

March 10, 2020

City of Battle Creek
 150 S. Kendall Street
 Battle Creek, MI 49037

Attention: Mr. Carl Fedders, P.E., City Engineer / Assistant DPW Director

RE: NORTH STREET / EMMETT STREET INTERSECTION – ROUNDABOUT

Dear Carl:

Wightman has reviewed the Road Safety Audit (RSA) dated December 2018 as prepared by OHM Advisors. The City of Battle Creek (City) has implemented many of the recommendations identified in the RSA for safety improvements to this intersection. The one remaining recommendation is the consideration of a roundabout at this intersection. Prior to proceeding, the City requested an independent review and evaluation be completed to determine the functionality of a roundabout at this location.

This review included an analysis of the proposed roundabout for this intersection with estimated current traffic volumes for 2020 (projected from actual 2018 counts) and projected volumes for 2023, 2030 and 2040. The projected 2023 traffic volumes were generated to account for the ultimate full enrollment of Fremont International Academy, which was recently opened to the east of the project site.

Existing traffic volumes, pedestrian counts and growth rates were provided by the City of Battle Creek. The annual growth rate for this corridor was estimated to be 0.25% for the base traffic. In 2019, Battle Creek Public Schools re-opened a previously vacated school building and repurposed it as the Fremont International Academy. Since the opening of the school, there has been and will continue to be an incremental increase in the traffic disproportional to the growth of the area until the school is at full capacity. Based on discussions with Fremont International Academy, they intend to be at full capacity during the 2022-23 school year. In order to incorporate this additional traffic from the school, the AM and PM peak hour trips were estimated and are shown in *Table 1* below. Estimated trips were determined from data in *Trip Generation, An ITE International Report, 8th Edition*.

Table 1: Trip Generation: LU534 Private School (K-8)

	School Year			
	2019-20	2020-21	2021-22	2022-23
Staff / Teachers	45	48	51	54
Students	200	256	312	368
AM Peak Trips	184	234	284	335
PM Peak Trips	118	152	186	220

*Source: Trip Generation, An ITE International Report, 8th Edition

Although this school is part of the Battle Creek Public School system, the characteristics resemble those of a private school, which is why LU534 was selected rather than LU520 or LU522. This is due to the fact that the school does not offer busing and serves a regional area rather than a local neighborhood.

ALLEGAN

A 1670 LINCOLN RD. (M-40)
 ALLEGAN, MI 49010
 o 269.673.8465

BENTON HARBOR

A 2303 PIPESTONE RD.
 BENTON HARBOR, MI 49022
 o 269.927.0100

KALAMAZOO

A 433 E. RANSOM ST.
 KALAMAZOO, MI 49007
 o 269.327.3532

ROYAL OAK

A 306 S. WASHINGTON AVE., SUITE 200
 ROYAL OAK, MI 48067
 o 248.791.1371

The existing AM and PM peak turning movement counts were adjusted to account for the additional traffic generated by the school for the analysis periods of 2020 and 2023. The analysis periods of 2030 and 2040 were based on the 0.25% projected growth after 2023. These projected turning movement counts are attached in **Appendix A**.

As part of the RSA, an option presented to construct a roundabout to improve the safety of both pedestrians and vehicles. Based on the conceptual layout provided, the roundabout appears to be a single lane “Compact Urban Roundabout” with an inscribed center diameter of approximately 100 feet and a 20-foot-wide circulation lane. Each leg of the intersection would have a splitter island with pedestrian crosswalks.

In order to assess the functionality of a roundabout at this intersection, the Level of Service (LOS) of a roundabout was compared to the LOS of a signalized intersection. The LOS is an indication of the general acceptability of the delay to drivers.

The signalized intersection was modeled using SYNCHRO 10 software with the original data files provided by the City, which appeared to be based on the Highway Capacity Manual (HCM) 2000 with a 60 second cycle length. The LOS criteria for a signalized intersection per the HCM is shown in *Table 2* below.

Table 2: LOS Criteria for Signalized Intersections

Level of Service (LOS)	Average Control Delay (seconds/vehicle)
A	<10
B	>10 – 20
C	>20 – 35
D	>35 – 55
E	>55 – 80
F	>80

*Source: Highway Capacity Manual 2010, Transportation Research Board, 2010

A proposed roundabout was modeled using RODEL software, which uses capacity equations from the HCM and NCHRP Report 672, using the approximate geometry shown on a sketch provided by the City. Roundabout LOS is determined based on the same LOS criteria as an un-signalized intersection per the HCM and is shown in *Table 3* below.

Table 3: LOS Criteria for Un-Signalized Intersections

Level of Service (LOS)	Average Control Delay (seconds/vehicle)
A	<10
B	>10 – 15
C	>15 – 25
D	>25 – 35
E	>35 – 50
F	>50

*Source: Highway Capacity Manual 2010, Transportation Research Board, 2010

Signalized and un-signalized intersections that operate at an overall LOS E or better during peak hours are generally considered acceptable in urban environments. Although this is generally an acceptable LOS, it is not always acceptable to the user. It should also be noted that individual lane groups may have a separate LOS that may be different than the total approach or intersection LOS. If one of these lane groups have a LOS rated E or lower, the approach may be considered to have failed. Therefore, these individual lane groups should also be considered when evaluating the need for additional lanes at intersections, split phases, or protected turning movements.

For a roundabout it is recommended that each entry approach should operate at a LOS D or better after an acceptable geometry is identified.

In order to compare the roundabout to a signalized intersection, the model was prepared following the MDOT Roundabout Guidance document using a “control” delay, which is consistent with LOS determinations for signalized intersections. Based on the models, we have determined the projected delay for both types of intersections. A comparison of the capacity analysis results for existing and future volumes for the AM and PM peak hours are provided in *Tables 4 and 5* below. Due to the pedestrian traffic that is present at this intersection and as a direct result of the surrounding commercial uses, the entry capacity of the intersection was adjusted by a factor of 0.95 in accordance with Exhibit 4-7 on page 4-14 of NCHRP Report 672. The RODEL and SYNCHRO reports are provided in **Appendix B**. All movements with LOS E or worse are highlighted in the following tables.

Table 4: AM Peak Hour Intersection Analysis

Year	Approach	Signalized Intersection		Proposed Roundabout	
		LOS	Delay, sec/veh	LOS	Delay, sec/veh
2020	SB	E	60.8	C	16.0
	EB	C	22.6	A	9.3
	NB	C	24.0	A	9.1
	WB	D	37.8	B	12.7
	Overall	D	39.0	B	12.4
2023	SB	E	66.3	C	18.3
	EB	C	28.5	B	10.1
	NB	C	26.1	A	9.9
	WB	D	46.3	B	14.4
	Overall	D	44.6	B	13.9
2030	SB	E	71.1	C	19.3
	EB	C	32.9	B	10.4
	NB	C	26.6	B	10.1
	WB	D	49.5	B	15.0
	Overall	D	48.0	B	14.4
2040	SB	E	79.3	C	21.4
	EB	D	43.0	B	10.9
	NB	C	27.3	B	10.5
	WB	E	55.5	C	16.0
	Overall	D	54.4	C	15.6

As shown in *Table 4*, if the intersection was to remain a signalized intersection, the SB approach of North Street is operating and will be operating at a LOS E based on the current signal timing and phasing of the signal. Based on a review of the SYNCHRO reports, the poor LOS is due to the combined thru-right turn lane exceeding the capacity of the intersection. Further review of the SYNCHRO reports shows that for the 2030 analysis period the EB Left, WB Thru-Right, and SB Thru operate at a LOS E and for the 2040 analysis period the EB Left, WB Thru-Right, and SB Thru operate at a LOS F, LOS E, and LOS F, respectively. Although the overall approach delay may be acceptable, the individual lanes do not operate at a desired LOS.

