

MEMO

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To: Brad Brickel
Nowak & Fraus Engineers

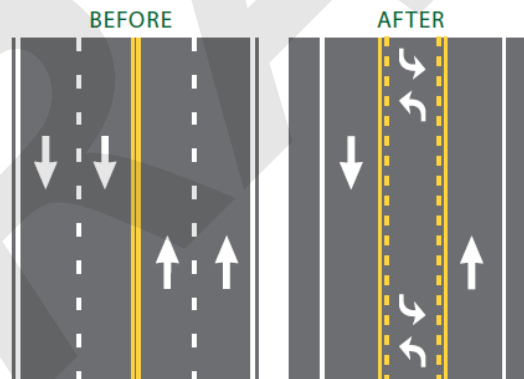
From: Julie M. Kroll, PE, PTOE
Paul Bonner, EIT
Fleis & VandenBrink

Date: May 28, 2024

Re: Road Diet Corridor Study, 11 Mile Road
Madison Heights, Michigan
Traffic Engineering Study

1 INTRODUCTION

This memorandum presents the results of the Road Diet Traffic Study for the 11 Mile Road corridor through the City of Madison Heights, Michigan. The City is evaluating the possibility of a road diet through the City limits, from NB Stephenson Highway to Dequindre Road, to change the existing 4-Lane sections to 3-Lane sections, thereby providing a “road diet” through the corridor. The potential road diet will provide a three-lane cross-section, with one (1) lane in each direction and a center two-way left-turn lane (TWLTL).



The primary goal of the proposed road diet is improved safety and reduce traffic crashes along the corridor. The project limits are shown on the attached **Figure 1** and additional roadway information is summarized in **Table 1**.

Table 1: Existing Roadway Information (11-Mile Road)

11 Mile Road (NB Stephenson Highway to Dequindre Road)	
Lane	4-lanes (2 lanes in each direction)
Average Daily Traffic (2023)	13,360 vpd
Functional Classification	Minor Arterial
Posted Speed Limit	35 mph

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This study has been completed to examine the traffic operations and capacity, safety, and geometric needs of the corridor, including the following study intersections on 11 Mile Road:

1. Dequindre Road
2. Hales Street
3. Lorenz Street
4. John R Road
5. Hampden Street
6. NB Stephenson Highway

The study includes the evaluation of the existing intersection operations and recommendations, including safety improvements, signal timing optimization along 11 Mile Road, geometric improvements, and other measures that would be effective in improving the operations along the roadway corridor.

This evaluation included the following analyses:

Existing Conditions (2024)	Road Diet Opening Day (2024)	Road Diet Horizon Year (2044)
• Existing Traffic Volumes • 4-Lanes Undivided • Existing Geometry	• Existing Traffic Volumes • 3-Lanes (Center TWLTL) • Proposed Geometry	• Horizon Year Traffic Volumes • 3-Lanes (Center TWLTL) • Proposed Geometry

The purpose of this analysis is to determine the feasibility of a road diet for this study corridor and to determine what improvements, if any, are recommended to accommodate such a road diet. The scope of this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practices and information published by the Institute of Transportation Engineers (ITE). The study analyses were completed using Synchro/SimTraffic (Version 11). Sources of data for this study include F&V subconsultant Quality Counts, LLC (QC), Michigan Department of Transportation (MDOT), Road Commission for Oakland County (RCOC), Monroe County Road Commission (MCRC), and ITE.

2 DATA COLLECTION

The existing weekday turning movement traffic volume data was collected by F&V subconsultant Quality Counts, LLC (QC) on Wednesday, April 24, 2024. Intersection Turning Movement Counts (TMC) were collected during the weekday AM (7:00 AM to 9:00 AM), MD (11:00 AM to 1:00 PM), School PM (2:00 PM to 4:00 PM), and PM (4:00 PM to 6:00 PM) peak periods at all study intersections. The data collection included Peak Hour Factors (PHFs), pedestrian volumes, and commercial trucks percentages which were used in the analysis in accordance with MDOT Electronic Traffic Control Devices guidelines. The peak hours at each intersection were utilized and through volumes were carried along the main study roadways and were balanced upwards through the study roadway network in accordance with MDOT guidelines. Additionally, at locations where access is provided between study intersections, "dummy node" intersections were used in the traffic modeling to account for sink and source volumes. Therefore, the traffic volumes utilized in the analysis and shown on the attached traffic volume figures may not match the raw traffic volumes shown in the data collection.

F&V collected an inventory of existing lane use and traffic controls, as shown on the attached **Figure 2**. Additionally, F&V obtained the current signal timing permits for the signalized study intersections from RCOC and MCRC. The existing 2024 peak hour traffic volumes used in the analysis are shown on the attached **Figure 3**. All applicable background data referenced in this memorandum is attached.

3 EXISTING (2024) CONDITIONS ANALYSIS

The existing AM, MD, School PM, and PM peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersections using Synchro (Version 11) traffic analysis software. This analysis was performed based on the existing peak hour traffic volumes shown on the attached **Figure 3**, the existing lane use and traffic control shown on the attached **Figure 2**, and methodologies presented in the *Highway Capacity Manual 6th Edition* (HCM6). *Note: The NB Stephenson Highway & 11 Mile Road intersection has a northbound shared through/left-turn lane, which is not supported by the HCM6 methodology; therefore, the HCM 2000 methodology was determined to be more appropriate for use at this study intersection.*

All of the signalized study intersections (with the exception of 11 Mile Road & NB Stephenson Highway and 11 Mile Road & Dequindre Road), operate on RCOC's Sydney Coordinated Adaptive Traffic System (SCATS). Therefore, the baseline timings were input, and the signal timings were optimized for each scenario studied at each of these SCATS intersections, in order to reflect the real time optimizations that are occurring to accommodate the actual traffic volumes observed by the approach lane detectors.

Descriptions of LOS "A" through "F", as defined in the HCM6, are attached. Typically, LOS D is considered acceptable, with LOS A representing minimal delay and LOS F indicating failing conditions. Additionally, SimTraffic network simulations were reviewed to evaluate network operations and vehicles queues. The results of the existing conditions analysis are attached and summarized in **Table 2**.

The results of the existing conditions analysis indicates that all approaches and movements at the study intersections are currently operating acceptably, at LOS D or better during the AM, MD, School PM, and PM peak periods with the following exceptions:

Dequindre Road & 11 Mile Road

- Several intersection approaches and movements currently operate a LOS E or F during the peak periods.
- Review of the operations shows that the signal currently operates with a 180 second cycle length. Therefore, it is not unreasonable for vehicles to experience high delays. Review of SimTraffic network simulations indicates that the majority of vehicle queue were observed to be serviced within each cycle length throughout the study corridor.

Table 2: Existing Geometry (4-Lanes) Intersection Operations

11 Mile Road Intersection		Control	Approach	Existing Conditions (2024)							
				AM Peak		MD Peak		School PM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Dequindre Road	Signalized	EBL	136.4	F	69.7	E	151.2	F	133.0	F
			EBTR	87.0	F	47.9	D	84.4	F	85.2	F
			WBL	59.7	E	35.9	D	68.1	E	72.0	E
			WBT	85.4	F	36.2	D	97.5	F	81.9	F
			WBTR	112.3	F	55.0	D	100.2	F	93.3	F
			NBL	42.3	D	25.8	C	50.5	D	51.9	D
			NBTR	81.1	F	48.5	D	71.6	E	71.5	E
			SBL	49.5	D	29.9	C	62.7	E	57.9	E
			SBT	71.5	E	41.6	D	66.7	E	62.9	E
			SBR	46.2	D	27.6	C	41.0	D	34.6	C
			Overall	80.0	E	44.6	D	77.5	E	73.6	E
2	Hales Street	Signalized	EBTL	0.3	A	1.4	A	12.2	B	2.0	A
			EBTR	0.3	A	1.5	A	12.7	B	2.1	A
			WBTL	3.0	A	1.4	A	3.8	A	1.7	A
			WBTR	3.0	A	1.4	A	3.9	A	1.8	A
			NB	33.5	C	38.4	D	32.3	C	37.6	D
			SB	36.8	D	38.4	D	36.4	D	38.6	D
			Overall	5.2	A	2.8	A	10.3	B	3.1	A
3	Lorenz Street	Signalized	EBTL	0.2	A	0.2	A	0.4	A	0.4	A
			EBTR	0.3	A	0.2	A	0.4	A	0.5	A
			WBTL	12.9	B	0.2	A	0.6	A	0.4	A
			WBTR	13.0	B	0.2	A	0.7	A	0.5	A
			NB	31.2	C	37.1	D	31.9	C	35.1	D
			SB	35.6	D	38.6	D	36.1	D	37.5	D
			Overall	12.4	B	3.6	A	4.3	A	3.6	A

