi-Cola Bottlers Company will not impact traffic on Maple Leaf Boulevard.

APPENDIX A-3

HIGHWAY CAPACITY SOFTWARE (HCS) REPORTS

HCS7 Signalized Intersection Input Data

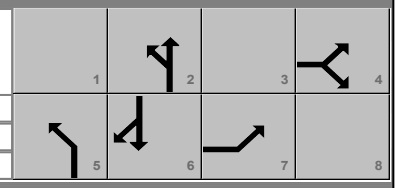
General Information				Intersection Information	
Agency	Ciorba Group			Duration, h	0.25
Analyst	VZ	Analysis Date	Jun 16, 2023	Area Type	Other
Jurisdiction	Munster, IN	Time Period	AM	PHF	0.95
Urban Street	Calumet Ave	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Maple Leaf Boulevard	File Name	AM_Peak_Calumet_MapleLeaf_2024.xus		
Project Description	Maple Leaf Blvd Traffic Signal Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30		5				49	1086			1049	12

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.1	72.5	6.4	0.0	0.0	0.0						
Yellow	3.0	4.5	4.5	0.0	0.0	0.0						
Red	0.0	1.5	1.5	0.0	0.0	0.0						



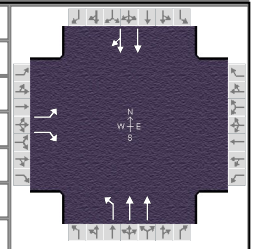
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30		5				49	1086			1049	12
Initial Queue (Q_b), veh/h	0		0				0	0			0	0
Base Saturation Flow Rate (s_o), veh/h	1900		1900				1900	2000			2000	1900
Parking (N_m), man/h		None						None			None	
Heavy Vehicles (P_{HV}), %	0		0				0	5			5	
Ped / Bike / RTOR, /h	0	0		0	0		0	0		0	0	0
Buses (N_b), 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 (*W*), ft	12.0		12.0				12.0	12.0			12.0	
Turn Bay Length, ft	300		70				80	0			0	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	35		35				35	35			35	35

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	51.0	51.0			27.0	49.0		22.0
Yellow Change Interval (*Y*), s	3.0	4.5			3.0	4.5		4.5
Red Clearance Interval (R_c), s	1.0	1.5			0.0	1.5		1.5
Minimum Green (G_{min}), s	10	10			8	15		15
Start-Up Lost Time (*l1*), s	2.0				2.0	2.0		2.0
Extension of Effective Green (*e*), s	2.0				2.0	2.0		2.0
Passage (*PT*), 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 (*Walk*), s		0.0		0.0				0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0				0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	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 / Curb	0	0	No		0		0		No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0				12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No				0.50		No	0.50	

HCS7 Signalized Intersection Results Summary

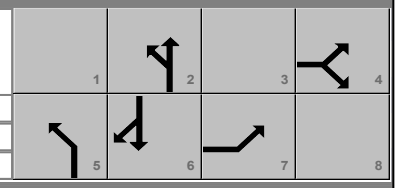
General Information				Intersection Information	
Agency	Ciorba Group			Duration, h	0.25
Analyst	VZ	Analysis Date	Jun 16, 2023	Area Type	Other
Jurisdiction	Munster, IN	Time Period	AM	PHF	0.95
Urban Street	Calumet Ave	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Maple Leaf Boulevard	File Name	AM_Peak_Calumet_MapleLeaf_2024.xus		
Project Description	Maple Leaf Blvd Traffic Signal Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30		5				49	1086			1049	12

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.1	72.5	6.4	0.0	0.0	0.0	
Yellow	3.0	4.5	4.5	0.0	0.0	0.0	
Red	0.0	1.5	1.5	0.0	0.0	0.0	