Table 5: PM Peak Hour Intersection Analysis

Year	Approach	Signalized Intersection		Proposed Roundabout	
		LOS	Delay, sec/veh	LOS	Delay, sec/veh
2020	SB	D	49.8	C	16.4
	EB	C	28.2	C	21.5
	NB	C	30.7	C	18.0
	WB	C	24.6	B	14.4
	Overall	C	34.6	C	17.6
2023	SB	D	54.2	C	18.0
	EB	C	29.8	C	24.4
	NB	C	34.3	C	20.1
	WB	C	26.3	C	15.8
	Overall	D	37.4	C	19.6
2030	SB	E	59.8	C	19.1
	EB	C	31.0	D	26.6
	NB	D	36.6	C	21.5
	WB	C	26.7	C	16.6
	Overall	D	40.0	C	21.0
2040	SB	E	71.7	C	21.1
	EB	C	33.3	D	30.5
	NB	D	41.1	C	23.8
	WB	C	27.2	C	17.9
	Overall	D	45.3	C	23.4

As shown in *Table 5*, if the intersection was to remain a signalized intersection, the intersection will operate at an acceptable LOS up to and including the 2023 analysis period. However, after the 2023 analysis period the SB approach of North Street will be operating at a LOS E based on the current signal timing and phasing of the signal. Based on a review of the SYNCHRO reports, the poor LOS is due to the combined thru-right turn lane exceeding the capacity of the intersection.

In order to improve the LOS of the signalized intersection, capacity enhancements are required. To address the left turn lane, this would require either adding a separate phase to provide a protected movement for the turning vehicles or increasing the duration of the signal cycle to allow more time for the vehicles to clear the intersection. For the thru movement, this could be addressed by adding time to the signal phase or adding a thru lane for increased capacity. However, in both instances this would impact the pedestrian movement by increasing the length of roadway the pedestrians need to cross or increasing the allotted time for the pedestrians to cross the roadway. This could result in increased jaywalking or pedestrians crossing the roadway when traffic has the right-of-way.

Conclusion

Based on the overall review and modeling of the intersection, a roundabout would be the preferred option to address the vehicular capacity and pedestrian safety concerns during both the AM and PM peaks. During both the AM and PM peak hours for all analysis periods, the roundabout operates at an acceptable LOS. There may be brief periods during the peak hours where the roundabout may not operate as modeled due to fluctuations in the traffic flows. However, the roundabout will operate continuously. The splitter islands will offer refuge for pedestrians and provide shorter crossing distances. Operationally, a roundabout will eliminate maintenance costs associated with a signalized intersection. Furthermore, as traffic volumes increase, the signal will require upgrades, additional phases, and increased cycle lengths. The signal timing will have to be continuously adjusted over time to ensure the signal is optimized.

With regard to a roundabout, the proposed geometrics appear to be sufficient to have the intersection operate at a LOS E or better. However, it is recommended that a roundabout be planned to accommodate an extra lane in the future. A roundabout with a single lane is generally capable of handling a total hourly traffic volume of 2,000 vehicles. Provided the traffic grows at the anticipated rate of 0.25% or less, the volumes should be within the threshold until the year 2040. After the year 2040, it appears the roundabout may no longer function at an acceptable level without added capacity. Alternately, if the intersection remains signalized, there is a reasonable expectation that the intersection would need to be widened to accommodate additional lanes, including the upgrades to the signal itself.

It is recommended that the City provide current turning movement counts and pedestrian counts so that the accuracy of the projected 2020 counts may be confirmed, including the current movements generated by the school.

If you have any questions, please feel free to contact me.

Very truly yours,



Aaron Neitling, P.E.
aneitling@gowightman.com

Enclosure(s):

1. Appendix A: Signalized Intersection Synchro Analysis
 - a. (2020 AM/PM, 2023 AM/PM, 2030 AM/PM, 2040 AM/PM)
2. Appendix B: Rodel Roundabout Analysis
 - a. (2020 AM/PM, 2023 AM/PM, 2030 AM/PM, 2040 AM/PM)
3. 2016 Turning Movement Counts (AM, PM, Off-Peak)



APPENDIX A

Synchro Analysis Reports (Signalized Intersections)

2020 AM / PM Peak Hour

2023 AM / PM Peak Hour

2030 AM / PM Peak Hour

2040 AM / PM Peak Hour

HCM Signalized Intersection Capacity Analysis

6: Emmett St. W. & North Ave

02/21/2020



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	112	179	10	61	334	57	23	306	52	54	358	139
Future Volume (vph)	112	179	10	61	334	57	23	306	52	54	358	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	12	16	11	12	15	11
Total Lost time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1841		1711	1764		1770	2056		1770	1973	
Flt Permitted	0.36	1.00		0.60	1.00		0.23	1.00		0.53	1.00	
Satd. Flow (perm)	663	1841		1079	1764		435	2056		983	1973	
Peak-hour factor, PHF	0.73	0.75	0.50	0.70	0.76	0.83	0.64	0.93	0.75	0.91	0.81	0.96
Adj. Flow (vph)	153	239	20	87	439	69	36	329	69	59	442	145
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	153	259	0	87	508	0	36	398	0	59	587	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	18.7	18.7		18.7	18.7		17.6	17.6		17.6	17.6	
Effective Green, g (s)	18.7	18.7		18.7	18.7		17.6	17.6		17.6	17.6	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.29	0.29		0.29	0.29	
Clearance Time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	206	573		336	549		127	603		288	578	
v/s Ratio Prot		0.14			c0.29			0.19			c0.30	
v/s Ratio Perm	0.23			0.08			0.08			0.06		
v/c Ratio	0.74	0.45		0.26	0.93		0.28	0.66		0.20	1.02	
Uniform Delay, d1	18.5	16.5		15.5	20.0		16.3	18.6		15.9	21.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.35	1.14	
Incremental Delay, d2	13.5	0.6		0.4	21.6		5.5	5.6		1.5	40.5	
Delay (s)	32.0	17.1		15.9	41.5		21.9	24.2		23.0	64.6	
Level of Service	C	B		B	D		C	C		C	E	
Approach Delay (s)		22.6			37.8			24.0			60.8	
Approach LOS		C			D			C			E	





















Intersection Summary

HCM 2000 Control Delay	39.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	23.7
Intersection Capacity Utilization	101.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

6: Emmett St. W. & North Ave

02/21/2020

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	162	316	25	77	238	82	16	397	62	82	424	129
Future Volume (vph)	162	316	25	77	238	82	16	397	62	82	424	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	12	16	11	12	15	11
Total Lost time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.96		1.00	0.98		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1835		1711	1732		1770	2071		1770	1977	
Flt Permitted	0.54	1.00		0.49	1.00		0.22	1.00		0.31	1.00	
Satd. Flow (perm)	1006	1835		883	1732		417	2071		573	1977	
Peak-hour factor, PHF	0.76	0.86	0.63	0.79	0.86	0.86	0.80	0.81	0.87	0.86	0.89	0.89
Adj. Flow (vph)	213	367	40	97	277	95	20	490	71	95	476	145
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	213	407	0	97	372	0	20	561	0	95	621	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	17.0	17.0		17.0	17.0		19.3	19.3		19.3	19.3	
Effective Green, g (s)	17.0	17.0		17.0	17.0		19.3	19.3		19.3	19.3	
Actuated g/C Ratio	0.28	0.28		0.28	0.28		0.32	0.32		0.32	0.32	
Clearance Time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	285	519		250	490		134	666		184	635	
v/s Ratio Prot		c0.22			0.21			0.27			c0.31	
v/s Ratio Perm	0.21			0.11			0.05			0.17		
v/c Ratio	0.75	0.78		0.39	0.76		0.15	0.84		0.52	0.98	
Uniform Delay, d1	19.5	19.8		17.3	19.6		14.5	18.9		16.6	20.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.24	1.13	
Incremental Delay, d2	10.2	7.6		1.0	6.7		2.3	12.3		9.6	30.1	
Delay (s)	29.8	27.4		18.3	26.3		16.8	31.2		30.1	52.8	
Level of Service	C	C		B	C		B	C		C	D	
Approach Delay (s)		28.2			24.6			30.7			49.8	
Approach LOS		C			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			34.6				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			60.0				Sum of lost time (s)			23.7		
Intersection Capacity Utilization			104.5%				ICU Level of Service			G		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis

6: Emmett St. W. & North Ave

02/21/2020



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	113	194	10	75	350	69	23	309	67	66	360	140
Future Volume (vph)	113	194	10	75	350	69	23	309	67	66	360	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	12	16	11	12	15	11
Total Lost time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1843		1711	1759		1770	2044		1770	1973	
Flt Permitted	0.31	1.00		0.59	1.00		0.23	1.00		0.49	1.00	
Satd. Flow (perm)	576	1843		1059	1759		431	2044		915	1973	
Peak-hour factor, PHF	0.73	0.75	0.50	0.70	0.76	0.83	0.64	0.93	0.75	0.91	0.81	0.96
Adj. Flow (vph)	155	259	20	107	461	83	36	332	89	73	444	146
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	155	279	0	107	544	0	36	421	0	73	590	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	19.0	19.0		19.0	19.0		17.3	17.3		17.3	17.3	
Effective Green, g (s)	19.0	19.0		19.0	19.0		17.3	17.3		17.3	17.3	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.29	0.29		0.29	0.29	
Clearance Time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	182	583		335	557		124	589		263	568	
v/s Ratio Prot		0.15			c0.31			0.21			c0.30	
v/s Ratio Perm	0.27			0.10			0.08			0.08		
v/c Ratio	0.85	0.48		0.32	0.98		0.29	0.71		0.28	1.04	
Uniform Delay, d1	19.2	16.5		15.6	20.3		16.6	19.1		16.5	21.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.32	1.13	
Incremental Delay, d2	29.8	0.6		0.6	31.9		5.8	7.2		2.5	47.4	
Delay (s)	49.0	17.1		16.1	52.2		22.4	26.4		24.3	71.5	
Level of Service	D	B		B	D		C	C		C	E	
Approach Delay (s)		28.5			46.3			26.1			66.3	
Approach LOS		C			D			C			E	

Intersection Summary

HCM 2000 Control Delay	44.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	23.7
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

6: Emmett St. W. & North Ave

02/21/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	163	328	25	86	248	90	16	400	73	89	427	130
Future Volume (vph)	163	328	25	86	248	90	16	400	73	89	427	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	12	16	11	12	15	11
Total Lost time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.96		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1836		1711	1728		1770	2065		1770	1977	
Flt Permitted	0.52	1.00		0.47	1.00		0.21	1.00		0.28	1.00	
Satd. Flow (perm)	961	1836		845	1728		396	2065		521	1977	
Peak-hour factor, PHF	0.76	0.86	0.63	0.79	0.86	0.86	0.80	0.81	0.87	0.86	0.89	0.89
Adj. Flow (vph)	214	381	40	109	288	105	20	494	84	103	480	146
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	214	421	0	109	393	0	20	578	0	103	626	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	17.2	17.2		17.2	17.2		19.1	19.1		19.1	19.1	
Effective Green, g (s)	17.2	17.2		17.2	17.2		19.1	19.1		19.1	19.1	
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.32	0.32		0.32	0.32	
Clearance Time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	275	526		242	495		126	657		165	629	
v/s Ratio Prot		c0.23			0.23			0.28			c0.32	
v/s Ratio Perm	0.22			0.13			0.05			0.20		
v/c Ratio	0.78	0.80		0.45	0.79		0.16	0.88		0.62	1.00	
Uniform Delay, d1	19.6	19.8		17.5	19.8		14.7	19.4		17.4	20.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.20	1.12	
Incremental Delay, d2	13.0	8.5		1.3	8.5		2.7	15.6		16.0	34.1	
Delay (s)	32.6	28.3		18.9	28.3		17.4	34.9		36.9	57.1	
Level of Service	C	C		B	C		B	C		D	E	
Approach Delay (s)		29.8			26.3			34.3			54.2	
Approach LOS		C			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			37.4				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			60.0				Sum of lost time (s)			23.7		
Intersection Capacity Utilization			105.8%				ICU Level of Service			G		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis

18: North Ave & Hospital Driveway

02/21/2020



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	30	23	395	63	82	503
Future Volume (vph)	30	23	395	63	82	503
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	16	12	12	12
Total Lost time (s)	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	2111	1583	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.49	1.00
Satd. Flow (perm)	1770	1583	2111	1583	904	1863
Peak-hour factor, PHF	0.75	0.52	0.82	0.88	0.68	0.87
Adj. Flow (vph)	40	44	482	72	121	578
RTOR Reduction (vph)	0	41	0	19	0	0
Lane Group Flow (vph)	40	3	482	53	121	578
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Actuated Green, G (s)	4.7	4.7	44.3	44.3	44.3	44.3
Effective Green, g (s)	4.7	4.7	44.3	44.3	44.3	44.3
Actuated g/C Ratio	0.08	0.08	0.74	0.74	0.74	0.74
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	138	124	1558	1168	667	1375
v/s Ratio Prot	c0.02		0.23			c0.31
v/s Ratio Perm		0.00		0.03	0.13	
v/c Ratio	0.29	0.03	0.31	0.05	0.18	0.42
Uniform Delay, d1	26.1	25.5	2.7	2.1	2.4	3.0
Progression Factor	1.00	1.00	0.51	0.75	1.00	1.00
Incremental Delay, d2	1.2	0.1	0.3	0.0	0.6	0.9
Delay (s)	27.2	25.6	1.6	1.6	3.0	3.9
Level of Service	C	C	A	A	A	A
Approach Delay (s)	26.4		1.6			3.8
Approach LOS	C		A			A





















Intersection Summary

HCM 2000 Control Delay	4.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	57.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

6: Emmett St. W. & North Ave

02/21/2020

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	197	10	76	356	70	23	314	68	67	366	142
Future Volume (vph)	115	197	10	76	356	70	23	314	68	67	366	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	12	16	11	12	15	11
Total Lost time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1843		1711	1760		1770	2044		1770	1973	
Flt Permitted	0.30	1.00		0.59	1.00		0.23	1.00		0.48	1.00	
Satd. Flow (perm)	555	1843		1055	1760		431	2044		891	1973	
Peak-hour factor, PHF	0.73	0.75	0.50	0.70	0.76	0.83	0.64	0.93	0.75	0.91	0.81	0.96
Adj. Flow (vph)	158	263	20	109	468	84	36	338	91	74	452	148
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	158	283	0	109	552	0	36	429	0	74	600	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	19.0	19.0		19.0	19.0		17.3	17.3		17.3	17.3	
Effective Green, g (s)	19.0	19.0		19.0	19.0		17.3	17.3		17.3	17.3	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.29	0.29		0.29	0.29	
Clearance Time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	175	583		334	557		124	589		256	568	
v/s Ratio Prot		0.15			c0.31			0.21			c0.30	
v/s Ratio Perm	0.28			0.10			0.08			0.08		
v/c Ratio	0.90	0.49		0.33	0.99		0.29	0.73		0.29	1.06	
Uniform Delay, d1	19.6	16.6		15.6	20.4		16.6	19.2		16.6	21.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.31	1.13	
Incremental Delay, d2	41.3	0.6		0.6	35.7		5.8	7.7		2.7	52.7	
Delay (s)	60.9	17.2		16.2	56.1		22.4	26.9		24.5	76.8	
Level of Service	E	B		B	E		C	C		C	E	
Approach Delay (s)		32.9			49.5			26.6			71.1	
Approach LOS		C			D			C			E	
Intersection Summary												
HCM 2000 Control Delay			48.0									D
HCM 2000 Volume to Capacity ratio			1.02									
Actuated Cycle Length (s)			60.0								23.7	
Intersection Capacity Utilization			105.1%									G
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Emmett St. W. & North Ave