11 Mile Road Intersection		Control	Approach	Existing Conditions (2024)							
				AM Peak		MD Peak		School PM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
4	John R Road	Signalized	EBL	38.6	D	36.1	D	42.6	D	37.3	D
			EBT	36.6	D	34.8	C	34.1	C	43.0	D
			EBTR	37.3	D	35.2	D	34.7	C	44.1	D
			WBL	33.0	C	33.5	C	32.4	C	36.4	D
			WBT	39.4	D	40.1	D	46.4	D	43.6	D
			WBTR	40.1	D	41.3	D	46.7	D	44.9	D
			NBL	20.8	C	15.3	B	29.2	C	23.8	C
			NBT	29.1	C	24.0	C	31.6	C	26.3	C
			NBR	24.1	C	20.6	C	24.2	C	21.3	C
			SBL	21.0	C	17.4	B	30.2	C	27.9	C
			SBT	26.6	C	23.1	C	30.3	C	25.9	C
			SBR	26.5	C	22.6	C	26.2	C	23.1	C
			Overall	31.6	C	27.6	C	35.4	D	32.9	C
5	Hampden Street	Signalized	EBTL	0.2	A	0.2	A	0.3	A	0.5	A
			EBTR	0.2	A	0.2	A	0.4	A	0.5	A
			WBTL	2.6	A	2.4	A	3.1	A	2.6	A
			WBTR	2.7	A	2.4	A	3.1	A	2.7	A
			NB	44.2	D	38.3	D	39.1	D	38.6	D
			SB	43.4	D	38.3	D	38.8	D	38.5	D
			Overall	4.1	A	3.6	A	4.0	A	3.0	A
6	NB Stephenson Highway	Signalized	EBL	18.5	B	3.7	A	15.6	B	7.2	A
			EBT	8.4	A	2.1	A	10.8	B	3.0	A
			WBT	13.2	B	8.2	A	11.6	B	12.0	B
			WBR	14.5	B	8.4	A	13.7	B	12.4	B
			NBL	36.3	D	37.7	D	35.9	D	34.9	C
			NBTL	38.8	D	36.9	D	34.7	C	33.8	C
			NBR	35.5	D	37.2	D	34.0	C	34.3	C
			Overall	21.9	C	14.9	B	18.7	B	15.2	B

4 ROAD DIET (3-LANES)

4.1 OPENING DAY ANALYSIS (2024)

The proposed road diet configuration (3-lanes) was evaluated along the 11 Mile Road corridor, based on the proposed lane use and traffic control shown on the attached **Figure 4**, existing (2024) peak hour traffic volumes shown on the attached **Figure 3**, and methodologies presented in the HCM. The road diet intersection operations analysis results are attached and summarized in the attached **Table 3**. The results of the road diet evaluation indicate that, with the implementation of the proposed three-lane road-diet, all study intersection approaches and movements will continue to operate in a manner similar to the existing conditions analysis, with additional impacts for LOS for the following location:

Dequindre Road & 11 Mile Road

- During the MD peak hour: The westbound right-turn lane is expected to operate at LOS E.
- Review of SimTraffic network simulations indicates the westbound right-turn movement operates acceptably during the MD peak hour, the majority of vehicle queues were observed to be serviced within each cycle length.

Review of SimTraffic network simulations indicates generally acceptable operations throughout the study roadway network. Vehicle queues were observed to be serviced within each cycle length with minimal residual vehicle queueing. However, the westbound through movement at the intersection of Dequindre Road & 11 Mile

Road was observed to experience periods of long vehicle queues during the School PM peak period. However, these queues were observed to dissipate throughout the School PM peak period.

A corridor travel time evaluation was completed utilizing SimTraffic network simulations to calculate the existing network travel time and the projected travel time with the proposed road diet. The results of this comparison show negligible change in travel time for the peak periods, with the highest increase occurring for the westbound traffic during the School PM peak which is anticipate to increase by approximately three (3) minutes. The travel time summary for each peak period is attached and summarized in **Table 4**.

Table 3: Road Diet Geometry (3-Lanes) Travel Time – Opening Day (2024)

Peak Period	Existing Conditions (2024)		Road Diet Opening Day (2024)		Difference	
	EB (minutes)	WB (minutes)	EB (minutes)	WB (minutes)	EB (minutes)	WB (minutes)
AM Peak	4.36	5.06	4.54	5.35	0.18	0.29
MD Peak	3.85	4.44	3.92	4.63	0.07	0.19
School PM Peak	4.64	5.16	4.74	8.19	0.10	3.04
PM Peak	4.39	5.13	4.47	5.59	0.08	0.46

4.2 HORIZON YEAR ANALYSIS (2044)

Historical population and economic profile data was obtained for the City of Madison Heights from the Southeast Michigan Council of Governments (SEMCOG) database, in order to calculate a background growth rate to project the existing 2024 peak hour traffic volumes to the horizon year of 2044. Population and employment projections from 2020 to 2050 were reviewed and show an average annual growth rate of 0.15% and 0.32%, respectively. Therefore, a conservative background growth rate of **0.5%** per year was applied to the existing peak hour traffic volumes to forecast the horizon year 2044 peak hour traffic volumes, as shown on the attached **Figure 5**.

The Horizon Year (2044) conditions analysis was evaluated based on the recommended lane use and traffic control shown on the attached **Figure 4**, peak hour traffic volumes shown on the attached **Figure 5**, and methodologies presented in the HCM. The Horizon Year (2024) intersection operations analysis results are attached and summarized in the attached **Table 5**. The results of the Horizon Year (2044) road diet evaluation indicate that all study intersection approaches and movements will continue to operate in a manner similar to the Opening Day (2024) conditions analysis, with following additional impacts to LOS:

Dequindre Road & 11 Mile Road

- During the AM peak hour: The southbound left-turn movement is expected to operate at LOS E.
- During the School PM peak hour: The northbound left-turn movement is expected to operate at LOS E.

Review of SimTraffic network simulations indicate long periods of vehicle queues for the southbound left-turn and westbound through movements during the AM, School PM, and PM peak periods. These queues were observed to be present throughout the School PM peak hour. The 95th percentile queue length for the southbound left-turn and westbound through movements were observed to be the highest during the AM peak hour, at 880 feet, and the School PM peak hour, at 1,650 feet, respectively. This intersection is under the jurisdiction of Macomb County Department of Road (MCDR) and currently operates with a 180 second cycle length. Preliminary analysis indicates that queues would be reduced by optimizing the cycle length to 120 seconds.

John R Road & 11 Mile Road

- During the School PM peak hour: The northbound and southbound through movements are expected to operate at LOS F and the overall intersection is expected to operate at LOS E.

Review of SimTraffic network simulations indicated periods of long vehicle queues during the School PM peak period for the northbound and southbound approaches. However, these queues were observed to dissipate and were not present throughout the entire peak hour.

A corridor travel time evaluation was completed utilizing SimTraffic network simulations to calculate the projected Opening Day (2024) network travel time and the projected Horizon Year (2044) travel time with the proposed road diet. The results of this comparison show negligible change in travel time for the peak periods, with the highest increase occurring for the westbound traffic during the School PM peak which is anticipate to increase by approximately four (4) minutes. The travel time summary for each peak period is attached and summarized in **Table 6**.

Table 4: Road Diet Geometry (3-Lanes) Travel Time – Horizon Year (2044)

Peak Period	Road Diet Opening Day (2024)		Road Diet Horizon Year (2044)		Difference	
	EB (minutes)	WB (minutes)	EB (minutes)	WB (minutes)	EB (minutes)	WB (minutes)
AM Peak	4.54	5.35	4.44	5.98	-0.10	0.63
MD Peak	3.92	4.63	3.95	4.73	0.04	0.10
School PM Peak	4.74	8.19	4.76	11.91	0.02	3.71
PM Peak	4.47	5.59	4.77	5.78	18.1	0.20

Note: Decreased travel times result from SCATS optimizations, improved progression, and HCM methodologies.

5 SAFETY STUDY

5.1 CRASH ANALYSIS

A crash analysis was conducted at the study intersections and roadway segments along the 11 Mile Road corridor. F&V obtained the crash data used in the analysis from the Michigan Traffic Crash Facts (MTCF) historical crash database for the most recent **five years** (January 1, 2018 to December 31, 2022) of available data. There were a total of 289 crashes reported along the study corridor in the past five years. There were 86 crashes with injuries, include four (4) "Type A" injury crashes; however, there were no fatalities.

The general crash type along the corridor is Angle (43%), Rear-End – Straight (27%), and Sideswipe – Same Direction (11%) crashes. The majority of crashes at the signalized intersections and angle and rear-end crashes, which is typical of signalized intersections. Review of the UD-10 reports for these intersections indicate that the crashes were distributed equally from all directions of travel, suggesting that a directional crash pattern was not present. All crashes included in this analysis are summarized in **Chart 1**. The individual intersection and segment crash types along the 11 Mile Road corridor are summarized in **Table 7**. Review of the summary data indicate that the majority of crashes occurred at the 11 Mile Road intersections with NB Stephenson Highway and Dequindre Road and along the roadway segments between Hampden Street and John R Road, John R Road and Lorenz Street, and Lorenz Street and Dequindre Road.