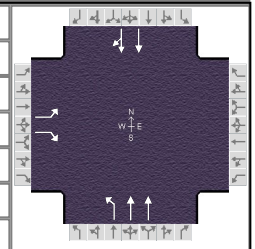
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		12.4			9.1	87.6		78.5
Change Period, ($Y+R_c$), s		6.0			3.0	6.0		6.0
Max Allow Headway (*MAH*), s		6.1			4.0	0.0		0.0
Queue Clearance Time (g_s), s		3.7			2.6			
Green Extension Time (g_e), s		0.2			0.2	0.0		0.0
Phase Call Probability		0.64			0.76			
Max Out Probability		0.00			0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	32		5				52	1143			560	557
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1810		1610				1810	1830			1922	1914
Queue Service Time (g_s), s	1.7		0.3				0.6	0.0			34.5	1.6
Cycle Queue Clearance Time (g_c), s	1.7		0.3				0.6	0.0			34.5	1.6
Green Ratio (*g/C*)	0.06		0.06				0.81	0.82			0.73	0.73
Capacity (*c*), veh/h	116		103				377	2986			1393	1388
Volume-to-Capacity Ratio (*X*)	0.272		0.051				0.137	0.383			0.402	0.402
Back of Queue (*Q*), ft/ln (95 th percentile)	36.9		6				18.5	7.2			30.6	29.4
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5		0.2				0.7	0.3			1.2	1.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.12		0.09				0.23	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	44.6		43.9				9.1	0.0			0.5	0.5
Incremental Delay (d_2), s/veh	2.7		0.4				0.2	0.4			0.9	0.9
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	47.2		44.4				9.3	0.4			1.3	1.4
Level of Service (LOS)	D		D				A	A			A	A
Approach Delay, s/veh / LOS	46.8	D		0.0			0.8	A		1.4	A	
Intersection Delay, s/veh / LOS	1.8						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.32	B	2.15	B	0.62	A	1.85	B
Bicycle LOS Score / LOS		F			1.47	A	1.41	A

HCS7 Signalized Intersection Intermediate Values

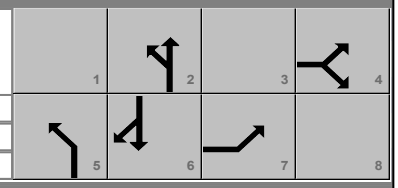
General Information				Intersection Information	
Agency	Ciorba Group			Duration, h	0.25
Analyst	VZ	Analysis Date	Jun 16, 2023	Area Type	Other
Jurisdiction	Munster, IN	Time Period	AM	PHF	0.95
Urban Street	Calumet Ave	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Maple Leaf Boulevard	File Name	AM_Peak_Calumet_MapleLeaf_2024.xus		
Project Description	Maple Leaf Blvd Traffic Signal Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30		5				49	1086			1049	12

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.1	72.5	6.4	0.0	0.0	0.0						
Yellow	3.0	4.5	4.5	0.0	0.0	0.0						
Red	0.0	1.5	1.5	0.0	0.0	0.0						



Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000				1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	1.000	1.000				1.000	0.961	1.000	1.000	0.961	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000				1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.952	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000					0.952	0.000		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847					1.000	1.000		0.996	0.996
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000						1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000						1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000				1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000				1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	1810	0	1610				1810	3752	0	0	3793	43
Proportion of Vehicles Arriving on Green (P)	0.06	0.00	0.06	0.00	0.00	0.00	0.08	1.00	0.00	0.00	0.97	0.97
Incremental Delay Factor (k)	0.23		0.23				0.11	0.50			0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		4.0			3.0	6.0		6.0
Green Ratio (g/C)		0.06			0.81	0.82		0.73
Permitted Saturation Flow Rate (s_p), veh/h/ln		1810			512	0		500
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								0
Permitted Effective Green Time (g_p), s		0.0			74.5	0.0		0.0
Permitted Service Time (g_u), s		0.0			38.0	0.0		0.0
Permitted Queue Service Time (g_{ps}), s					4.0			
Time to First Blockage (g_f), s		0.0			0.0	0.0		72.5
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		0						
Protected Right Effective Green Time (g_R), s		0.0						

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.557	0.000	1.389	0.000	0.000	0.000	1.198	0.000
Pedestrian F_s / F_{delay}	0.000	0.162	0.000	0.161	0.000	0.021	0.000	0.053
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b		57.25		55.13	1631.85	1.69	1450.02	3.78
Bicycle F_w / F_v	-3.64		-3.64		-3.64	0.99	-3.64	0.92