02/21/2020



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	166	334	25	88	252	92	16	407	74	91	435	132
Future Volume (vph)	166	334	25	88	252	92	16	407	74	91	435	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	12	16	11	12	15	11
Total Lost time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.96		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1837		1711	1728		1770	2065		1770	1978	
Flt Permitted	0.51	1.00		0.46	1.00		0.21	1.00		0.26	1.00	
Satd. Flow (perm)	941	1837		827	1728		392	2065		493	1978	
Peak-hour factor, PHF	0.76	0.86	0.63	0.79	0.86	0.86	0.80	0.81	0.87	0.86	0.89	0.89
Adj. Flow (vph)	218	388	40	111	293	107	20	502	85	106	489	148
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	218	428	0	111	400	0	20	587	0	106	637	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	17.3	17.3		17.3	17.3		19.0	19.0		19.0	19.0	
Effective Green, g (s)	17.3	17.3		17.3	17.3		19.0	19.0		19.0	19.0	
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.32	0.32		0.32	0.32	
Clearance Time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	271	529		238	498		124	653		156	626	
v/s Ratio Prot		c0.23			0.23			0.28			c0.32	
v/s Ratio Perm	0.23			0.13			0.05			0.21		
v/c Ratio	0.80	0.81		0.47	0.80		0.16	0.90		0.68	1.02	
Uniform Delay, d1	19.8	19.8		17.6	19.8		14.8	19.6		17.8	20.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.18	1.12	
Incremental Delay, d2	15.8	8.9		1.4	9.1		2.8	17.7		20.7	39.9	
Delay (s)	35.5	28.7		19.0	28.9		17.5	37.2		41.9	62.8	
Level of Service	D	C		B	C		B	D		D	E	
Approach Delay (s)		31.0			26.7			36.6			59.8	
Approach LOS		C			C			D			E	





















Intersection Summary

HCM 2000 Control Delay	40.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	23.7
Intersection Capacity Utilization	106.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

6: Emmett St. W. & North Ave





















02/21/2020

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	118	202	10	78	365	72	24	322	70	69	376	146
Future Volume (vph)	118	202	10	78	365	72	24	322	70	69	376	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	12	16	11	12	15	11
Total Lost time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1843		1711	1759		1770	2044		1770	1973	
Flt Permitted	0.28	1.00		0.58	1.00		0.23	1.00		0.46	1.00	
Satd. Flow (perm)	515	1843		1050	1759		431	2044		860	1973	
Peak-hour factor, PHF	0.73	0.75	0.50	0.70	0.76	0.83	0.64	0.93	0.75	0.91	0.81	0.96
Adj. Flow (vph)	162	269	20	111	480	87	38	346	93	76	464	152
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	162	289	0	111	567	0	38	439	0	76	616	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	19.0	19.0		19.0	19.0		17.3	17.3		17.3	17.3	
Effective Green, g (s)	19.0	19.0		19.0	19.0		17.3	17.3		17.3	17.3	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.29	0.29		0.29	0.29	
Clearance Time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	163	583		332	557		124	589		247	568	
v/s Ratio Prot		0.16			c0.32			0.21			c0.31	
v/s Ratio Perm	0.31			0.11			0.09			0.09		
v/c Ratio	0.99	0.50		0.33	1.02		0.31	0.75		0.31	1.08	
Uniform Delay, d1	20.4	16.6		15.7	20.5		16.7	19.4		16.7	21.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.30	1.12	
Incremental Delay, d2	68.3	0.7		0.6	42.7		6.3	8.3		3.1	62.0	
Delay (s)	88.8	17.3		16.3	63.2		23.0	27.7		24.8	86.0	
Level of Service	F	B		B	E		C	C		C	F	
Approach Delay (s)		43.0			55.5			27.3			79.3	
Approach LOS		D			E			C			E	
Intersection Summary												
HCM 2000 Control Delay			54.4			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			1.05									
Actuated Cycle Length (s)			60.0			Sum of lost time (s)			23.7			
Intersection Capacity Utilization			106.6%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

6: Emmett St. W. & North Ave

02/21/2020

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	170	342	26	90	259	94	17	417	76	93	446	136
Future Volume (vph)	170	342	26	90	259	94	17	417	76	93	446	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	12	16	11	12	15	11
Total Lost time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.96		1.00	0.98		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1837		1711	1729		1770	2065		1770	1977	
Flt Permitted	0.49	1.00		0.44	1.00		0.21	1.00		0.24	1.00	
Satd. Flow (perm)	914	1837		799	1729		396	2065		446	1977	
Peak-hour factor, PHF	0.76	0.86	0.63	0.79	0.86	0.86	0.80	0.81	0.87	0.86	0.89	0.89
Adj. Flow (vph)	224	398	41	114	301	109	21	515	87	108	501	153
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	224	439	0	114	410	0	21	602	0	108	654	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	17.5	17.5		17.5	17.5		18.8	18.8		18.8	18.8	
Effective Green, g (s)	17.5	17.5		17.5	17.5		18.8	18.8		18.8	18.8	
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.31	0.31		0.31	0.31	
Clearance Time (s)	11.5	11.5		11.5	11.5		12.2	12.2		12.2	12.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	266	535		233	504		124	647		139	619	
v/s Ratio Prot		0.24			0.24			0.29			c0.33	
v/s Ratio Perm	c0.25			0.14			0.05			0.24		
v/c Ratio	0.84	0.82		0.49	0.81		0.17	0.93		0.78	1.06	
Uniform Delay, d1	20.0	19.8		17.6	19.7		14.9	20.0		18.7	20.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.17	1.11	
Incremental Delay, d2	20.8	9.8		1.6	9.7		2.9	21.9		33.0	51.5	
Delay (s)	40.7	29.6		19.2	29.5		17.9	41.9		54.8	74.5	
Level of Service	D	C		B	C		B	D		D	E	
Approach Delay (s)		33.3			27.2			41.1			71.7	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay			45.3				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			60.0				Sum of lost time (s)			23.7		
Intersection Capacity Utilization			108.3%				ICU Level of Service			G		
Analysis Period (min)			15									
c Critical Lane Group												

APPENDIX B

Rodel Roundabout Analysis

2020 AM / PM Peak Hour

2023 AM / PM Peak Hour

2030 AM / PM Peak Hour

2040 AM / PM Peak Hour

Operational Data

HCM Lanes and Headways

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	Emmett St (WB)	0.00	1.00	None	0	1.000	0.90
2	North Ave (SB)	0.00	1.00	None	0	1.000	0.90
3	Emmett St (EB)	0.00	1.00	None	0	1.000	0.90
4	North Ave (NB)	0.00	1.00	None	0	1.000	0.90

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	Emmett St (WB)	0	0.950	2.0	1.00
2	North Ave (SB)	0	0.950	2.0	1.00
3	Emmett St (EB)	0	0.950	2.0	1.00
4	North Ave (NB)	0	0.950	2.0	1.00

Traffic Flow Data (veh/hr)