Chart 1: Percentage of Crashes by Type

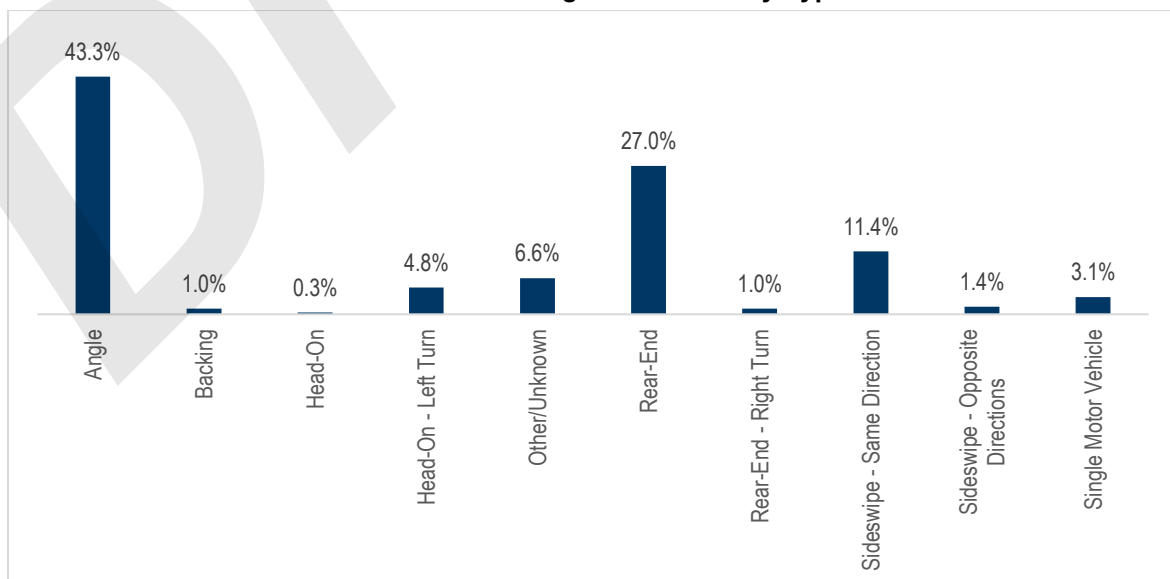


Table 5: Intersection and Segment Crash Summary by Crash Type

11 Mile Road – Road Location		Angle	Backing	Head-On	Head-On Left-Turn	Other/Unknown	Rear-End (Straight)	Rear-End Right-Turn	Sideswipe – Opposite	Sideswipe - Same	Single Motor Vehicle	Total	Percentage
NB Stephenson Hwy	Intersection	22	0	0	4	4	4	0	1	2	1	38	13%
NB Stephenson Hwy – Hampden Street	Segment	13	0	0	0	0	6	0	0	6	0	25	9%
Hampden Street	Intersection	1	0	0	0	1	1	0	0	0	0	3	1%
Hampden Street – John R Road	Segment	14	1	0	1	3	19	1	0	5	6	50	17%
John R Road	Intersection	13	0	0	1	3	4	0	1	4	0	26	9%
John R Road – Lorenz Street	Segment	17	0	1	1	3	16	1	0	6	0	45	16%
Lorenz Street	Intersection	7	0	0	0	1	1	0	0	0	0	9	3%
Lorenz Street – Hales Street	Segment	10	0	0	1	1	7	0	0	1	0	20	7%
Hales Street	Intersection	3	0	0	0	0	0	0	0	0	0	3	1%
Hales Street – Dequindre Road	Segment	9	1	0	1	1	13	0	1	7	2	35	12%
Dequindre Road	Intersection	16	1	0	5	2	7	1	1	2	0	35	12%
Total		125	3	1	14	19	78	3	4	33	9	289	100%

Table 6: Road Conditions Summary

Road Conditions		
Condition	Number of Crashes	%
Dry	217	75%
Other/Unknown	2	0%
Wet	53	18%
Snowy/Icy/Slush	17	6%
Total	289	100%

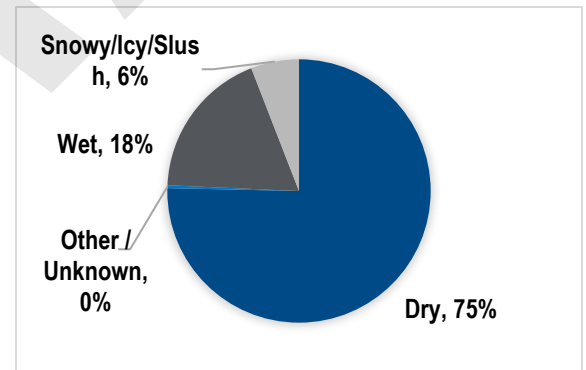


Table 7: Light Conditions Summary

Light Conditions		
Condition	Number of Crashes	%
Dark-Lighted	52	18%
Dark-Unlighted	1	0%
Dusk	4	1%
Dawn	3	1%
Daylight	229	79%
Total	289	100%

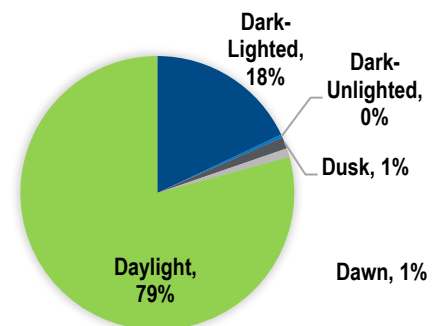
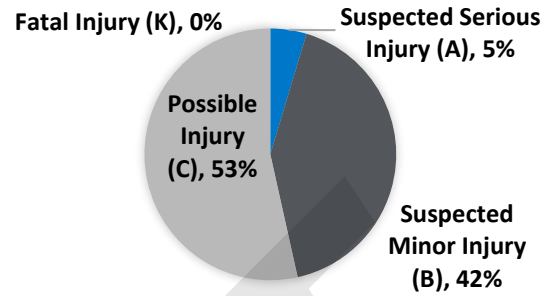


Table8: Crashes with Injury

Worst Injury in Crash		
Severity	Crashes with Injury	% of Injuries
Fatalities	0	0%
"A" Injuries	4	5%
"B" Injuries	36	42%
"C" Injuries	46	53%
Total	86	100%



The SEMCOG Crash Analysis Process *Regional Critical Intersection Crash Rates, Frequencies and Casualty Ratios: By Presence or Absence of Signalization* was used to compare the actual crash rates and frequencies to the regional rates for similar intersection operations. The study area included in this analysis is located within the SEMCOG region. Therefore, the data provided by SEMCOG provides an applicable comparison to the crash rates experienced within the study area. The results of the analysis are summarized in **Table 11**.

Table 9: Study Network Intersection Crash Comparison

Intersection		Average ADT (Entering Volume vpd)	Total (5 years)	Crash Frequency (crashes/year)			Crash Rate (crashes per MV)		
				Intersection Annual Crash Frequency	SEMCOG Average Annual Crash Frequency	Difference	Intersection Crash Rate	SEMCOG Average Crash Rate	Difference
1	11 Mile Road & Dequindre Road	34,223	35	7.0	13.51	-6.51	0.56	1.07	-0.51
2	11 Mile Road & Hales Street	10,373	3	0.6	4.69	-4.09	0.16	0.87	-0.71
3	11 Mile Road & Lorenz Street	10,900	9	1.8	4.69	-2.89	0.45	0.87	-0.42
4	11 Mile Road & John R Road	23,607	26	5.2	8.77	-3.57	0.60	0.96	-0.36
5	11 Mile Road & Hampden Street	11,477	3	0.6	4.69	-4.09	0.14	0.87	-0.73
6	11 Mile Road & NB Stephenson Hwy	17,573	38	7.6	4.69	2.91	1.18	0.87	0.31

The results of the analysis indicates that the majority of the study intersections currently have crash frequencies (crashes per year) and crash rates (crashes per million entering vehicles) below the SEMCOG average for intersections with similar characteristics. The study intersection of 11 Mile Road and NB Stephenson Highway has crash frequency and crash rate above the SEMCOG average. Further review of the crash reports indicates that the majority of crashes at the 11 Mile Road & NB Stephenson Highway intersection were angle crashes (58%). However, NB Stephenson Highway is the project limits for this study; therefore, no changes to the roadway geometry or traffic control operations are recommended as part of this study. It should be noted that the intersection of NB Stephenson Highway and 11 Mile Road is under the jurisdiction of the City of Royal Oak; therefore, any further investigation into this intersection would be completed by the City of Royal Oak.

5.2 HIGHWAY SAFETY MANUAL ANALYSIS

The Federal Highway Administration (FHWA) has identified Road Diets a proven safety countermeasure and promotes them as a safety-focused design alternative to a traditional four-lane. In order to determine the predictive impact on safety, an analysis was performed according to the Highway Safety Manual (HSM) crash predictive methodology. The analysis included the evaluation of the existing operations along the 11-Mile Road corridor and a safety review of the operations after the implementation of the recommended road diet to provide corridor-wide three-lane striping.

The latest HSM predictive methods analysis spreadsheet, provided by the MDOT Safety Programs Unit, was utilized to determine the expected and predicted crashes associated with the existing conditions and proposed road diet conditions. This analysis used the urban/sub-urban segments model and the crash prediction values

provided by MDOT in the HSM spreadsheet. The results of the analysis are summarized in **Table 12** below and the detailed HSM summary sheets are attached.

Table 12: Highway Safety Analysis Summary

Scenario	Property Damage Only (PDO)		Fatal and Injury (FI)		Total			
	Predicted Crashes per Year	Crash Rate (Crashes / mile / year)	Predicted Crashes per Year	Crash Rate (Crashes / mile / year)	Predicted Crashes per Year	Reduction (%)	Crash Rate (Crashes / mile / year)	Reduction (%)
NB Stephenson Hwy to Hamden St	0.46	4.64	0.10	0.95	0.56		5.59	
Road Diet (4-lane to 3-lane)	0.41	4.11	0.06	0.64	0.47	15.1%	4.74	15.1%
Hampden St to John R Rd	2.07	4.94	0.43	1.02	2.50		5.96	
Road Diet (4-lane to 3-lane)	1.83	4.35	0.29	0.68	2.12	15.5%	5.04	15.5%
John R Rd to Lorenz St	1.14	4.06	0.23	.084	1.37		4.89	
Road Diet (4-lane to 3-lane)	1.00	3.58	0.16	0.56	1.16	15.4%	4.14	15.4%
Lorenz St to Hales St	0.96	2.66	0.22	0.60	1.18		3.27	
Road Diet (4-lane to 3-lane)	0.85	2.36	0.15	0.40	0.99	15.5%	2.76	15.5%
Hales St to Dequindre Rd	1.90	5.01	0.42	1.10	2.32		6.11	
Road Diet (4-lane to 3-lane)	1.68	4.41	0.28	0.74	1.96	15.7%	5.15	15.7%

The result of the analysis indicates that the 4-lane to 3-lane road diet is expected to reduce the predicted crash rates and frequencies by approximately 15-16% per year throughout the 11-Mile Road study corridor.