HCS7 Signalized Intersection Results Graphical Summary

General Information				Intersection Information	
Agency	Ciorba Group			Duration, h	0.25
Analyst	VZ	Analysis Date	Jun 16, 2023	Area Type	Other
Jurisdiction	Munster, IN	Time Period	AM	PHF	0.95
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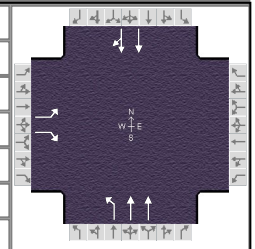
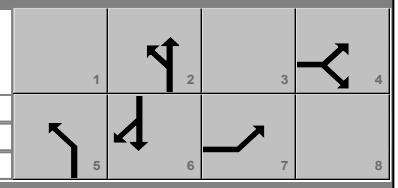
Intersection	Maple Leaf Boulevard	File Name	AM_Peak_Calumet_MapleLeaf_2024.xus		
Project Description	Maple Leaf Blvd Traffic Signal Study				



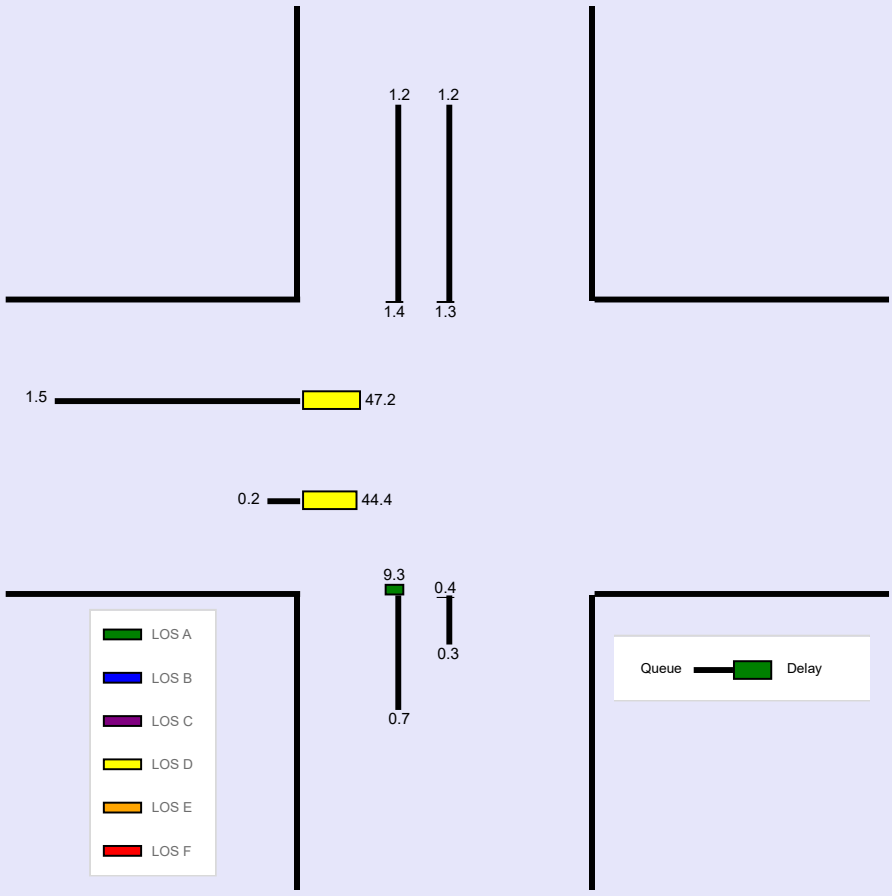
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30		5				49	1086			1049	12

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.1	72.5	6.4	0.0	0.0	0.0	
Yellow	3.0	4.5	4.5	0.0	0.0	0.0	
Red	0.0	1.5	1.5	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (*Q*), ft/ln (95 th percentile)	36.9		6				18.5	7.2			30.6	29.4
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5		0.2				0.7	0.3			1.2	1.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.12		0.09				0.23	0.00			0.00	0.00
Control Delay (*d*), s/veh	47.2		44.4				9.3	0.4			1.3	1.4
Level of Service (LOS)	D		D				A	A			A	A
Approach Delay, s/veh / LOS	46.8	D		0.0			0.8	A		1.4	A	
Intersection Delay, s/veh / LOS	1.8						A					



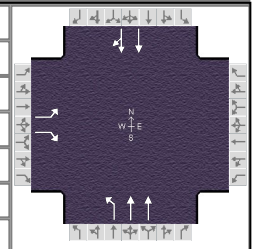
--- Messages ---

No errors or warnings exist.