2020 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers	
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor
1	Emmett St (WB)	0	61	334	57	0	2.0	1.00
2	North Ave (SB)	0	54	358	139	0	2.0	1.00
3	Emmett St (EB)	0	112	179	10	0	2.0	1.00
4	North Ave (NB)	0	23	306	52	0	2.0	1.00

Operational Results

HCM 2016 - 2020 AM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		452		440		813				0.556	
2	North Ave (SB)		551		418		832				0.662	
3	Emmett St (EB)		301		473		786				0.383	
4	North Ave (NB)		381		345		898				0.424	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		12.7		12.7		3.7				B	B
2	North Ave (SB)		16.0		16.0		5.6				C	C
3	Emmett St (EB)		9.3		9.3		1.8				A	A
4	North Ave (NB)		9.1		9.1		2.2				A	A

Operational Data

HCM Lanes and Headways

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	Emmett St (WB)	0.00	1.00	None	0	1.000	0.90
2	North Ave (SB)	0.00	1.00	None	0	1.000	0.90
3	Emmett St (EB)	0.00	1.00	None	0	1.000	0.90
4	North Ave (NB)	0.00	1.00	None	0	1.000	0.90

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	Emmett St (WB)	0	0.950	2.0	1.00
2	North Ave (SB)	0	0.950	2.0	1.00
3	Emmett St (EB)	0	0.950	2.0	1.00
4	North Ave (NB)	0	0.950	2.0	1.00

Traffic Flow Data (veh/hr)

2020 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers	
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor
1	Emmett St (WB)	0	77	238	82	0	2.0	1.00
2	North Ave (SB)	0	82	424	129	0	2.0	1.00
3	Emmett St (EB)	0	162	316	25	0	2.0	1.00
4	North Ave (NB)	0	16	397	62	0	2.0	1.00

Operational Results

HCM 2016 - 2020 PM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		397		575		707				0.562	
2	North Ave (SB)		635		331		910				0.697	
3	Emmett St (EB)		503		583		701				0.718	
4	North Ave (NB)		475		560		718				0.662	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		14.4		14.4		3.8				B	B
2	North Ave (SB)		16.4		16.4		6.6				C	C
3	Emmett St (EB)		21.5		21.5		7.1				C	C
4	North Ave (NB)		18.0		18.0		5.6				C	C

Operational Data

HCM Lanes and Headways

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	Emmett St (WB)	0.00	1.00	None	0	1.000	0.90
2	North Ave (SB)	0.00	1.00	None	0	1.000	0.90
3	Emmett St (EB)	0.00	1.00	None	0	1.000	0.90
4	North Ave (NB)	0.00	1.00	None	0	1.000	0.90

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	Emmett St (WB)	0	0.950	2.0	1.00
2	North Ave (SB)	0	0.950	2.0	1.00
3	Emmett St (EB)	0	0.950	2.0	1.00
4	North Ave (NB)	0	0.950	2.0	1.00

Traffic Flow Data (veh/hr)

2023 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers	
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor
1	Emmett St (WB)	0	75	350	69	0	2.0	1.00
2	North Ave (SB)	0	66	360	140	0	2.0	1.00
3	Emmett St (EB)	0	113	194	10	0	2.0	1.00
4	North Ave (NB)	0	23	309	67	0	2.0	1.00

Operational Results

HCM 2016 - 2023 AM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		494		444		810				0.610	
2	North Ave (SB)		566		448		806				0.702	
3	Emmett St (EB)		317		501		763				0.415	
4	North Ave (NB)		399		373		872				0.457	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		14.4		14.4		4.6				B	B
2	North Ave (SB)		18.3		18.3		6.7				C	C
3	Emmett St (EB)		10.1		10.1		2.1				B	B
4	North Ave (NB)		9.9		9.9		2.5				A	A

HCM 2016 - 2023 AM Peak 15 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		549		494		769				0.714	
2	North Ave (SB)		629		498		766				0.822	
3	Emmett St (EB)		352		557		720				0.489	
4	North Ave (NB)		443		415		835				0.531	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		19.1		19.1		6.1				C	C
2	North Ave (SB)		26.6		26.6		9.0				D	D
3	Emmett St (EB)		12.1		12.1		2.7				B	B
4	North Ave (NB)		11.7		11.7		3.2				B	B

Operational Data

HCM Lanes and Headways

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	Emmett St (WB)	0.00	1.00	None	0	1.000	0.90
2	North Ave (SB)	0.00	1.00	None	0	1.000	0.90
3	Emmett St (EB)	0.00	1.00	None	0	1.000	0.90
4	North Ave (NB)	0.00	1.00	None	0	1.000	0.90

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	Emmett St (WB)	0	0.950	2.0	1.00
2	North Ave (SB)	0	0.950	2.0	1.00
3	Emmett St (EB)	0	0.950	2.0	1.00
4	North Ave (NB)	0	0.950	2.0	1.00

Traffic Flow Data (veh/hr)

2023 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers	
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor
1	Emmett St (WB)	0	86	248	90	0	2.0	1.00
2	North Ave (SB)	0	89	427	130	0	2.0	1.00
3	Emmett St (EB)	0	163	328	25	0	2.0	1.00
4	North Ave (NB)	0	16	400	73	0	2.0	1.00

Operational Results

HCM 2016 - 2023 PM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		424		578		704				0.602	
2	North Ave (SB)		646		350		893				0.723	
3	Emmett St (EB)		516		603		686				0.752	
4	North Ave (NB)		489		580		703				0.696	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		15.8		15.8		4.4				C	C
2	North Ave (SB)		18.0		18.0		7.4				C	C
3	Emmett St (EB)		24.4		24.4		8.3				C	C
4	North Ave (NB)		20.1		20.1		6.5				C	C

HCM 2016 - 2023 PM Peak 15 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		471		643		658				0.716	
2	North Ave (SB)		718		388		858				0.837	
3	Emmett St (EB)		573		669		641				0.894	
4	North Ave (NB)		543		645		657				0.827	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		21.6		21.6		6.0				C	C
2	North Ave (SB)		25.8		25.8		9.8				D	D
3	Emmett St (EB)		39.4		39.4		11.0				E	E
4	North Ave (NB)		30.3		30.3		8.8				D	D

Operational Data

HCM Lanes and Headways

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	Emmett St (WB)	0.00	1.00	None	0	1.000	0.90
2	North Ave (SB)	0.00	1.00	None	0	1.000	0.90
3	Emmett St (EB)	0.00	1.00	None	0	1.000	0.90
4	North Ave (NB)	0.00	1.00	None	0	1.000	0.90

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	Emmett St (WB)	0	0.950	2.0	1.00
2	North Ave (SB)	0	0.950	2.0	1.00
3	Emmett St (EB)	0	0.950	2.0	1.00
4	North Ave (NB)	0	0.950	2.0	1.00

Traffic Flow Data (veh/hr)

2030 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers	
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor
1	Emmett St (WB)	0	76	356	70	0	2.0	1.00
2	North Ave (SB)	0	67	366	142	0	2.0	1.00
3	Emmett St (EB)	0	115	197	10	0	2.0	1.00
4	North Ave (NB)	0	23	314	68	0	2.0	1.00

Operational Results

HCM 2016 - 2030 AM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		502		451		804				0.624	
2	North Ave (SB)		575		455		801				0.718	
3	Emmett St (EB)		322		509		757				0.425	
4	North Ave (NB)		405		378		867				0.467	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		15.0		15.0		4.8				B	B
2	North Ave (SB)		19.3		19.3		7.2				C	C
3	Emmett St (EB)		10.4		10.4		2.2				B	B
4	North Ave (NB)		10.1		10.1		2.6				B	B