6 CONCLUSIONS

The conclusions of this Traffic Study are as follows:

1. EXISTING CONDITIONS ANALYSIS (4-LANES)

- The results of the existing conditions analysis indicates that all approaches and movements at the study intersections are currently operating acceptably, at LOS D or better, during the AM, MD, School PM, and PM peak periods with the following exceptions:
 - Dequindre Road & 11 Mile Road**
 - Several intersection approaches and movements currently operate at LOS E or F during the peak periods.
 - Review of the operations show that the signal currently operates with a 180 second cycle length. Therefore, it is not unreasonable for vehicles to experience high delays. Review of SimTraffic network simulations indicates that the majority of vehicle queues were observed to be serviced within each cycle length throughout the study corridor.

2. ROAD DIET ANALYSIS (3-LANES)

Opening Day (2024)

- The results of the road diet evaluation indicate that, with the implementation of the proposed three-lane road-diet, all study intersection approaches and movements will continue to operate in a manner similar to the existing conditions analysis, with the exception of the following:
 - Dequindre Road & 11 Mile Road**
 - During the MD peak hour: The westbound right-turn lane is expected to operate at LOS E.
 - Review of SimTraffic network simulations indicates the westbound right-turn movement operates acceptably during the MD peak hour, the majority of vehicle queues were observed to be serviced within each cycle length.

- A corridor travel time evaluation was completed utilizing SimTraffic network simulations to calculate the existing network travel time and the projected travel time with the proposed road diet. The results of this comparison show negligible change in travel time for the peak periods, with the highest increase occurring for the westbound traffic during the School PM peak which is anticipated to increase by approximately three (3) minutes.

Horizon Year (2044)

- The results of the Horizon Year (2044) road diet evaluation indicates that all study intersection approaches and movements will continue to operate in a manner similar to the Opening Day (2024) conditions analysis, with the exception of the following:
 - **Dequindre Road & 11 Mile Road**
 - During the AM peak hour: The southbound left-turn movement is expected to operate at LOS E.
 - During the School PM peak hour: The northbound left-turn movement is expected to operate at LOS E.
 - Review of SimTraffic network simulations indicates long periods of vehicle queues for the southbound left-turn and westbound through movements during the AM, School PM, and PM peak periods. These queues were observed to be present throughout the School PM peak hour. The 95th percentile queue length for the southbound left-turn and westbound through movements were observed to be highest during the AM peak hour, at 880 feet, and the School PM peak hour, at 1,650 feet, respectively. This intersection is under the jurisdiction of MCDR and currently operates with a 180 second cycle length. Preliminary analysis indicates that queues would be reduced by optimizing the cycle length to 120 seconds.
 - **John R Road & 11 Mile Road**
 - During the School PM peak hour: The northbound and southbound through movements are expected to operate at LOS F and the overall intersection is expected to operate at LOS E.
 - Review of SimTraffic network simulations indicated periods of long vehicle queues during the School PM peak period for the northbound and southbound approaches. However, these queues were observed to dissipate and were not present throughout the entire peak hour.
- A corridor travel time evaluation was completed utilizing SimTraffic network simulations to calculate the projected Opening Day (2024) network travel time and the projected Horizon Year (2044) travel time with the proposed road diet. The results of this comparison show negligible change in travel time for the peak periods, with the highest increase occurring for the westbound traffic during the School PM peak which is anticipated to increase by approximately four (4) minutes.

3. SAFETY ANALYSIS

- The result of the crash analysis indicates that there were a total of 289 crashes reported along the 11 Mile Road corridor in the past five year (2018-2022); of these crashes, 86 involved injuries, including four (4) "Type A" injuries. The general crash type trends were Angle (43%), Rear-End – Straight (27%), and Sideswipe – Same Direction (11%) crashes.
- The analysis indicates that the majority of the study intersections have crash frequencies and crash rates below the SEMCOG average for comparable intersections. The study intersection of 11 Mile Road & NB Stephenson Highway has crash frequency and crash rate above the SEMCOG average. It should be noted that the intersection of NB Stephenson Highway & 11 Mile Road is under the jurisdiction of the City of Royal Oak; therefore, any further investigation into this intersection would be completed by the City of Royal Oak.
- A safety review was performed according to the Highway Safety Manual (HSM) crash predictive methodology. The result of the analysis indicates that 4-lane to 3-lane road diet would reduce the

predicted crash rates and frequencies by approximately 15-16% per year throughout the 11 Mile Road study corridor.

7 RECOMMENDATIONS

- The primary goal of this road diet is to improve safety and reduce the crashes along the 11 Mile Road corridor. The result of the analysis indicates that crashes are expected to be reduced by **15-16%**.
- It is recommended that the road diet is implemented. There are several options to consider for the extra space created by the eliminated lanes, such as parking space, bike lanes, additional green space, etc. The use of the additional space is up to the discretion of the city.
- It is recommended that at the intersection of Dequindre Road & 11 Mile Road, that the westbound approach be restriped to include a left-turn lane, a through lane, and a right-turn lane.
- It is recommended that at the intersection of John R Road & 11 Mile Road, that the eastbound and westbound approaches be restriped to include a left-turn lane, a through lane, and a right-turn lane.

Any questions related to this memorandum, study, analysis, and results should be addressed to Fleis & VandenBrink.

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Michigan.

Attached: Figures 1-5
Traffic Volume Data
HCM LOS Description
Synchro Results
Table 3
Table 5
HSM Crash Analysis

