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9 MILE ROAD AT NAPIER ROAD

Intersection Study - Final Report

Road Commission for Oakland County

City of Novi

Lyon Township

March 2024

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1. INTRODUCTION

In 2023, the Road Commission for Oakland County (RCOC) held a series of community meetings on desired system improvements throughout the county. In conjunction with those meetings, three intersections were selected by the RCOC for preliminary, comparative analysis of potential intersection improvements. These locations are currently experiencing capacity deficiencies and/or safety concerns under the existing conditions. In addition, some of these concerns are further complicated by unique intersection configurations and challenging site constraints. Completing a preliminary review of these locations will provide the RCOC with a reviewed concept to begin discussions with the local community. This report will focus on the intersection of 9 Mile Road at Napier Road, one of the three study intersections.

The intersection of 9 Mile Road and Napier Road is located on the border of Lyon Township and the City of Novi. 9 Mile Road is a two-lane two-way roadway. An auxiliary right turn lane is provided for the eastbound 9 Mile Road approach. Napier Road is a two-lane two-way roadway with widening for an auxiliary left turn lane provided at the intersection. Both the eastbound and westbound approaches on 9 Mile Road are under stop control, while northbound and southbound traffic on Napier Road remain uncontrolled. 9 Mile Road runs east-west with a posted speed limit of 30 mph east of the intersection and 55 mph west of the intersection. Napier Road runs north-south and has a posted speed limit of 45 mph.

This study reviews the existing surface transportation network at this location, identifies concerns with the existing configuration, and explores opportunities to improve the traffic operations and safety. The study generates alternative improvements and provides a contextual evaluation of the pro(s)/con(s) for each. These projections will assist the RCOC in the refinement of an intersection improvement plan at this location.

2. TRAFFIC INFORMATION

Traffic data was collected by QC (Quality Counts) in June of 2023. Data was collected at this location in coordination with the RCOC. The morning peak hour occurs between 7:30 am and 8:30 am, and the afternoon peak hour occurs between 4:45 pm and 5:45 pm. Existing traffic volume data can be found in **Appendix A**.

The existing peak hour turning movement volumes are shown in Figure 1.

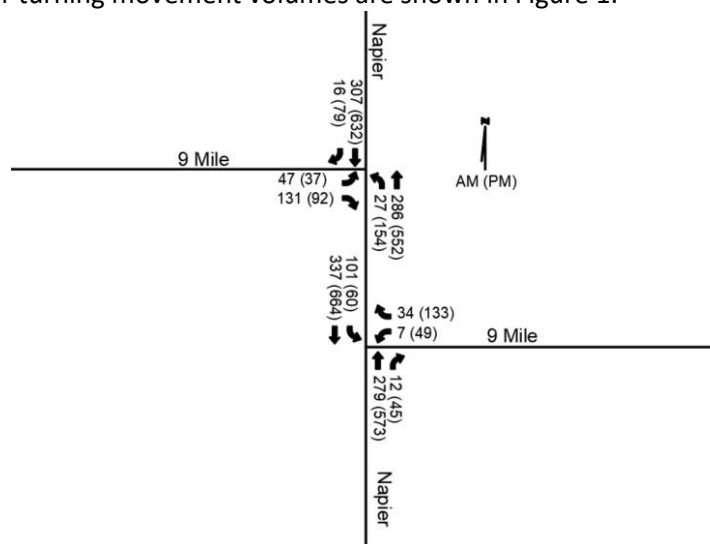


Figure 1: Existing Peak Hour Volumes



In order to analyze the impacts of future roadway improvements, traffic data was projected to the horizon year of the study. This study will identify the impacts of improvements based on 2043 data. Traffic projections were based on SEMCOG's Traffic Forecast Map. This tool allows users to view volumes at five-year intervals. Since the years 2023 and 2043 do not fall on one of the five-year intervals, the year 2020 was compared to 2040 and 2025 was compared to 2045. The overall growth and growth per year were calculated from these volumes. In order to account for the general impacts of traffic growth, a modest growth factor of 10.0% between current year and the projected year of 2043 (0.48% per year) was used. In addition, Napier Road was recently paved so these numbers should show continued growth. This growth in traffic does not account for specific developments in close proximity to the intersection, but rather general growth within the surrounding area.

3. SAFETY ANALYSIS

A safety analysis was performed to explore the recent crash history at this intersection. The primary focus of this analysis was to summarize and identify crash patterns. These patterns help identify safety concerns, which may be reduced by the proposed intersection improvements included in this study. Particular attention was given to head-on and angle crashes, which tend to result in more serious injuries and greater property damage.