--- Comments ---

HCS7 Signalized Intersection Input Data

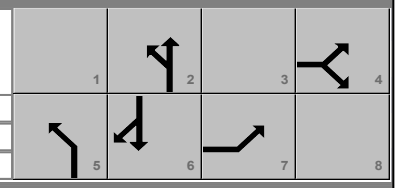
General Information				Intersection Information	
Agency	Ciorba Group			Duration, h	0.25
Analyst	VZ	Analysis Date	Jun 16, 2023	Area Type	Other
Jurisdiction	Munster, IN	Time Period	PM	PHF	0.95
Urban Street	Calumet Ave	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Maple Leaf Boulevard	File Name	PM_Peak_Calumet_MapleLeaf_2024.xus		
Project Description	Maple Leaf Blvd Traffic Signal Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	75		12				39	1321			1574	10

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.7	79.9	9.4	0.0	0.0	0.0	
Yellow	3.0	4.5	4.5	0.0	0.0	0.0	
Red	0.0	1.5	1.5	0.0	0.0	0.0	



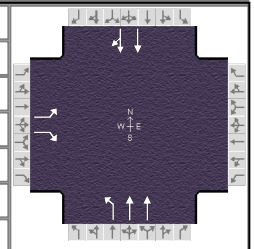
Traffic Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	75		12				39	1321			1574	10
Initial Queue (Q_b), veh/h	0		0				0	0			0	0
Base Saturation Flow Rate (s_o), veh/h	1900		1900				1900	2000			2000	1900
Parking (N_m), man/h		None						None			None	
Heavy Vehicles (P_{HV}), %	0		0				0	5			5	
Ped / Bike / RTOR, /h	0	0		0	0		0	0		0	0	0
Buses (N_b), 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 (*W*), ft	12.0		12.0				12.0	12.0			12.0	
Turn Bay Length, ft	300		70				80	0			0	
Grade (*Pg*), %		0			0			0			0	
Speed Limit, mi/h	35		35				35	35			35	35

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G_{max}) or Phase Split, s	74.0	74.0			15.0	36.0		21.0
Yellow Change Interval (*Y*), s	3.0	4.5			3.0	4.5		4.5
Red Clearance Interval (R_c), s	1.0	1.5			0.0	1.5		1.5
Minimum Green (G_{min}), s	10	10			8	15		15
Start-Up Lost Time (*l*t), s	2.0				2.0	2.0		2.0
Extension of Effective Green (*e*), s	2.0				2.0	2.0		2.0
Passage (*PT*), 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 (*Walk*), s		0.0		0.0				0.0
Pedestrian Clearance Time (*PC*), s		0.0		0.0				0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	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 / Curb	0	0	No		0		0		No	0	0	No
Width Outside / Bike Lane / Shoulder, ft	12	5.0	2.0				12	5.0	2.0	12	5.0	2.0
Pedestrian Signal / Occupied Parking	No		0.50	No					0.50	No		0.50

HCS7 Signalized Intersection Results Summary

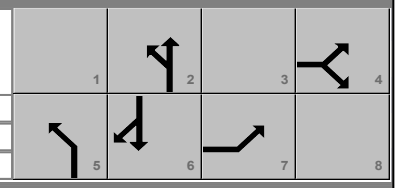
General Information				Intersection Information	
Agency	Ciorba Group			Duration, h	0.25
Analyst	VZ	Analysis Date	Jun 16, 2023	Area Type	Other
Jurisdiction	Munster, IN	Time Period	PM	PHF	0.95
Urban Street	Calumet Ave	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Maple Leaf Boulevard	File Name	PM_Peak_Calumet_MapleLeaf_2024.xus		
Project Description	Maple Leaf Blvd Traffic Signal Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	75		12				39	1321			1574	10

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.7	79.9	9.4	0.0	0.0	0.0	
Yellow	3.0	4.5	4.5	0.0	0.0	0.0	
Red	0.0	1.5	1.5	0.0	0.0	0.0	