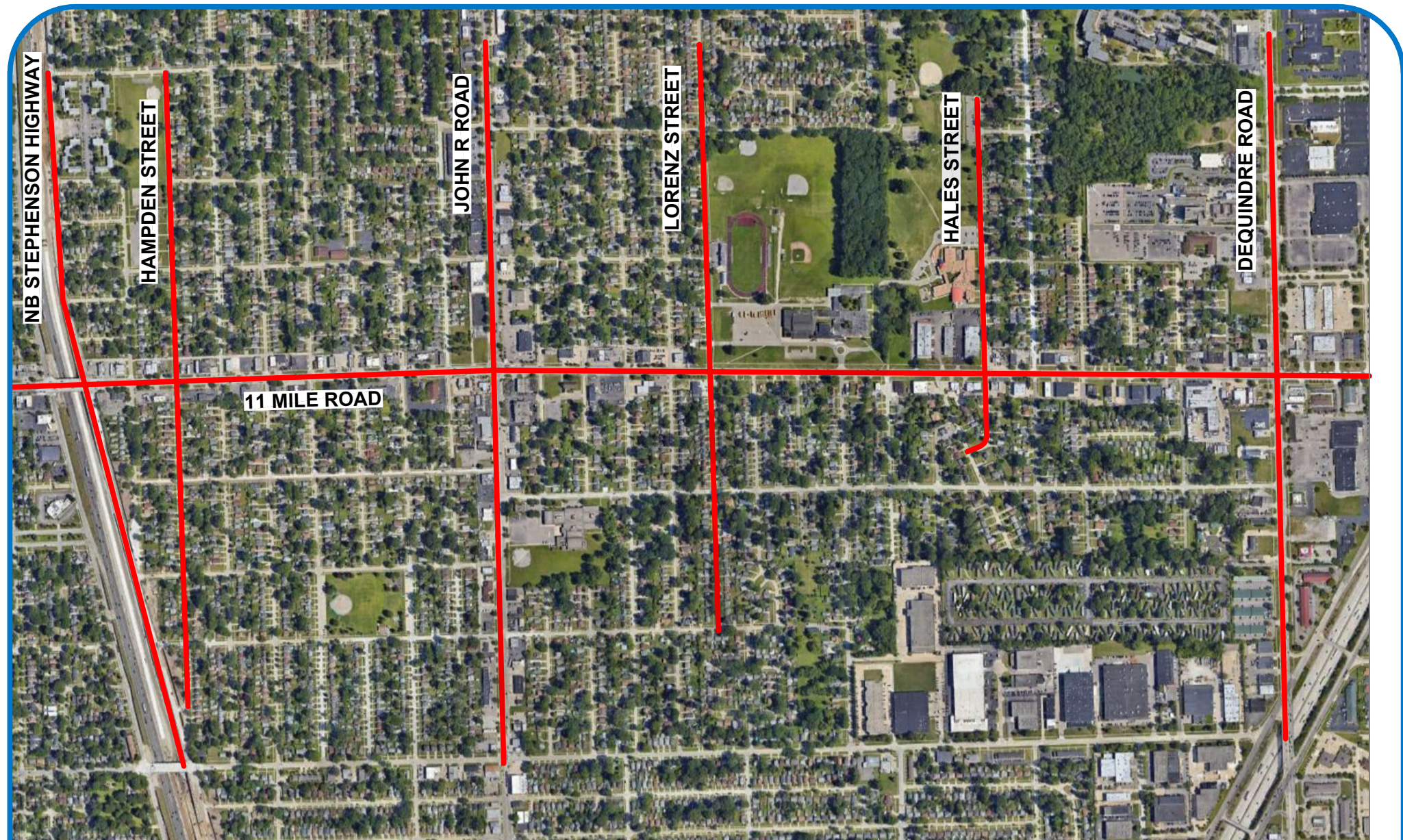


FIGURE 1 SITE LOCATION

11 MILE ROAD - ROAD DIET STUDY, MADISON HEIGHTS, MI

LEGEND



NORTH
SCALE: NOT TO SCALE

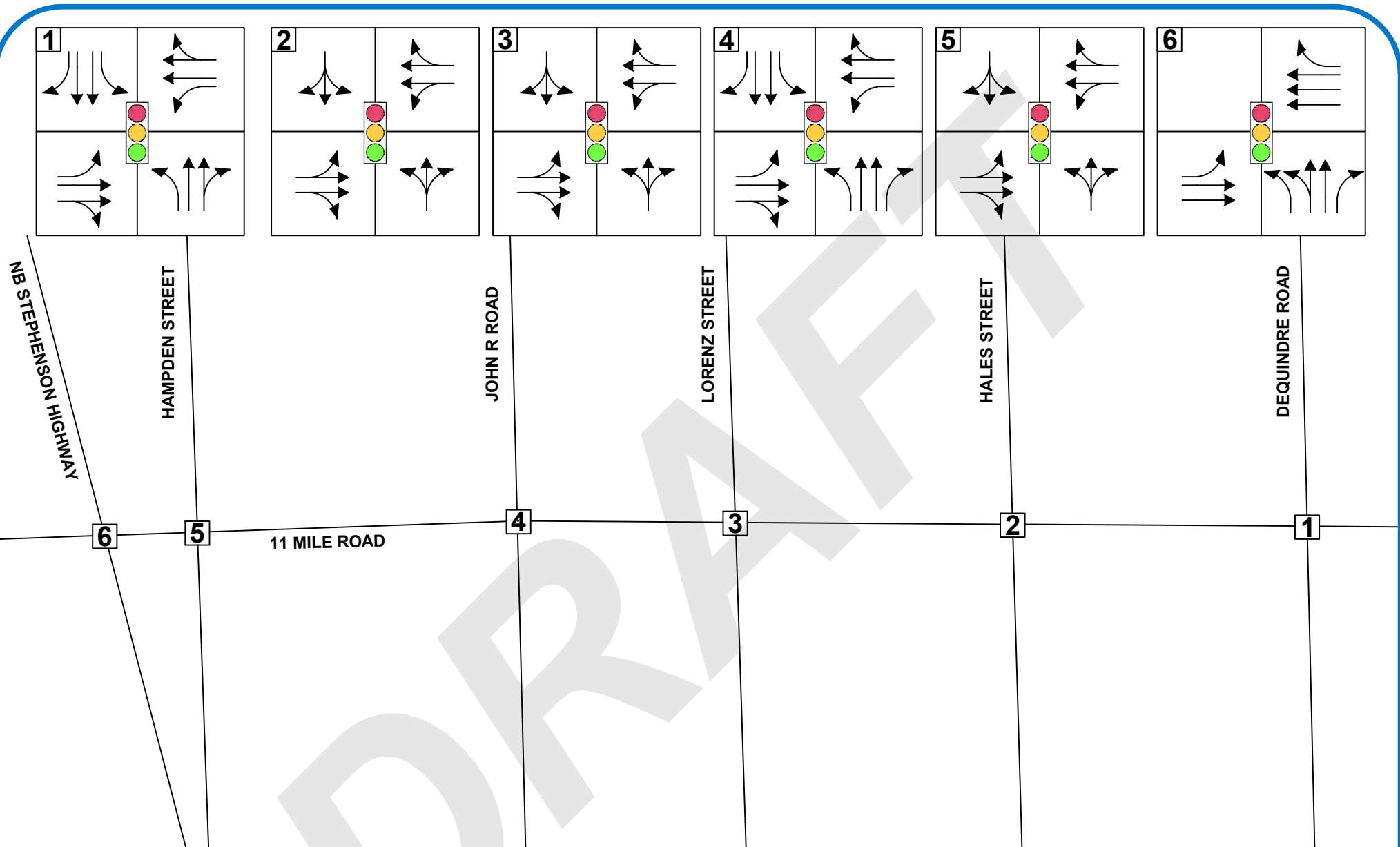


FIGURE 2

EXISTING LANE USE AND TRAFFIC CONTROL

11 MILE ROAD - ROAD DIET STUDY, MADISON HEIGHTS, MI



LEGEND

- ROADS
- LANE USE
- SIGNALIZED INTERSECTION



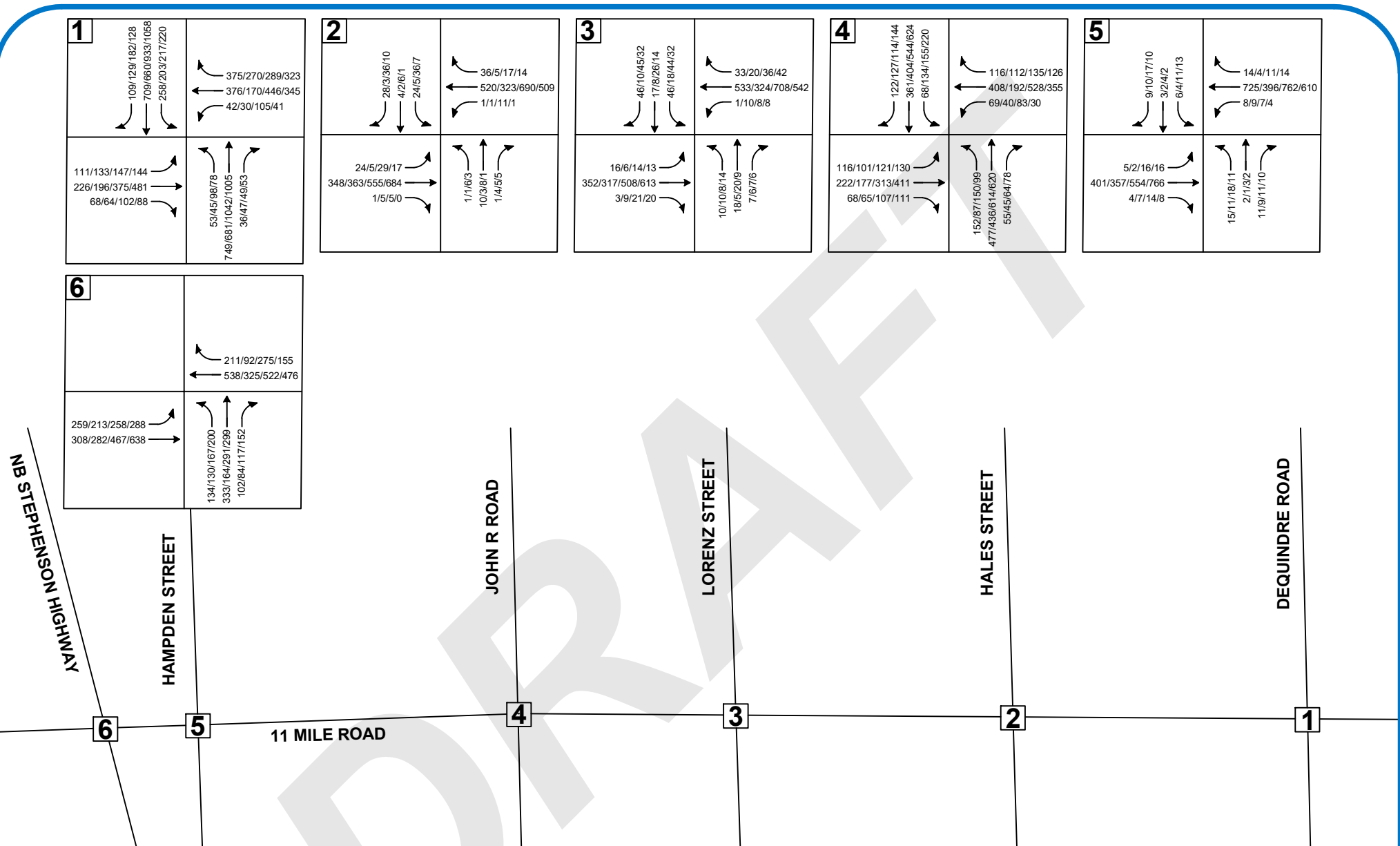


FIGURE 3

EXISTING TRAFFIC VOLUMES

11 MILE ROAD - ROAD DIET STUDY, MADISON HEIGHTS, MI