Crash data for the analysis was downloaded from the Traffic Improvement Association's (TIA) Traffic Crash Analysis Tool (TCAT). Detailed traffic crash reports (UD-10s) for the most severe, including any crashes with pedestrian or bicyclist involvement were also downloaded and reviewed in detail. The crash data encompassed a period of six full years spanning January 1, 2018, through December 31, 2023. Historical Crash Data can be found in **Appendix B**.

Intersection Crash Analysis

A summary of the intersection crash data is shown in Table 1.

Table 1: Intersection Crash Summary – 9 Mile Road at Napier Road

	Crash Type						TOTAL	Crash Severity				
	Sideswipe	Head-on Left Turn	Angle	Rear End	Single Vehicle	Other		K (Fatal)	A (Incapacitating)	B (Non-Incapacitating)	C (Possible)	O (Property Damage Only)
2018	1	0	1	1	0	0	3	0	1	0	0	2
2019	0	0	1	0	0	0	1	0	0	0	1	0
2020	0	0	1	0	0	0	1	0	0	0	0	1
2021	0	0	2	0	0	0	2	0	0	1	0	1
2022	1	0	1	0	1	1	4	0	0	0	1	3
2023	0	0	0	0	2	0	2	0	1	0	0	1
Total	2	0	6	1	3	1	13	0	2	1	2	8
Percent of Total	15%	0%	46%	8%	23%	8%	100%	0%	15%	8%	15%	62%



There were 13 total crashes during the study period. The most prominent crash type was angle crashes, accounting for 46% of all crashes. The majority of the angle crashes (four crashes) occurred in the eastbound direction. Eastbound vehicles attempting to turn onto Napier Road failed to yield to oncoming traffic. Three of the eastbound vehicles were attempting to turn left, while the fourth eastbound vehicle was attempting to turn right. Another angle crash occurred when a vehicle turning from Napier Road struck a vehicle that was pulled out past the stop bar waiting to turn onto Napier Road. The last angle crash occurred between a southbound vehicle and northbound left-turning vehicle. All of these crashes occurred during the day under dry pavement conditions, except one, which occurred under snowy pavement conditions.

During the analysis period, there were no crashes which resulted in a fatality and two crashes which resulted in an A-level (incapacitating) injury. One B-level (non-incapacitating) injury and two C-level (possible) injury crashes occurred at the intersection during the analysis period. The balance of the crashes resulted in property damage only (PDO). There were no crashes which involved a pedestrian and two crashes which involved a bicyclist. The first A-level injury crash resulted from an angle crash. A vehicle traveling east on 9 Mile Road failed to yield to a southbound vehicle on Napier Road. In the second A-level injury crash, a southbound driver collided with the bicyclist, which was crossing the intersection heading westbound. The vehicle saw the bicyclist, and both slowed down at the same time. The vehicle then proceeded through the intersection at the same time that the bicyclist decided to also continue through the intersection. In the C-level injury crash, a vehicle turning left from Napier Road onto 9 Mile Road struck a bicyclist in the road.

Further Considerations

The majority of the crashes that occurred during the analysis period were angle crashes. Reviewing sight distance at this intersection along with modifying the intersection geometry may help to reduce these crashes. Furthermore, there were a couple of crashes involving vulnerable road users. To help eliminate these types of crashes, high-emphasis crosswalks should be installed. Pedestrian signage can also be installed at stop-controlled intersections or roundabout intersections. These improvements will help increase pedestrian/bicyclist visibility for motorists. Another option would be to install a midblock crossing. This would move vulnerable road users away from the intersection to a safer crossing point along Napier Road.

Annual Safety Review

The Annual Safety Review (ASR) ranks intersections based on the weighted crash data of frequency of crashes, severity of crashes, and crash rate from the previous three calendar years. The 2018-2023 ASR rankings for both intersections are listed below in Table 2.

Table 2: Annual Safety Review Rankings

	Intersection Ranking
2018	118
2019	47
2020	116
2021	113
2022	100
2023	95

In general, this intersection has not changed rankings greatly over the study period.



4. SUMMARY OF SITE CONSTRAINTS

The location of this intersection provides unique challenges and opportunities. Site constraints at this location will play a critical role in the evaluation of improvement concepts. Consideration of these features throughout concept refinement will guide the study to develop concepts that acknowledge the site characteristics.