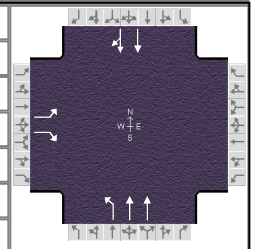
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		15.4			8.7	94.6		85.9
Change Period, ($Y+R_c$), s		6.0			3.0	6.0		6.0
Max Allow Headway (*MAH*), s		6.1			4.0	0.0		0.0
Queue Clearance Time (g_s), s		6.6			2.5			
Green Extension Time (g_e), s		0.7			0.1	0.0		0.0
Phase Call Probability		0.94			0.71			
Max Out Probability		0.00			0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	79		13				41	1391			834	833
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1810		1610				1810	1830			1922	1918
Queue Service Time (g_s), s	4.6		0.8				0.5	0.0			72.9	3.6
Cycle Queue Clearance Time (g_c), s	4.6		0.8				0.5	0.0			72.9	3.6
Green Ratio (*g/C*)	0.09		0.09				0.80	0.81			0.73	0.73
Capacity (*c*), veh/h	155		138				179	2948			1396	1393
Volume-to-Capacity Ratio (*X*)	0.511		0.092				0.230	0.472			0.598	0.598
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/ln (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
Uniform Delay (d_1), s/veh	48.1		46.4				30.6	0.0			0.5	0.5
Incremental Delay (d_2), s/veh	5.5		0.6				0.6	0.5			1.9	1.9
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	53.6		47.0				31.2	0.5			2.4	2.4
Level of Service (LOS)	D		D				C	A			A	A
Approach Delay, s/veh / LOS	52.7	D		0.0			1.4	A		2.4	A	
Intersection Delay, s/veh / LOS	3.4						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.32	B	2.15	B	0.63	A	1.85	B
Bicycle LOS Score / LOS		F			1.67	B	1.86	B

HCS7 Signalized Intersection Intermediate Values

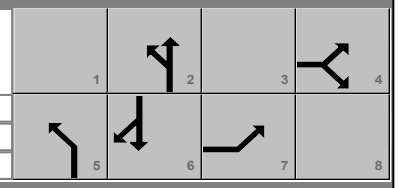
General Information				Intersection Information	
Agency	Ciorba Group			Duration, h	0.25
Analyst	VZ	Analysis Date	Jun 16, 2023	Area Type	Other
Jurisdiction	Munster, IN	Time Period	PM	PHF	0.95
Urban Street	Calumet Ave	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Maple Leaf Boulevard	File Name	PM_Peak_Calumet_MapleLeaf_2024.xus		
Project Description	Maple Leaf Blvd Traffic Signal Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	75		12				39	1321			1574	10

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.7	79.9	9.4	0.0	0.0	0.0						
Yellow	3.0	4.5	4.5	0.0	0.0	0.0						
Red	0.0	1.5	1.5	0.0	0.0	0.0						



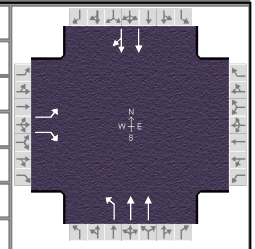
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000				1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	1.000	1.000				1.000	0.961	1.000	1.000	0.961	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000				1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.952	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000					0.952	0.000		1.000	1.000	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.847					1.000	1.000		0.998	0.998
Left-Turn Pedestrian Adjustment Factor (f_{Lpb})	1.000						1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000						1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000				1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000				1.000	1.000	1.000	1.000	1.000	1.000
Movement Saturation Flow Rate (s), veh/h	1810	0	1610				1810	3752	0	0	3815	24
Proportion of Vehicles Arriving on Green (P)	0.09	0.00	0.09	0.00	0.00	0.00	0.07	1.00	0.00	0.00	0.97	0.97
Incremental Delay Factor (k)	0.23		0.23				0.11	0.50			0.50	0.50

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		4.0			3.0	6.0		6.0
Green Ratio (g/C)		0.09			0.80	0.81		0.73
Permitted Saturation Flow Rate (s_p), veh/h/ln		1810			302	0		395
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								0
Permitted Effective Green Time (g_p), s		0.0			81.9	0.0		0.0
Permitted Service Time (g_u), s		0.0			6.9	0.0		0.0
Permitted Queue Service Time (g_{ps}), s					6.9			
Time to First Blockage (g_f), s		0.0			0.0	0.0		79.9
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln		0						
Protected Right Effective Green Time (g_R), s		0.0						