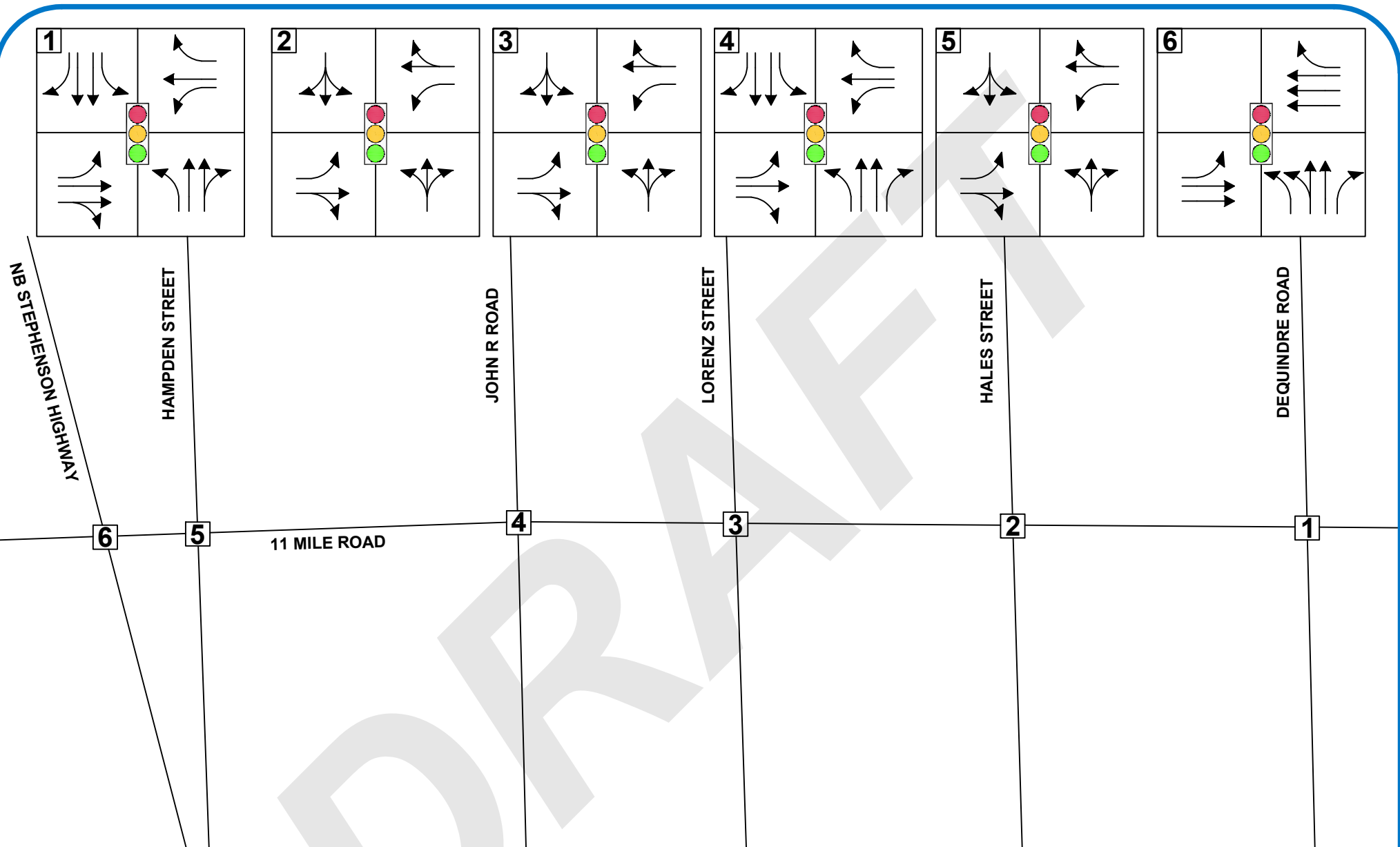


FIGURE 4 ROAD DIET LANE USE W/ RECOMMENDATIONS

11 MILE ROAD - ROAD DIET STUDY, MADISON HEIGHTS, MI

LEGEND

- ROADS
- ROAD DIET LANE USE
- SIGNALIZED INTERSECTION



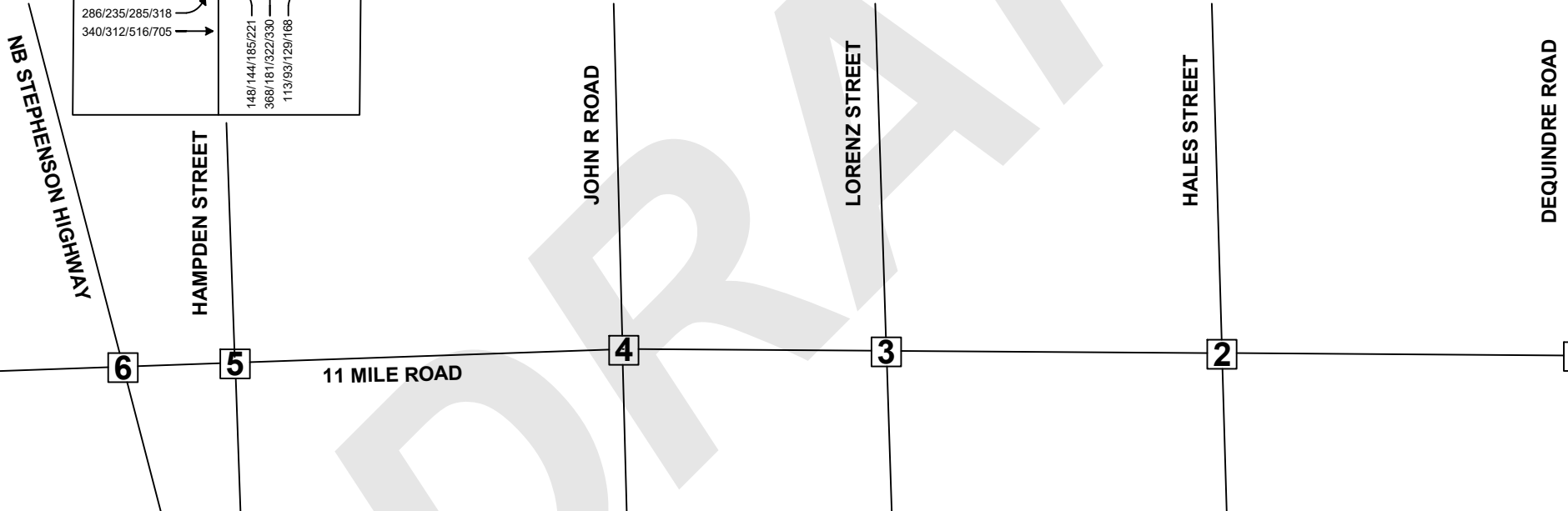
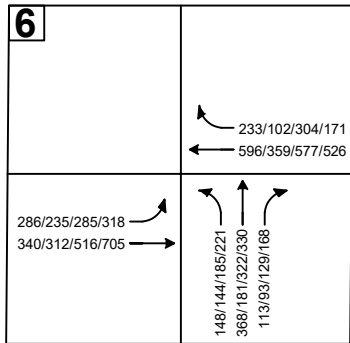
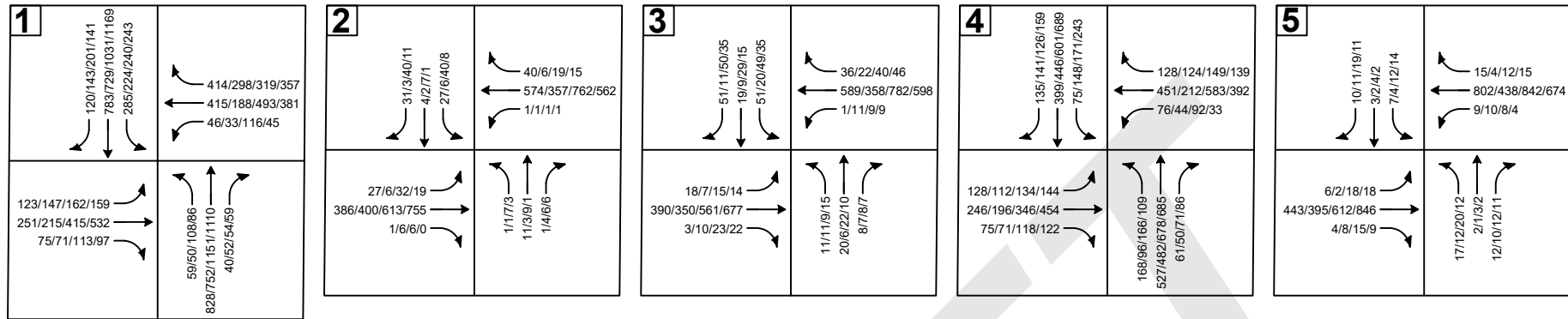


FIGURE 5 HORIZON YEAR (2044) TRAFFIC VOLUMES

11 MILE ROAD - ROAD DIET STUDY, MADISON HEIGHTS, MI

LEGEND

- ROADS
- TRAFFIC VOLUMES (AM/MD/School PM/PM)