Environmental Constraints

A preliminary review of available information including the EGLE Wetlands Map Viewer has indicated that wetlands soil types may be present at this location. While there are no identified wetlands within the project limits, there are identified wetlands located approximately 1200' to the east. In addition, there is a ~90' by 90' pond in the southwest quadrant surrounded by cattails and other foliage typical of wetlands.

Adjacent Properties and Context

The context is generally rural with several residential properties recently constructed or planned. With developments surrounding the area and the ITC Community Sports Park located a half a mile south of the intersection, the context along Napier Road might contain a more suburban feel than rural elements in the future. A noticeable amount of trucks travel on Napier Road. Gravel haulers often travel through the intersection to and from companies located near the 6 Mile Road and Chubb Road intersection. Signs on the east leg of 9 Mile Road indicate load restrictions and the prohibition of trucks passing through. The road transitions from paved to dirt 0.14 miles east and 0.95 miles west of the intersection. High speeds tend to be present on Napier Road.

There is fencing lining the southwest quadrant of the intersection that encompasses the pond that likely belongs to the resident on this corner. The land in the northeast corner of the intersection contains a home that was recently demolished. The City of Novi has indicated that a condo development might be pending, but nothing has been officially submitted. A new development of a residential subdivision is potentially planned in the northwest quadrant of the intersection, which is currently vacant. The southeast quadrant is a residential neighborhood.

The southwest parcel is accessed through a driveway on Napier Road, 150' south of 9 Mile Road. The northwest parcel has no defined driveway access points. The northeast parcel contains two access points along Napier Road at 50' and 150' north of 9 Mile Road, respectively. The two driveways are connected by a half circle. There is a driveway feeding the residence along the east leg of 9 Mile Road, 250' east of the intersection. Two new residential developments are being constructed approximately 1700' south of the intersection.

Non-Motorized Access

There are no crosswalks at this intersection. Existing sidewalk is limited to the southeast quadrant of the intersection and extends further south along the east side of Napier Road towards the ITC Community Sports Park. Along the east leg, the sidewalk on the south side of 9 Mile Road dead ends at Hillsdale Drive and a short stretch exists near Torino Drive on the north side. As desired by local communities, non-motorized facilities can be incorporated into any future improvements.

Utilities

There are electrical overhead utility lines crossing the intersection from the southeast to northwest quadrants of the intersection. Large utility poles are located on the southeast, northeast, and northwest



corners. There is a streetlight on the east side of Napier Road across from the eastbound 9 Mile Road approach.

Indications of underground utilities include a gas riser in the northeast and northwest quadrants of the intersection. A Lyon Township watermain easement located in the northwest corner of the intersection, running along 9 Mile Road. Watermain and sanitary easements are located in the southwest corner of the intersection, running along Napier Road. A 12" ductile iron water main runs along Napier Road from the easement in the northwest corner through the easement in the southwest corner. An 8" HDPE sanitary force main runs along Napier Road in the sanitary easement. There are two fire hydrants located inside the water main easements in the northwest and southwest quadrants of the intersection. The sanitary force main manhole in the southwest corner will require access in any proposed condition. Numerous other underground utilities appear to be in the area.

Other Features

There is noticeable curb damage and rutting behind the curb in the northwest quadrant of the intersection.

5. IMPROVEMENT CONCEPTS: PRELIMINARY ANALYSIS

At this location, multiple improvement concepts were reviewed. These options were identified and assessed on a cursory level. This preliminary analysis allowed for the identification of the most promising concepts. Concepts found to be impractical were eliminated from further consideration. With all of the signalized alternatives, pedestrian crossings with pushbutton actuation would be added to cross all four legs. In all of the alternatives, high-emphasis crosswalks would be installed.

Realigned Intersection

This alternative would modify the intersection geometry to create a simplified four-legged intersection under two-way stop control. The realignment would align the east and west legs of 9 Mile Road. This option eliminates the left-turn conflict to get from one 9 Mile Road leg to the other. The realignment would cause 9 Mile Road to be skewed in relation to Napier Road. This restricts sight distance and could make turns more difficult to complete. Due to the sight distance constraints and skewed vision angles, this alternative was eliminated from further consideration.

Signalized Intersection

This alternative would propose the installation of a signal at the intersection. Signal warrants were reviewed, and this intersection met several of the warrants. Warrants 1, 2, and 3 were met. Warrant 1 is the eight-hour volume warrant. Warrant 2 is the four-hour volume warrant. Warrant 3 is the peak-hour volume warrant. It should be noted that just because signal warrants were met, a signal does not have to be installed. Engineering judgement should be used after warrants are met to determine whether a signal should be installed at a specific location or not.