HCM 2016 - 2030 AM Peak 15 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		558		502		762				0.732	
2	North Ave (SB)		639		505		760				0.841	
3	Emmett St (EB)		358		566		714				0.502	
4	North Ave (NB)		450		421		830				0.542	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		20.1		20.1		6.5				C	C
2	North Ave (SB)		28.6		28.6		9.7				D	D
3	Emmett St (EB)		12.5		12.5		2.8				B	B
4	North Ave (NB)		12.1		12.1		3.3				B	B

Operational Data

HCM Lanes and Headways

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	Emmett St (WB)	0.00	1.00	None	0	1.000	0.90
2	North Ave (SB)	0.00	1.00	None	0	1.000	0.90
3	Emmett St (EB)	0.00	1.00	None	0	1.000	0.90
4	North Ave (NB)	0.00	1.00	None	0	1.000	0.90

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	Emmett St (WB)	0	0.950	2.0	1.00
2	North Ave (SB)	0	0.950	2.0	1.00
3	Emmett St (EB)	0	0.950	2.0	1.00
4	North Ave (NB)	0	0.950	2.0	1.00

Traffic Flow Data (veh/hr)

2030 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers	
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor
1	Emmett St (WB)	0	88	252	92	0	2.0	1.00
2	North Ave (SB)	0	91	435	132	0	2.0	1.00
3	Emmett St (EB)	0	166	334	25	0	2.0	1.00
4	North Ave (NB)	0	16	407	74	0	2.0	1.00

Operational Results

HCM 2016 - 2030 PM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		432		588		697				0.620	
2	North Ave (SB)		658		356		888				0.741	
3	Emmett St (EB)		525		615		678				0.774	
4	North Ave (NB)		497		591		695				0.715	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		16.6		16.6		4.7					C
2	North Ave (SB)		19.1		19.1		8.0					C
3	Emmett St (EB)		26.6		26.6		9.2					D
4	North Ave (NB)		21.5		21.5		7.0					C

HCM 2016 - 2030 PM Peak 15 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		480		654		651				0.737	
2	North Ave (SB)		731		396		851				0.859	
3	Emmett St (EB)		583		682		632				0.923	
4	North Ave (NB)		552		657		649				0.851	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		23.1		23.1		6.5				C	C
2	North Ave (SB)		28.2		28.2		10.7				D	D
3	Emmett St (EB)		44.5		44.5		12.0				E	E
4	North Ave (NB)		33.2		33.2		9.6				D	D

Operational Data

HCM Lanes and Headways

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	Emmett St (WB)	0.00	1.00	None	0	1.000	0.90
2	North Ave (SB)	0.00	1.00	None	0	1.000	0.90
3	Emmett St (EB)	0.00	1.00	None	0	1.000	0.90
4	North Ave (NB)	0.00	1.00	None	0	1.000	0.90

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	Emmett St (WB)	0	0.950	2.0	1.00
2	North Ave (SB)	0	0.950	2.0	1.00
3	Emmett St (EB)	0	0.950	2.0	1.00
4	North Ave (NB)	0	0.950	2.0	1.00

Traffic Flow Data (veh/hr)

2040 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers	
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor
1	Emmett St (WB)	0	78	365	72	0	2.0	1.00
2	North Ave (SB)	0	69	376	146	0	2.0	1.00
3	Emmett St (EB)	0	118	202	10	0	2.0	1.00
4	North Ave (NB)	0	24	322	70	0	2.0	1.00

Operational Results

HCM 2016 - 2040 AM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		515		463		794				0.648	
2	North Ave (SB)		591		467		791				0.747	
3	Emmett St (EB)		330		524		746				0.443	
4	North Ave (NB)		416		388		858				0.485	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		16.0		16.0		5.3					C
2	North Ave (SB)		21.4		21.4		8.2					C
3	Emmett St (EB)		10.9		10.9		2.4					B
4	North Ave (NB)		10.5		10.5		2.8					B

HCM 2016 - 2040 AM Peak 15 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		572		516		752				0.761	
2	North Ave (SB)		657		519		749				0.877	
3	Emmett St (EB)		367		580		703				0.522	
4	North Ave (NB)		462		432		820				0.564	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		22.1		22.1		7.2				C	C
2	North Ave (SB)		33.1		33.1		11.0				D	D
3	Emmett St (EB)		13.2		13.2		3.1				B	B
4	North Ave (NB)		12.7		12.7		3.6				B	B

Operational Data

HCM Lanes and Headways

HCM 2016 Default Headways (secs)

Lanes		Lane-1		Lane-2		Bypass Lane	
Entry	Circ	tf	tc	tf	tc	tf	tc
1	1			2.6087	4.9765	2.6087	4.9765
1	2			2.5352	4.3275	2.5352	4.3275
2	2	2.6667	4.6455	2.5352	4.3275		
2	1	2.5352	4.5435	2.5352	4.5435		

HCM 2016 Flow Profiles

Leg	Leg Names	Entry Lane Proportions		ByPass Capacity Modifiers (veh/hr)			Peak Hour Factor
		Left Lane	Right Lane	Bypass Type	Capacity + or -	Crosswalk Factor	
1	Emmett St (WB)	0.00	1.00	None	0	1.000	0.90
2	North Ave (SB)	0.00	1.00	None	0	1.000	0.90
3	Emmett St (EB)	0.00	1.00	None	0	1.000	0.90
4	North Ave (NB)	0.00	1.00	None	0	1.000	0.90

HCM 2016 Capacity and Volume Modifiers

Leg	Leg Names	Capacity Modifiers (veh/hr)		Volume Modifiers	
		Capacity + or -	Crosswalk Factor	Trucks %	Flow Factor
1	Emmett St (WB)	0	0.950	2.0	1.00
2	North Ave (SB)	0	0.950	2.0	1.00
3	Emmett St (EB)	0	0.950	2.0	1.00
4	North Ave (NB)	0	0.950	2.0	1.00

Traffic Flow Data (veh/hr)

2040 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers	
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor
1	Emmett St (WB)	0	90	259	94	0	2.0	1.00
2	North Ave (SB)	0	93	446	136	0	2.0	1.00
3	Emmett St (EB)	0	170	342	26	0	2.0	1.00
4	North Ave (NB)	0	17	417	76	0	2.0	1.00

Operational Results

HCM 2016 - 2040 PM Peak 60 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		443		603		686				0.645	
2	North Ave (SB)		675		366		879				0.768	
3	Emmett St (EB)		538		629		668				0.806	
4	North Ave (NB)		510		605		685				0.745	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		17.9		17.9		5.2				C	C
2	North Ave (SB)		21.1		21.1		9.1				C	C
3	Emmett St (EB)		30.5		30.5		10.7				D	D
4	North Ave (NB)		23.8		23.8		8.0				C	C

HCM 2016 - 2040 PM Peak 15 minutes

Flows and Capacity

Leg	Leg Names	Flows (veh/hr)					Capacity (veh/hr)					
		Arrival Flow			Opposing Flow		Capacity			Average VCR		
		Left	Right	Bypass	Entry	Bypass	Left	Right	Bypass	Left	Right	Bypass
1	Emmett St (WB)		492		672		639				0.770	
2	North Ave (SB)		750		407		842				0.891	
3	Emmett St (EB)		598		698		622				0.962	
4	North Ave (NB)		567		673		638				0.888	

Delays, Queues and Level of Service

Leg	Leg Names	Average Delay (sec)				95% Queue (veh)			Level of Service			
		Left	Right	Bypass	Leg	Left	Right	Bypass	Left	Right	Bypass	Leg
1	Emmett St (WB)		25.8		25.8		7.2				D	D
2	North Ave (SB)		32.3		32.3		12.0				D	D
3	Emmett St (EB)		52.8		52.8		13.6				F	F
4	North Ave (NB)		38.6		38.6		10.8				E	E