Table 3: Road Diet Geometry (3 Lanes) Intersection Operations - Opening Day

Intersection	Control	Approach	Existing Conditions (2024)								Road Diet (Opening Day 2024)								Difference								
			AM Peak		MD Peak		School PM Peak		PM Peak		AM Peak		MD Peak		School PM Peak		PM Peak		AM Peak		MD Peak		School PM Peak		PM Peak		
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	
1	Dequindre Road & 11 Mile Road	Signalized	EBL	136.4	F	69.7	E	151.2	F	133.0	F	136.4	F	63.9	E	151.2	F	119.7	F	0.0	-	-5.8	-	0.0	-	-13.3	-
			EBTR	87.0	F	47.9	D	84.4	F	85.2	F	87.0	F	47.9	D	84.4	F	85.2	F	0.0	-	0.0	-	0.0	-	0.0	-
			WBL	59.7	E	35.9	D	68.1	E	72.0	E	59.7	E	37.6	D	67.6	E	72.5	E	0.0	-	1.7	-	-0.5	-	0.5	-
			WBT	85.4	F	36.2	D	97.5	F	81.9	F	78.3	E	36.1	D	120.4	F	77.3	E	-7.1	F→E	-0.1	-	22.9	-	-4.6	F→E
			WBTR / WBR	112.3	F	55.0	D	100.2	F	93.3	F	112.3	F	56.6	E	74.9	E	94.9	F	0.0	-	1.6	D→E	-25.3	F→E	1.6	-
			NBL	42.3	D	25.8	C	50.5	D	51.9	D	42.3	D	24.3	C	50.9	D	51.5	D	0.0	-	-1.5	-	0.4	-	-0.4	-
			NBTR	81.1	F	48.5	D	71.6	E	71.5	E	81.1	F	48.5	D	71.6	E	71.5	E	0.0	-	0.0	-	0.0	-	0.0	-
			SBL	49.5	D	29.9	C	62.7	E	57.9	E	49.5	D	28.3	C	63.2	E	57.4	E	0.0	-	-1.6	-	0.5	-	-0.5	-
			SBT	71.5	E	41.6	D	66.7	E	62.9	E	71.5	E	41.6	D	66.7	E	62.9	E	0.0	-	0.0	-	0.0	-	0.0	-
			SBR	46.2	D	27.6	C	41.0	D	34.6	C	46.2	D	29.1	C	41.0	D	34.7	C	0.0	-	1.5	-	0.0	-	0.1	-
Overall	80.0	E	44.6	D	77.5	E	73.6	E	79.2	E	44.4	D	78.3	E	72.8	E	-0.8	-	-0.2	-	0.8	-	-0.8	-			
2	Hales Street & 11 Mile Road	Signalized	EBTL / EBL	0.3	A	1.4	A	12.2	B	2.0	A	1.0	A	0.1	A	8.6	A	0.3	A	0.7	-	-1.3	-	-3.6	B→A	-1.7	-
			EBTR	0.3	A	1.5	A	12.7	B	2.1	A	0.5	A	0.4	A	4.7	A	1.0	A	0.2	-	-1.1	-	-8.0	B→A	-1.1	-
			WBTL / WBL	3.0	A	1.4	A	3.8	A	1.7	A	2.1	A	1.1	A	5.6	A	1.3	A	-0.9	-	-0.3	-	1.8	-	-0.4	-
			WBTR	3.0	A	1.4	A	3.9	A	1.8	A	4.3	A	1.7	A	6.1	A	2.3	A	1.3	-	0.3	-	2.2	-	0.5	-
			NB	33.5	C	38.4	D	32.3	C	37.6	D	33.5	C	38.4	D	32.4	C	37.6	D	0.0	-	0.0	-	0.1	-	0.0	-
			SB	36.8	D	38.4	D	36.4	D	38.6	D	36.9	D	38.4	D	36.8	D	38.6	D	0.1	-	0.0	-	0.4	-	0.0	-
			Overall	5.2	A	2.8	A	10.3	B	3.1	A	6.0	A	2.4	A	8.5	A	2.8	A	0.8	-	-0.4	-	-1.8	B→A	-0.3	-
3	Lorenz Street & 11 Mile Road	Signalized	EBTL / EBL	0.2	A	0.2	A	0.4	A	0.4	A	2.9	A	0.0	A	1.0	A	0.1	A	2.7	-	-0.2	-	0.6	-	-0.3	-
			EBTR	0.3	A	0.2	A	0.4	A	0.5	A	0.5	A	0.4	A	0.9	A	1.1	A	0.2	-	0.2	-	0.5	-	0.6	-
			WBTL / WBL	12.9	B	0.2	A	0.6	A	0.4	A	5.5	A	0.0	A	0.0	A	0.0	A	-7.4	B→A	-0.2	-	-0.6	-	-0.4	-
			WBTR	13.0	B	0.2	A	0.7	A	0.5	A	11.0	B	0.4	A	2.0	A	1.1	A	-2.0	-	0.2	-	1.3	-	0.6	-
			NB	31.2	C	37.1	D	31.9	C	35.1	D	31.4	C	37.1	D	32.1	C	35.1	D	0.2	-	0.0	-	0.2	-	0.0	-
			SB	35.6	D	38.6	D	36.1	D	37.5	D	35.9	D	38.6	D	36.5	D	37.7	D	0.3	-	0.0	-	0.4	-	0.2	-
Overall	12.4	B	3.6	A	4.3	A	3.6	A	11.5	B	3.8	A	5.3	A	4.2	A	-0.9	-	0.2	-	1.0	-	0.6	-			
4	John R Road & 11 Mile Road	Signalized	EBL	38.6	D	36.1	D	42.6	D	37.3	D	39.8	D	36.5	D	44.4	D	33.5	C	1.2	-	0.4	-	1.8	-	-3.8	D→C
			EBT	36.6	D	34.8	C	34.1	C	43.0	D	36.4	D	38.3	D	33.5	C	43.9	D	-0.2	-	3.5	C→D	-0.6	-	0.9	-
			EBTR / EBR	37.3	D	35.2	D	34.7	C	44.1	D	30.3	C	32.8	C	26.3	C	22.9	C	-7.0	D→C	-2.4	D→C	-8.4	-	-21.2	D→C
			WBL	33.0	C	33.5	C	32.4	C	36.4	D	31.4	C	34.7	C	30.0	C	37.1	D	-1.6	-	1.2	-	-2.4	-	0.7	-
			WBT	39.4	D	40.1	D	46.4	D	43.6	D	43.0	D	40.7	D	54.8	D	43.5	D	3.6	-	0.6	-	8.4	-	-0.1	-
			WBTR / WBR	40.1	D	41.3	D	46.7	D	44.9	D	29.8	C	37.1	D	26.0	C	31.2	C	-10.3	D→C	-4.2	-	-20.7	D→C	-13.7	D→C
			NBL	20.8	C	15.3	B	29.2	C	23.8	C	25.3	C	15.8	B	38.6	D	29.8	C	4.5	-	0.5	-	9.4	C→D	6.0	-
			NBT	29.1	C	24.0	C	31.6	C	26.3	C	32.2	C	23.0	C	39.5	D	30.5	C	3.1	-	-1.0	-	7.9	C→D	4.2	-
			NBR	24.1	C	20.6	C	24.2	C	21.3	C	25.9	C	19.9	B	27.0	C	23.9	C	1.8	-	-0.7	C→B	2.8	-	2.6	-
			SBL	21.0	C	17.4	B	30.2	C	27.9	C	25.3	C	18.0	B	43.6	D	36.0	D	4.3	-	0.6	-	13.4	C→D	8.1	C→D
			SBT	26.6	C	23.1	C	30.3	C	25.9	C	28.8	C	22.2	C	36.4	D	29.9	C	2.2	-	-0.9	-	6.1	C→D	4.0	-
SBR	26.5	C	22.6	C	26.2	C	23.1	C	28.8	C	21.7	C	29.6	C	26.2	C	2.3	-	-0.9	-	3.4	-	3.1	-			
Overall	31.6	C	27.6	C	35.4	D	32.9	C	33.1	C	27.2	C	39.6	D	33.9	C	1.5	-	-0.4	-	4.2	-	1.0	-			
5	Hampden Street & 11 Mile Road	Signalized	EBTL / EBL	0.2	A	0.2	A	0.3	A	0.5	A	1.1	A	0.2	A	2.3	A	0.7	A	0.9	-	0.0	-	2.0	-	0.2	-
			EBTR	0.2	A	0.2	A	0.4	A	0.5	A	0.5	A	0.4	A	0.8	A	1.4	A	0.3	-	0.2	-	0.4	-	0.9	-
			WBTL / WBL	2.6	A	2.4	A	3.1	A	2.6	A	1.8	A	1.9	A	2.0	A	1.9	A	-0.8	-	-0.5	-	-1.1	-	-0.7	-
			WBTR	2.7	A	2.4	A	3.1	A	2.7	A	4.1	A	3.0	A	5.4	A	3.7	A	1.4	-	0.6	-	2.3	-	1.0	-
			NB	44.2	D	38.3	D	39.1	D	38.6	D	44.2	D	38.3	D	39.2	D	38.6	D	0.0	-	0.0	-	0.1	-	0.0	-
			SB	43.4	D	38.3	D	38.8	D	38.5	D	43.4	D	38.3	D	38.8	D	38.5	D	0.0	-	0.0	-	0.0	-	0.0	-
Overall	4.1	A	3.6	A	4.0	A	3.0	A	5.0	A	4.0	A	5.5	A	3.9	A	0.9	-	0.4	-	1.5	-	0.9	-			
6	NB Stephenson Highway & 11 Mile Road	Signalized	EBL	18.5	B	3.7	A	15.6	B	7.2	A	18.5	B	3.7	A	15.6	B	7.2	A	0.0	-	0.0	-	0.0	-	0.0	-
			EBT	8.4	A	2.1	A	10.8	B	3.0	A	8.4	A	2.1	A	10.8	B	3.0	A	0.0	-	0.0	-	0.0	-	0.0	-
			WBT	13.2	B	8.2	A	11.6	B	12.0	B	12.9	B	8.4	A	12.4	B	12.5	B	-0.3	-	0.2	-	0.8	-	0.5	-
			WBR	14.5	B	8.4	A	13.7	B	12.4	B	13.8	B	8.5	A	14.0	B	12.7	B	-0.7	-	0.1	-	0.3	-	0.3	-
			NBL	36.3	D	37.7	D	35.9	D	34.9	C	36.3	D	37.7	D	35.9	D	34.9	C	0.0	-	0.0	-	0.0	-	0.0	-
			NBTL	38.8	D	36.9	D	34.7	C	33.8	C	38.8	D	36.9	D	34.7	C	33.8	C	0.0	-	0.0	-	0.0	-	0.0	-
			NBR	35.5	D	37.2	D	34.0	C	34.3	C	35.5	D	37.2	D	34.0	C	34.3	C	0.0	-	0.0	-	0.0	-	0.0	-
Overall	21.9	C	14.9	B	18.7	B	15.2	B	21.7	C	15.0	A	19.0	B	15.3	B	-0.2	-	0.1	B→A	0.3	-	0.1	-			

* Decreased delays and improved LOS are the result of improved progression and arrival on green factors and HCM methodology

Table 5: Road Diet Geometry (3 Lanes) Intersection Operations - Horizon Year (2044)