Due to the existing configuration of the intersection, two signals would need to be installed. These signals would be coordinated. Northbound and southbound traffic would be allowed to move through the intersection at the same time; however, eastbound, and westbound traffic would have split phasing. This means that eastbound and westbound movements would not be allowed at the same time. In general, this creates a longer cycle length and increased delays. Under existing conditions, a vehicle attempting to turn left onto eastbound 9 Mile Road comes head on with a vehicle attempting to turn left at the same time onto westbound 9 Mile Road. Split phasing allows all eastbound vehicles to proceed through the



intersection and then all westbound vehicles to proceed through the intersection, which in turn eliminates the existing left-turn lane conflict. It would also help address issues with intersection visibility. Due to the challenging operations and high costs with little operational benefit associated with this option, this alternative was eliminated from further consideration.

Realigned and Signalized Intersection

This alternative eliminates the staggered configuration, by creating a single signalized four-legged intersection that aligns 9 Mile Road to Napier Road at approximately 83 degrees. Additionally, this option adds a 100-foot left-turn lane to all four legs, plus a right-turn lane at all legs except the east leg. This alternative no longer requires split phasing since the east and west legs are aligned. Allowing eastbound and westbound traffic movements to occur at the same time would result in less delay.

Realigning this intersection allows for more conventional signal phasing and eliminates the left-turn conflict between both 9 Mile Road approaches for opposing thru traffic vehicles.

Single Lane Roundabout Intersection

This alternative includes the construction of a single lane roundabout with an ovular shape having an inscribed circle diameter of approximately 150 feet by 110 feet at this intersection. Passenger vehicles are accommodated in the circulating roadway with larger vehicles using the provided truck apron for the required additional width. As with all roundabouts, all approaches will be under yield control.

The installation of a roundabout at this location would improve capacity over the existing side street stop control. The roundabout approach geometry will help reduce speeds, reduce conflict points, and help reduce the severity of crashes at this location. This alternative will change the roadway alignment, with the footprint of the intersection expanding to the southwest. Additionally, roundabouts are found to greatly reduce the number of severe crashes at intersections due to their geometry. Installing a roundabout at this intersection would likely eliminate angle crashes.

Peanut Roundabout Intersection

This alternative includes the construction of a single lane roundabout with a peanut shape at this intersection. This geometry allows for improved separation of approaches while maintaining a smaller impact outside the existing right-of-way. Passenger vehicles are accommodated in the circulating roadway with larger vehicles using the provided truck apron for the required additional width. As with all roundabouts, all four approaches will be under yield control.

The installation of a roundabout at this location would improve capacity over the existing side street stop control. The roundabout approach geometry will help reduce speeds, reduce conflict points, and help reduce the severity of crashes at this location. This alternative will change the roadway alignment, with the footprint of the intersection expanding to the southwest. The peanut roundabout alternative has a larger footprint than the single lane roundabout alternative. A roundabout at this location will improve capacity for the current stop-controlled approaches.

Concepts Selected for Further Analysis

The following concepts were selected for further analysis.

1. Realigned and Signalized Intersection
2. Single Lane Roundabout Intersection
3. Peanut Roundabout Intersection



6. PROJECT STAKEHOLDER MEETING

A project stakeholder meeting with representatives from the RCOC, Lyon Township, and the City of Novi was held on August 9, 2023. At this meeting, the township representatives expressed concern about safety. Additionally, the stakeholders were in support of a roundabout at this location. A summary of the discussion at this meeting can be found in **Appendix I**.

7. OPERATIONAL ANALYSIS

The study intersections were analyzed according to the methodologies published in the Highway Capacity Manual, 2010 edition. For this project, Synchro Version 11 software was used to conduct the analysis for traditional intersections. Rodel software was used to conduct the analysis for intersections under roundabout control. Software printouts for the evaluations of intersections have been included in **Appendix C** and **Appendix D**. These software packages compute delay values based on factors such as number and type of lanes, intersection controls such as STOP signs or traffic signals, traffic volumes, pedestrian volumes, geometric characteristics, signal timing characteristics, roadway grade, speed limit, etc. This analysis determines the average delay experienced by vehicles. This value is an average across the entire peak hour, vehicles arriving during the busiest portion of the peak hour or arriving in a clustered group of vehicles instead of in a random pattern could experience longer delays. On the other hand, vehicles arriving during a lighter portion of the peak hour could experience a shorter delay. The average delay is used to determine the corresponding level of service (LOS) values for each intersection movement as well as the intersection as a whole.