OHM Advisors

34000 Plymouth Road
Livonia, MI 48150

Advancing Communities

TMC @ Intersection of Emmett & North
City of Battle Creek

File Name : TMC006
Site Code : 00000000
Start Date : 12/6/2016
Page No : 1

Groups Printed- Class 1

Start Time	North Ave Southbound				Emmett St Westbound				North Ave Northbound				Emmett St Eastbound				Int. Total
	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	
06:00 AM	14	18	4	36	1	31	2	34	4	17	0	21	1	7	4	12	103
06:15 AM	18	18	2	38	9	40	5	54	2	21	0	23	1	10	8	19	134
06:30 AM	35	44	10	89	11	52	3	66	1	25	5	31	3	12	13	28	214
06:45 AM	34	40	6	80	11	72	8	91	7	36	3	46	4	30	28	62	279
Total	101	120	22	243	32	195	18	245	14	99	8	121	9	59	53	121	730
07:00 AM	30	50	3	83	11	68	5	84	7	39	2	48	1	34	19	54	269
07:15 AM	36	76	9	121	9	72	9	90	10	62	3	75	3	33	38	74	360
07:30 AM	36	92	10	138	12	83	7	102	5	78	4	87	2	54	22	78	405
07:45 AM	31	109	11	151	13	104	13	130	12	82	9	103	0	38	21	59	443
Total	133	327	33	493	45	327	34	406	34	261	18	313	6	159	100	265	1477
08:00 AM	35	78	10	123	9	57	16	82	9	82	7	98	5	37	30	72	375
08:15 AM	30	80	7	117	8	52	11	71	17	66	2	85	3	35	26	64	337
08:30 AM	33	79	8	120	15	56	12	83	5	69	7	81	4	38	24	66	350
08:45 AM	18	76	8	102	12	41	13	66	14	67	7	88	4	39	22	65	321
Total	116	313	33	462	44	206	52	302	45	284	23	352	16	149	102	267	1383
*** BREAK ***																	
11:00 AM	31	71	11	113	12	34	13	59	15	91	4	110	4	43	35	82	364
11:15 AM	33	97	12	142	25	33	16	74	8	94	4	106	6	36	39	81	403
11:30 AM	26	78	11	115	17	37	7	61	9	92	4	105	6	40	34	80	361
11:45 AM	27	110	12	149	14	47	9	70	15	67	2	84	3	55	32	90	393
Total	117	356	46	519	68	151	45	264	47	344	14	405	19	174	140	333	1521
12:00 PM	27	95	22	144	18	59	15	92	17	79	2	98	7	40	26	73	407
12:15 PM	40	109	20	169	22	54	16	92	13	65	5	83	4	29	32	65	409
12:30 PM	23	80	18	121	19	48	10	77	13	92	4	109	3	46	41	90	397
12:45 PM	31	121	15	167	16	45	18	79	21	93	7	121	5	46	32	83	450
Total	121	405	75	601	75	206	59	340	64	329	18	411	19	161	131	311	1663
*** BREAK ***																	
02:00 PM	22	95	11	128	22	51	17	90	16	74	4	94	2	32	22	56	368
02:15 PM	26	99	5	130	25	55	14	94	19	78	5	102	2	42	32	76	402
02:30 PM	43	102	16	161	24	60	17	101	14	84	6	104	10	62	33	105	471
02:45 PM	34	111	21	166	18	70	17	105	14	89	5	108	8	58	31	97	476
Total	125	407	53	585	89	236	65	390	63	325	20	408	22	194	118	334	1717
03:00 PM	35	97	18	150	16	49	15	80	14	122	4	140	3	71	53	127	497
03:15 PM	36	99	21	156	21	56	21	98	15	96	4	115	5	66	41	112	481
03:30 PM	31	107	17	155	19	55	16	90	8	73	5	86	10	88	39	137	468
03:45 PM	26	118	16	160	16	66	14	96	15	103	3	121	7	79	28	114	491
Total	128	421	72	621	72	226	66	364	52	394	16	462	25	304	161	490	1937
04:00 PM	29	100	17	146	25	45	20	90	13	82	7	102	9	76	28	113	451
04:15 PM	28	100	13	141	17	66	16	99	15	95	4	114	7	80	29	116	470
04:30 PM	32	79	17	128	19	44	12	75	14	117	5	136	9	88	45	142	481
04:45 PM	25	83	20	128	20	44	15	79	14	98	1	113	5	62	35	102	422
Total	114	362	67	543	81	199	63	343	56	392	17	465	30	306	137	473	1824
05:00 PM	18	98	19	135	19	44	15	78	14	120	1	135	6	99	52	157	505
05:15 PM	25	81	25	131	18	41	12	71	8	108	3	119	9	87	38	134	455
05:30 PM	16	79	26	121	13	44	9	66	12	86	4	102	6	64	35	105	394
05:45 PM	19	81	11	111	13	34	9	56	15	92	1	108	4	48	32	84	359
Total	78	339	81	498	63	163	45	271	49	406	9	464	25	298	157	480	1713
Grand Total	1033	3050	482	4565	569	1909	447	2925	424	2834	143	3401	171	1804	1099	3074	13965
Apprch %	22.6	66.8	10.6		19.5	65.3	15.3		12.5	83.3	4.2		5.6	58.7	35.8		
Total %	7.4	21.8	3.5	32.7	4.1	13.7	3.2	20.9	3	20.3	1	24.4	1.2	12.9	7.9	22	