Intersection	Control	Approach	Road Diet (Opening Day 2024)										Road Diet (Horizon Year 2044)								Difference							
			AM Peak		MD Peak		School PM Peak		PM Peak		AM Peak		MD Peak		School PM Peak		PM Peak		AM Peak		MD Peak		School PM Peak		PM Peak			
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS		
1	Dequindre Road & 11 Mile Road	Signalized	EBL	136.4	F	63.9	E	151.2	F	119.7	F	166.0	F	66.7	E	179.9	F	146.5	F	29.6	-	2.8	-	28.7	-	26.8	-	
			EBTR	87.0	F	47.9	D	84.4	F	85.2	F	85.7	F	47.3	D	85.4	F	86.6	F	-1.3	-	-0.6	-	1.0	-	1.4	-	
			WBL	59.7	E	37.6	D	67.6	E	72.5	E	61.3	E	36.3	D	70.8	E	72.3	E	1.6	-	-1.3	-	3.2	-	-0.2	-	
			WBT	78.3	E	36.1	D	120.4	F	77.3	E	92.8	F	35.0	D	157.6	F	78.7	E	14.5	E→F	-1.1	-	37.2	-	1.4	-	
			WBTR / WBR	112.3	F	56.6	E	74.9	E	94.9	F	143.0	F	59.9	E	85.5	F	100.4	F	30.7	-	3.3	-	10.6	E→F	5.5	-	
			NBL	42.3	D	24.3	C	50.9	D	51.5	D	45.8	D	27.9	C	55.4	E	59.1	E	3.5	-	3.6	-	4.5	D→E	7.6	D→E	
			NBTR	81.1	F	48.5	D	71.6	E	71.5	E	77.5	E	47.1	D	68.6	E	68.5	E	-3.6	F→E	-1.4	-	-3.0	-	-3.0	-	
			SBL	49.5	D	28.3	C	63.2	E	57.4	E	55.9	E	32.8	C	73.8	E	69.5	E	6.4	D→E	4.5	-	10.6	-	12.1	-	
			SBT	71.5	E	41.6	D	66.7	E	62.9	E	68.2	E	40.3	D	63.2	E	59.4	E	-3.3	-	-1.3	-	-3.5	-	-3.5	-	
			SBR	46.2	D	29.1	C	41.0	D	34.7	C	42.9	D	27.0	C	37.6	D	31.1	C	-3.3	-	-2.1	-	-3.4	-	-3.6	-	
Overall	79.2	E	44.4	D	78.3	E	72.8	E	84.1	F	44.4	D	83.5	F	73.5	E	4.9	E→F	0.0	-	5.2	E→F	0.7	-				
2	Hales Street & 11 Mile Road	Signalized	EBTL / EBL	1.0	A	0.1	A	8.6	A	0.3	A	1.4	A	0.1	A	4.5	A	0.4	A	0.4	-	0.0	-	-4.1	-	0.1	-	
			EBTR	0.5	A	0.4	A	4.7	A	1.0	A	0.5	A	0.4	A	1.4	A	1.3	A	0.0	-	0.0	-	-3.3	-	0.3	-	
			WBTL / WBL	2.1	A	1.1	A	5.6	A	1.3	A	2.2	A	1.2	A	3.0	A	1.3	A	0.1	-	0.1	-	-2.6	-	0.0	-	
			WBTR	4.3	A	1.7	A	6.1	A	2.3	A	4.8	A	1.8	A	7.6	A	2.6	A	0.5	-	0.1	-	1.5	-	0.3	-	
			NB	33.5	C	38.4	D	32.4	C	37.6	D	33.4	C	38.3	D	31.7	C	37.5	D	-0.1	-	-0.1	-	-0.7	-	-0.1	-	
			SB	36.9	D	38.4	D	36.8	D	38.6	D	37.3	D	38.4	D	36.3	D	38.5	D	0.4	-	0.0	-	-0.5	-	-0.1	-	
			Overall	6.0	A	2.4	A	8.5	A	2.8	A	6.2	A	2.4	A	7.9	A	2.9	A	0.2	-	0.0	-	-0.6	-	0.1	-	
3	Lorenz Street & 11 Mile Road	Signalized	EBTL / EBL	2.9	A	0.0	A	1.0	A	0.1	A	3.9	A	0.0	A	0.1	A	0.1	A	1.0	-	0.0	-	-0.9	-	0.0	-	
			EBTR	0.5	A	0.4	A	0.9	A	1.1	A	0.6	A	4.0	A	1.1	A	1.4	A	0.1	-	3.6	-	0.2	-	0.3	-	
			WBTL / WBL	5.5	A	0.0	A	0.0	A	0.0	A	5.8	A	0.0	A	0.0	A	0.1	A	0.3	-	0.0	-	0.0	-	0.1	-	
			WBTR	11.0	B	0.4	A	2.0	A	1.1	A	12.4	A	0.4	A	2.8	A	1.4	A	1.4	B→A	0.0	-	0.8	-	0.3	-	
			NB	31.4	C	37.1	D	32.1	C	35.1	D	30.7	C	37.0	D	31.3	C	34.9	C	-0.7	-	-0.1	-	-0.8	-	-0.2	D→C	
			SB	35.9	D	38.6	D	36.5	D	37.7	D	35.5	D	38.7	D	36.1	D	37.4	D	-0.4	-	0.1	-	-0.4	-	-0.3	-	
Overall	11.5	B	3.8	A	5.3	A	4.2	A	12.2	B	3.9	A	5.8	A	4.4	A	0.7	-	0.1	-	0.5	-	0.2	-				
4	John R Road & 11 Mile Road	Signalized	EBL	39.8	D	36.5	D	44.4	D	33.5	C	42.7	D	37.0	D	50.5	D	34.9	C	2.9	-	0.5	-	6.1	-	1.4	-	
			EBT	36.4	D	38.3	D	33.5	C	43.9	D	35.8	D	37.9	D	32.3	C	49.3	D	-0.6	-	-0.4	-	-1.2	-	5.4	-	
			EBTR / EBR	30.3	C	32.8	C	26.3	C	22.9	C	29.4	C	32.1	C	25.0	C	21.9	C	-0.9	-	-0.7	-	-1.3	-	-1.0	-	
			WBL	31.4	C	34.7	C	30.0	C	37.1	D	31.1	C	34.7	C	27.1	C	37.1	D	-0.3	-	0.0	-	-2.9	-	0.0	-	
			WBT	43.0	D	40.7	D	54.8	D	43.5	D	45.1	D	40.7	D	48.8	D	45.7	D	2.1	-	0.0	-	-6.0	-	2.2	-	
			WBTR / WBR	29.8	C	37.1	D	26.0	C	31.2	C	29.0	C	36.7	D	20.5	C	30.6	C	-0.8	-	-0.4	-	-5.5	-	-0.6	-	
			NBL	25.3	C	15.8	B	38.6	D	29.8	C	28.3	C	17.5	B	46.4	D	32.0	C	3.0	-	1.7	-	7.8	-	2.2	-	
			NBT	32.2	C	23.0	C	39.5	D	30.5	C	30.5	C	24.7	C	134.6	F	38.6	D	-1.7	-	1.7	-	95.1	D→F	8.1	C→D	
			NBR	25.9	C	19.9	B	27.0	C	23.9	C	24.3	C	20.7	C	31.8	C	26.0	C	-1.6	-	0.8	B→C	4.8	-	2.1	-	
			SBL	25.3	C	18.0	B	43.6	D	36.0	D	28.1	C	20.3	C	52.3	D	46.7	D	2.8	-	2.3	B→C	8.7	-	10.7	-	
			SBT	28.8	C	22.2	C	36.4	D	29.9	C	27.2	C	23.6	C	100.9	F	36.8	D	-1.6	-	1.4	-	64.5	D→F	6.9	C→D	
SBR	28.8	C	21.7	C	29.6	C	26.2	C	27.1	C	23.0	C	37.6	D	29.4	C	-1.7	-	1.3	-	8.0	C→D	3.2	-				
Overall	33.1	C	27.2	C	39.6	D	33.9	C	33.0	C	28.2	C	69.6	E	39.1	D	-0.1	-	1.0	-	30.0	D→E	5.2	C→D				
5	Hampden Street & 11 Mile Road	Signalized	EBTL / EBL	1.1	A	0.2	A	2.3	A	0.7	A	1.6	A	0.3	A	3.5	A	0.9	A	0.5	-	0.1	-	1.2	-	0.2	-	
			EBTR	0.5	A	0.4	A	0.8	A	1.4	A	0.5	A	0.4	A	1.0	A	1.7	A	0.0	-	0.0	-	0.2	-	0.3	-	
			WBTL / WBL	1.8	A	1.9	A	2.0	A	1.9	A	1.8	A	2.0	A	2.0	A	1.9	A	0.0	-	0.1	-	0.0	-	0.0	-	
			WBTR	4.1	A	3.0	A	5.4	A	3.7	A	4.6	A	3.1	A	6.3	A	4.0	A	0.5	-	0.1	-	0.9	-	0.3	-	
			NB	44.2	D	38.3	D	39.2	D	38.6	D	44.4	D	38.3	D	39.3	D	38.7	D	0.2	-	0.0	-	0.1	-	0.1	-	
			SB	43.4	D	38.3	D	38.8	D	38.5	D	43.6	D	38.3	D	39.0	D	38.5	D	0.2	-	0.0	-	0.2	-	0.0	-	
			Overall	5.0	A	4.0	A	5.5	A	3.9	A	5.4	A	4.0	A	6.1	A	4.2	A	0.4	-	0.0	-	0.6	-	0.3	-	
6	NB Stephenson Highway & 11 Mile Road	Signalized	EBL	18.5	B	3.7	A	15.6	B	7.2	A	23.5	C	4.2	A	19.3	B	9.2	A	5.0	B→C	0.5	-	3.7	-	2.0	-	
			EBT	8.4	A	2.1	A	10.8	B	3.0	A	10.2	B	2.1	A	12.2	B	3.2	A	1.8	A→B	0.0	-	1.4	-	0.2	-	
			WBT	12.9	B	8.4	A	12.4	B	12.5	B	14.1	B	8.9	A	13.9	B	13.1	B	1.2	-	0.5	-	1.5	-	0.6	-	
			WBR	13.8	B	8.5	A	14.0	B	12.7	B	15.2	B	8.9	A	16.1	B	13.5	B	1.4	-	0.4	-	2.1	-	0.8	-	
			NBL	36.3	D	37.7	D	35.9	D	34.9	C	34.8	C	37.7	D	34.9	C	34.5	C	-1.5	D→C	0.0	-	-1.0	D→C	-0.4	-	
			NBTL	38.8	D	36.9	D	34.7	C	33.8	C	37.4	D	36.7	D	33.6	C	33.3	C	-1.4	-	-0.2	-	-1.1	-	-0.5	-	
			NBR	35.5	D	37.2	D	34.0	C	34.3	C	34.0	C	37.0	D	32.8	C	34.0	C	-1.5	D→C	-0.2	-	-1.2	-	-0.3	-	
			Overall	21.7	C	15.0	A	19.0	B	15.3	B	22.5	C	15.2	B	20.0	C	15.8	B	0.8	-	0.2	A→B	1.0	B→C	0.5	-	

* Decreased delays and improved LOS are the result of improved progression and arrival on green factors and HCM methodology