The LOS of an intersection is based on factors such as number and types of lanes, intersection controls such as STOP signs or traffic signals, traffic volumes, pedestrian volumes, etc. LOS is expressed as a letter grade, in a range from A through F. In this context, 'A' represents the best conditions, with very little or no average delay to vehicles. LOS 'F' is the worst of conditions, equated with very large average delays and few gaps of acceptable length. The following tables identify level of service criteria for signalized and un-signalized intersections.

Table 3: Level of Service Criteria For Signalized Intersections

Level of Service	Average Delay/Vehicle (seconds)	Description
A	Less than or equal to 10	Most vehicles do not stop at all. Most arrive during the green phase. Little or no delay.
B	> 10 to 20	More vehicles stop than for LOS A. Still good progression through lights. Short traffic delays.
C	> 20 to 35	Significant numbers of vehicles stop, although many pass through without stopping.
D	> 35 to 55	Many vehicles stop. Individual signal cycle failures are noticeable. Progression is intermittent.
E	> 55 to 80	Considered to be the limit of acceptable delay. Individual cycle failures are frequent, and progression is poor.
F	>80	Extreme and unacceptable traffic delays.

SOURCE: Transportation Research Board, Highway Capacity Manual 2010.

**Table 4: Level of Service Criteria For Unsignalized Intersections**

Level of Service	Average Delay/Vehicle (seconds)	Description
A	0 to 10	Little or no delay, very low main street traffic
B	> 10 to 15	Short traffic delays, many acceptable gaps
C	> 15 to 25	Average traffic delays, frequent gaps still occur
D	> 25 to 35	Longer traffic delays, limited number of acceptable gaps
E	> 35 to 50	Very long traffic delays, very small number of acceptable gaps
F	>50	Extreme traffic delays, virtually no acceptable gaps in traffic

SOURCE: Transportation Research Board, Highway Capacity Manual 2010.

An intersection LOS 'D' is considered by many traffic safety professionals to be the minimum acceptable condition in an urban/suburban area. For rural areas, most highway agencies consider LOS 'C' the minimum. Given the location of the study intersections, on the edge of an urbanized area, LOS 'D' was utilized as the study goal.

2023 Operations

The study intersections were evaluated for the concepts during each of the peak hour periods. First, the intersection was evaluated under the existing conditions. Also analyzed were the concepts identified in the preliminary analysis. Table 5 shows the intersection LOS and corresponding delays during the AM Peak Hour. Table 6 shows the intersection LOS and corresponding delays during the PM Peak Hour.

Table 5: Intersections of 9 Mile at Napier 2023 AM Peak Delay and Level of Service

	Eastbound		Westbound		Northbound		Southbound		Intersection	
	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS
Existing Geometry	12.2	B	11.3	B	0.7	A	1.9	A	3.2	A
Realigned and Signalized	7.3	A	5.5	A	12.4	B	12.5	B	10.9	B
Single Lane Roundabout	6.6	A	4.4	A	8.1	A	8.2	A	7.6	A
Peanut Roundabout	6.8	A	4.7	A	7.1	A	7.9	A	7.3	A

**Table 6: Intersections of 9 Mile at Napier 2023 PM Peak Delay and Level of Service**

	Eastbound		Westbound		Northbound		Southbound		Intersection	
	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS
Existing Geometry	20.9	C	28.4	D	2.4	A	0.8	A	3.7	A
Realigned and Signalized	10.8	B	12.4	B	17.4	B	18.8	B	17.0	B
Single Lane Roundabout	7.5	A	7.9	A	22.3	C	18.0	C	17.9	C
Peanut Roundabout	7.9	A	8.8	A	15.8	C	16.8	C	14.9	C

Under existing conditions, individual approaches have acceptable delays and levels of service during both peak hours. The westbound approach experiences longer delays during the PM Peak period, but still meets the target LOS D. The existing volume analysis demonstrates acceptable operations for both the realigned signal with additional improvements, single lane roundabout control, and peanut roundabout control alternatives.

2043 Operations

The projected increase in traffic at this location is expected to slightly impact the traffic congestion. This intersection was again evaluated for the selected concepts during each of the peak hour periods under the 2043 projected volumes. Table 7 shows the intersection LOS and corresponding delays during the AM Peak Hour. Table 8 shows the intersection LOS and corresponding delays during the PM Peak Hour.