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.557	0.000	1.389	0.000	0.000	0.000	1.198	0.000
Pedestrian F_s / F_{delay}	0.000	0.166	0.000	0.164	0.000	0.029	0.000	0.057
Pedestrian M_{corner} / M_{cw}								
Bicycle c_b / d_b		62.22	-90.91	60.11	1611.04	2.08	1452.53	4.12
Bicycle F_w / F_v	-3.64		-3.64		-3.64	1.18	-3.64	1.38

HCS7 Signalized Intersection Results Graphical Summary

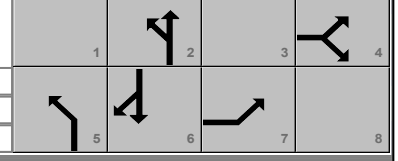
General Information				Intersection Information	
Agency	Ciorba Group			Duration, h	0.25
Analyst	VZ	Analysis Date	Jun 16, 2023	Area Type	Other
Jurisdiction	Munster, IN	Time Period	PM	PHF	0.95
Urban Street	Calumet Ave	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Maple Leaf Boulevard	File Name	PM_Peak_Calumet_MapleLeaf_2024.xus		
Project Description	Maple Leaf Blvd Traffic Signal Study				



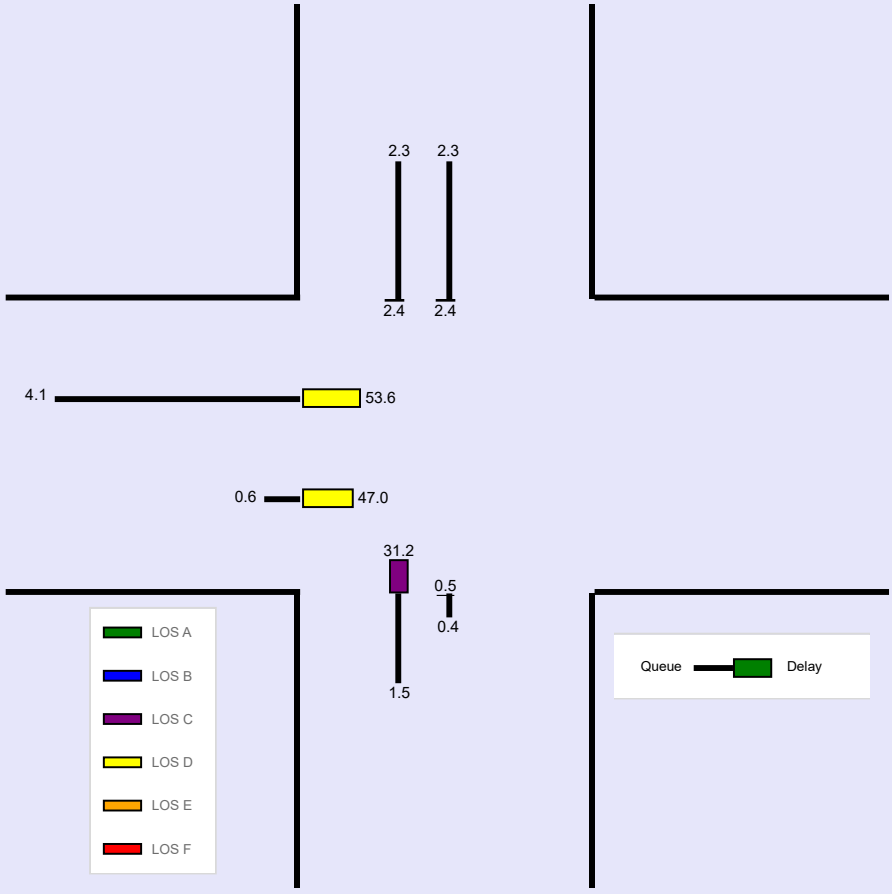
Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	75		12				39	1321			1574	10

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.7	79.9	9.4	0.0	0.0	0.0	
Yellow	3.0	4.5	4.5	0.0	0.0	0.0	
Red	0.0	1.5	1.5	0.0	0.0	0.0	



Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	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/ln (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				C	A			A	A
Approach Delay, s/veh / LOS	52.7		D	0.0			1.4		A	2.4		A
Intersection Delay, s/veh / LOS	3.4						A					



--- Messages ---

No errors or warnings exist.

--- Comments ---