OHM Advisors

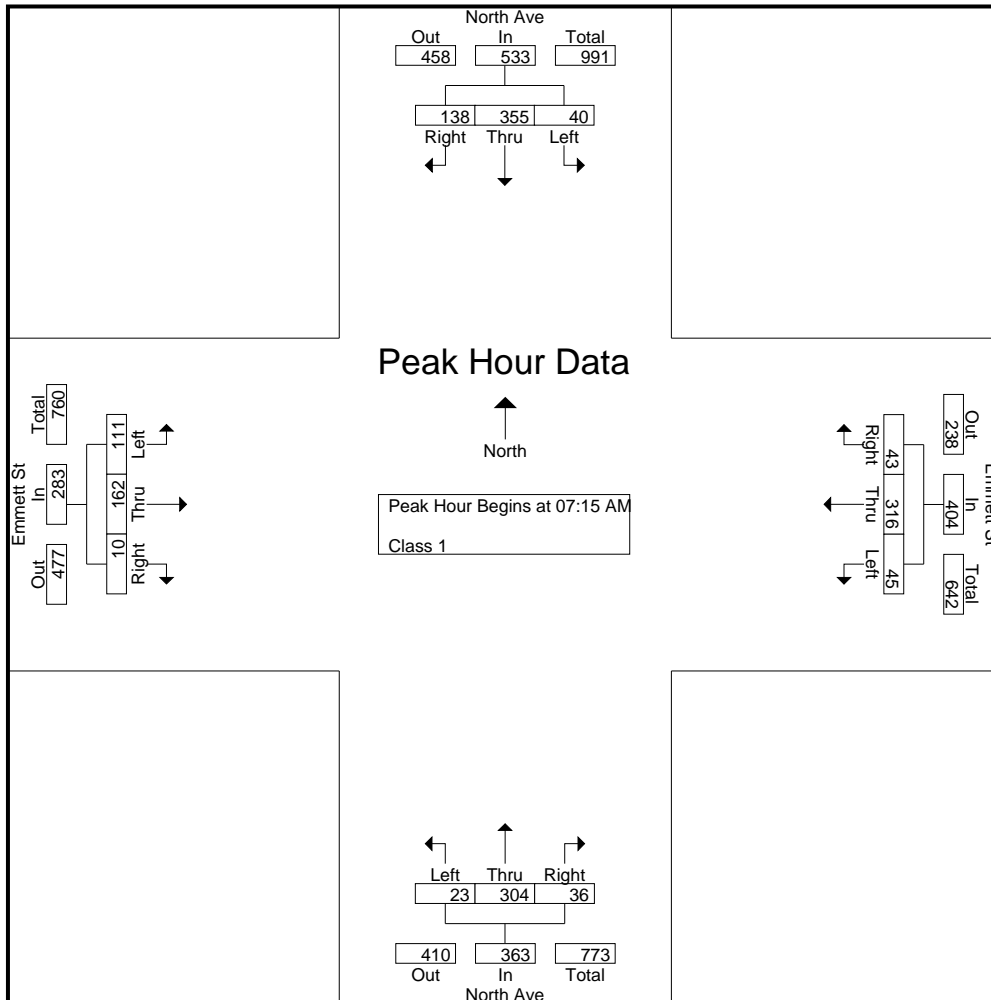
34000 Plymouth Road
Livonia, MI 48150

Advancing Communities

TMC @ Intersection of Emmett & North
City of Battle Creek

File Name : TMC006
Site Code : 00000000
Start Date : 12/6/2016
Page No : 3

Start Time	North Ave Southbound				Emmett St Westbound				North Ave Northbound				Emmett St Eastbound				Int. Total
	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	36	76	9	121	9	72	9	90	10	62	3	75	3	33	38	74	360
07:30 AM	36	92	10	138	12	83	7	102	5	78	4	87	2	54	22	78	405
07:45 AM	31	109	11	151	13	104	13	130	12	82	9	103	0	38	21	59	443
08:00 AM	35	78	10	123	9	57	16	82	9	82	7	98	5	37	30	72	375
Total Volume	138	355	40	533	43	316	45	404	36	304	23	363	10	162	111	283	1583
% App. Total	25.9	66.6	7.5		10.6	78.2	11.1		9.9	83.7	6.3		3.5	57.2	39.2		
PHF	.958	.814	.909	.882	.827	.760	.703	.777	.750	.927	.639	.881	.500	.750	.730	.907	.893



OHM Advisors

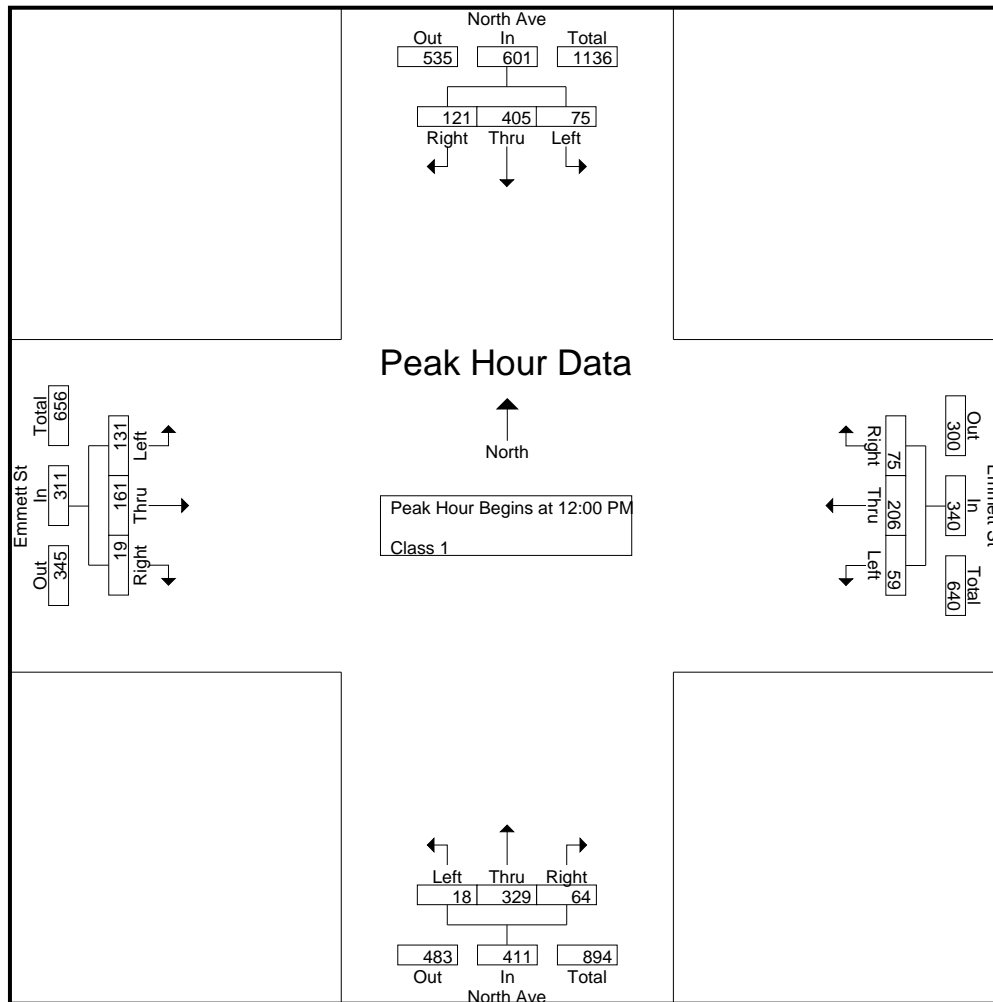
34000 Plymouth Road
Livonia, MI 48150

Advancing Communities

TMC @ Intersection of Emmett & North
City of Battle Creek

File Name : TMC006
Site Code : 00000000
Start Date : 12/6/2016
Page No : 4

Start Time	North Ave Southbound				Emmett St Westbound				North Ave Northbound				Emmett St Eastbound				Int. Total
	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 12:00 PM																	
12:00 PM	27	95	22	144	18	59	15	92	17	79	2	98	7	40	26	73	407
12:15 PM	40	109	20	169	22	54	16	92	13	65	5	83	4	29	32	65	409
12:30 PM	23	80	18	121	19	48	10	77	13	92	4	109	3	46	41	90	397
12:45 PM	31	121	15	167	16	45	18	79	21	93	7	121	5	46	32	83	450
Total Volume	121	405	75	601	75	206	59	340	64	329	18	411	19	161	131	311	1663
% App. Total	20.1	67.4	12.5		22.1	60.6	17.4		15.6	80	4.4		6.1	51.8	42.1		
PHF	.756	.837	.852	.889	.852	.873	.819	.924	.762	.884	.643	.849	.679	.875	.799	.864	.924



OHM Advisors

34000 Plymouth Road
Livonia, MI 48150

Advancing Communities

TMC @ Intersection of Emmett & North
City of Battle Creek

File Name : TMC006
Site Code : 00000000
Start Date : 12/6/2016
Page No : 5

Start Time	North Ave Southbound				Emmett St Westbound				North Ave Northbound				Emmett St Eastbound				Int. Total
	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:00 PM																	
03:00 PM	35	97	18	150	16	49	15	80	14	122	4	140	3	71	53	127	497
03:15 PM	36	99	21	156	21	56	21	98	15	96	4	115	5	66	41	112	481
03:30 PM	31	107	17	155	19	55	16	90	8	73	5	86	10	88	39	137	468
03:45 PM	26	118	16	160	16	66	14	96	15	103	3	121	7	79	28	114	491
Total Volume	128	421	72	621	72	226	66	364	52	394	16	462	25	304	161	490	1937
% App. Total	20.6	67.8	11.6		19.8	62.1	18.1		11.3	85.3	3.5		5.1	62	32.9		
PHF	.889	.892	.857	.970	.857	.856	.786	.929	.867	.807	.800	.825	.625	.864	.759	.894	.974