Table 7: Intersections of 9 Mile at Napier 2043 AM Peak Delay and Level of Service

	Eastbound		Westbound		Northbound		Southbound		Intersection	
	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS
Existing Geometry	13.3	B	12.0	B	0.7	A	1.9	A	3.4	A
Realigned and Signalized	7.3	A	5.4	A	13.1	B	13.3	B	11.5	B
Single Lane Roundabout	7.0	A	4.5	A	8.6	A	8.8	A	8.1	A
Peanut Roundabout	7.3	A	4.9	A	7.5	A	8.5	A	7.7	A



Table 8: Intersections of North 9 Mile at Napier 2043 PM Peak Delay and Level of Service

	Eastbound		Westbound		Northbound		Southbound		Intersection	
	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS	Delay (Sec.)	LOS
Existing Geometry	26.6	D	54.9	F	2.3	A	0.8	A	6.3	A
Realigned and Signalized	10.9	B	12.8	B	26.1	C	24.6	C	23.0	C
Single Lane Roundabout	8.2	A	8.7	A	33.6	D	24.7	C	25.4	D
Peanut Roundabout	8.7	A	9.7	A	20.4	C	22.4	C	19.3	C

Under existing conditions, all approaches have acceptable delays and level of service during the peak hours, except for the westbound approach during the PM peak hour. The existing volume analysis demonstrates acceptable operations for the realigned signal with additional improvements, single lane roundabout control, and peanut roundabout control alternatives.

After review of the 2023 and 2043 operations, the realigned signal-controlled intersection with additional improvements, single lane roundabout control intersection, and peanut roundabout control intersection were evaluated for geometric and cost considerations. Renderings can be found in **Appendix E**.

8. BENEFIT AND COST EVALUATION

A benefit and cost evaluation was performed to assist in quantifying and comparing the performance of the three alternatives. This analysis consists of an abbreviated life cycle cost analysis for the intersection to be used alongside other contextually sensitive factors. The life-cycle analysis is based on the methodology described in National Cooperative Highway Research Program (NCHRP) Project 03-110. This project developed a spreadsheet-based computation method to allow comparison of initial construction costs, ongoing maintenance and operations costs, operational efficiencies for a variety of modes, safety impacts, and emissions. The end product is an understanding of long-term costs leading to a quantifiable comparison of alternatives. The spreadsheet and the final report for NCHRP Project 03-110 was finalized in September 2015 and is based upon recent national research data.

This analysis was limited to the difference in quantifiable costs associated with the construction, anticipated safety of the three alternatives and the monetarized costs of motorists' delay. We did not include the planning and design cost, utility relocation cost, construction engineering cost, and operation costs in our analysis. The detailed opinion of cost for each alternative is located in **Appendix F**.

Safety costs use the National Highway Traffic Safety Administration (NHTSA) accounting data for fatal, injury and property damage collisions. The expected crash frequency resulting from implementation of the alternatives was determined in accordance with the methodologies published in MDOT's Michigan Urban Trunkline Intersections Safety Performance Functions (SPFs) Development and Support ORBP Reference Number: OR 14-015. Crash modifications factors (CMFs) were extracted from the FHWA's CMF Clearinghouse. A table summarizing the CMF's used for the crash prediction is shown below:

**Table 9: Crash Modification Factor (CMF) Summary**

Description	CMF	Source
Install a traffic signal	0.56	https://www.cmfclearinghouse.org/study_detail.php?stud=22
Conversion of stop-controlled intersection into single-lane roundabout	0.42	https://www.cmfclearinghouse.org/study_detail.php?stud=46

User delay costs are based on US DOT Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis (Revision 2 – corrected). The calculations use a discount rate of 3.0 percent, in keeping with OMB Circular A-4 recommendations, to convert future costs into a present value. The life cycle calculations assume an operating interval of 20 years and calculates the Present Value of Net Benefits for each alternative. The Present Value of Net Benefits is the Net Present Value (NPV) of Benefits minus the NPV of Costs. This information is summarized in Table 10.

Table 10: Net Present Value Comparison

	Realigned Signal Control	Roundabout Control	Peanut Roundabout
NPV of Auto Passenger Time Benefit	\$ (3,356,852)	\$ (2,341,759)	\$ (2,000,611)
NPV of Truck Time Benefit	\$ (187,237)	\$ (130,618)	\$ (111,589)
NPV of Safety Benefit	\$ 392,370	\$ 517,215	\$ 517,215
NPV of Construction Costs	\$ 3,413,303	\$ 1,997,869	\$ 2,342,093
Total Present Value of Net Benefits	\$ (6,565,022)	\$ (3,953,030)	\$ (3,937,078)
Benefit-Cost Ratio	-0.92	-0.98	-0.68

Based on this abbreviated analysis, all of the alternatives have a negative total present value of net benefits. A detailed breakdown can be found in **Appendix G**.

In addition to the NCHRP spreadsheet, the Michigan Department of Transportation (MDOT) Time of Return (TOR) spreadsheet was also completed. This spreadsheet is a requirement for MDOT safety program applications.

The TOR spreadsheet reviews crash data between 3-5 years and applies crash reduction factors (CRFs). Each CRF has a percentage associated with a specific type of crash. Additionally, each crash may only be applied to one CRF. In addition to crash type, crash severity is also reviewed. Fatalities and incapacitating or A-level injuries have a greater impact on the TOR. The resultant number that is produced from the spreadsheet expresses the number of years that it will take to offset the cost of the improvement. Therefore, a lower TOR value is desired and will have a greater chance of getting funding.

For the installation of a signal from stop control, angle crashes provide a 65% reduction, rear-end crashes provide a -25% reduction, and all other non-rear-end crashes provide a 20% reduction. Rear-end crashes tend to increase when a signal is installed; hence, the negative reduction. For the installment of a roundabout, a 78% reduction occurs for all fatal and A-injuries along with a 57% reduction for all minor crashes. This information is summarized in Table 10. A detailed breakdown can be found in **Appendix H**.

**Table 11: Time of Return Comparison**

Alternative	Crash Data (Years)	TOR
Realigned Signalized Intersection	2018-2020	29.38
Single Lane Roundabout	2021-2023	12.09
Peanut Roundabout	2021-2023	14.17

9. APPROXIMATE RIGHT-OF-WAY IMPACTS AND COST

The following table quantifies the potential impacts and costs associated with purchasing a permanent Highway Easement at each intersection. The calculations are rough and are based on the concepts provided. Property values are based on Zillow™ and the assessed value. The property value of parcel number 21-25-400-011 is the assessed value times two. One person owns both properties, 22301 Napier Road and 22-36-200-015, where the same property value is used in the calculation. The total approximate ROW acquisition cost includes a \$2,500 sum to cover costs of appraisal, title work, and register of deeds. This new total was multiplied by an adjustment factor of 1.6 to account for market conditions/after sales costs, being a parcel in Oakland County, and for rental/inconvenience per year of the project. This is not intended to be a comprehensive right-of-way cost, but rather another data point for the RCOC to use to assess the merits of pursuing each concept.

Table 12: ROW Acquisition for Realigned Signalized Intersection

Address/Parcel Number	Property Value(\$) per Zillow	Approx. Hwy Esmt (sft)	Approx. Esmt cost / sft	Approx. ROW acquisition cost (\$)
22301 Napier Rd	264,300	63	\$ 3.85	4,387.78
22422 Napier Rd	291,100	3,661	\$ 3.09	22,122.59
21-25-400-011	107,860	2,858	\$ 0.51	6,322.88
21-36-200-015	264,300	9,271	\$ 3.85	61,064.34

Table 13: ROW Acquisition for Single Lane Roundabout

Address/Parcel Number	Property Value(\$) per Zillow	Approx. Hwy Esmt (sft)	Approx. Esmt cost / sft	Approx. ROW acquisition cost (\$)
22301 Napier Rd	264,300	52	\$ 3.85	4,320.06
22422 Napier Rd	291,100	49	\$ 3.09	4,242.56
21-25-400-011	107,860	1,454	\$ 0.51	5,181.76
21-36-200-015	264,300	6,450	\$ 3.85	43,700.67

Table 14: ROW Acquisition for Peanut Roundabout

Address/Parcel Number	Property Value (\$) per Zillow	Approx. Hwy Esmt (sft)	Approx. Esmt cost / sft	Approx. ROW acquisition cost (\$)
22335 Waterland Dr	768,600	1,318	\$ 11.20	27,624.75
22422 Napier Rd	291,100	254	\$ 3.09	5,237.34
21-25-400-011	107,860	3,377	\$ 0.51	6,744.69
21-36-200-015	264,300	3,517	\$ 3.85	25,647.65



10. CONCEPT DISCUSSION AND CONCLUSION

Under existing conditions there are identified safety concerns at the intersection of 9 Mile Road at Napier Road. Historical crash patterns at this location identify angle crashes in the eastbound direction. Vehicles on 9 Mile Road fail to yield to traffic on Napier Road. Inadequate gaps and limited sight distance may be contributing to this crash pattern.

With the operational and safety performance of the existing intersection configuration, it is likely that improvements to the intersection will be necessary as traffic volumes increase. Multiple alternatives were explored for potential improvements at this location. The most promising alternatives are a realigned signalized intersection with additional improvements, a single lane roundabout, and a peanut roundabout.

Realigned and Signalized Intersection

This alternative eliminates the staggered configuration, by creating a single signalized four-legged intersection that aligns 9 Mile Road to Napier Road at approximately 83 degrees. Additionally, this option adds a 100-foot left-turn lane to all four legs, plus a right-turn lane at all legs except the east leg. This alternative no longer requires split phasing since the east and west legs are aligned. Allowing eastbound and westbound traffic movements to occur at the same time would result in less delay.

Realigning this intersection allows for more conventional signal phasing and eliminates the left-turn conflict between both 9 Mile Road approaches. This alternative will change the roadway alignment, with the footprint of the intersection expanding to the southwest. Highway easements are required for the northeast, northwest, and southwest quadrants. Proposed roadwork within public utility easements are required for both the southeast and southwest quadrants.

This option would maintain the high-speed context of the intersection and introduce curvature along 9 Mile Road in advance of the Napier Road intersection. Both features increase intersection crash risk severity.

Single Lane Roundabout Intersection

This alternative includes the construction of a single lane roundabout with an ovular shape having an inscribed circle diameter of approximately 150 feet by 110 feet at this intersection. Passenger vehicles are accommodated in the circulating roadway with larger vehicles using the provided truck apron for the required additional width. As with all roundabouts, all approaches will be under yield control.

The installation of a roundabout at this location would improve capacity over the existing side street stop control. The roundabout approach geometry will help reduce speeds, reduce conflict points, and help reduce the severity of crashes at this location. This alternative will change the roadway alignment, with the footprint of the intersection expanding to the southwest. Additionally, roundabouts are found to greatly reduce the number of severe crashes at intersections due to their geometry. Installing a roundabout at this intersection would likely eliminate angle crashes.

All approaches to the intersection will need to be reconstructed to develop appropriate entry geometry. Easements would need to be acquired along the northeast, northwest, and southwest quadrants of the intersection.



Peanut Roundabout Intersection

This alternative includes the construction of a single lane roundabout with a peanut shape at this intersection. This geometry allows for improved separation of approaches while maintaining a smaller impact outside the existing right-of-way. Passenger vehicles are accommodated in the circulating roadway with larger vehicles using the provided truck apron for the required additional width. As with all roundabouts, all four approaches will be under yield control.

The installation of a roundabout at this location would improve capacity over the existing side street stop control. The roundabout approach geometry will help reduce speeds, reduce conflict points, and help reduce the severity of crashes at this location. This alternative will change the roadway alignment, with the footprint of the intersection expanding to the southwest. The peanut roundabout alternative has a larger footprint than the single lane roundabout alternative. A roundabout at this location will improve capacity for the current stop-controlled approaches.

All approaches to the intersection will need to be reconstructed to develop appropriate entry geometry. Easements would need to be acquired along all four quadrants of the intersection.

Conclusion

The cost-benefit analysis indicates the studied alternatives will not provide a net benefit to justify the improvement costs. While the benefit is not shown, several other factors contribute to these intersections. Safety is improved in all of these cases.

The time of return analysis shows that the roundabout alternatives have a lower TOR compared to the realigned signalized alternative. Specifically, the single lane roundabout has the best time of return with only 12.09.

In addition, several crashes involved pedestrians and/or bicyclists. To help improve the safety of this intersection high-emphasis crosswalks should be provided. Pedestrian signage can also be installed with either of the roundabout alternatives. These improvements will help improve the visibility of vulnerable road users to motorists. Furthermore, changing the intersection control to either a signalized or roundabout intersection provides an environment where motorists are used to experiencing vulnerable road users. Under existing conditions, traffic on Napier Road has no reason to stop or slow down and are not expecting pedestrian/bicyclist traffic at the intersection. If no intersection improvements are desired, a midblock crossing would be a good alternative for vulnerable road users to safely cross Napier Road.

At this intersection, there are proposed future developments on the northeast and northwest corners. RCOC, the City, and the Township, continue to work with developers to determine the best outcome for this intersection.

APPENDIX A

TRAFFIC DATA

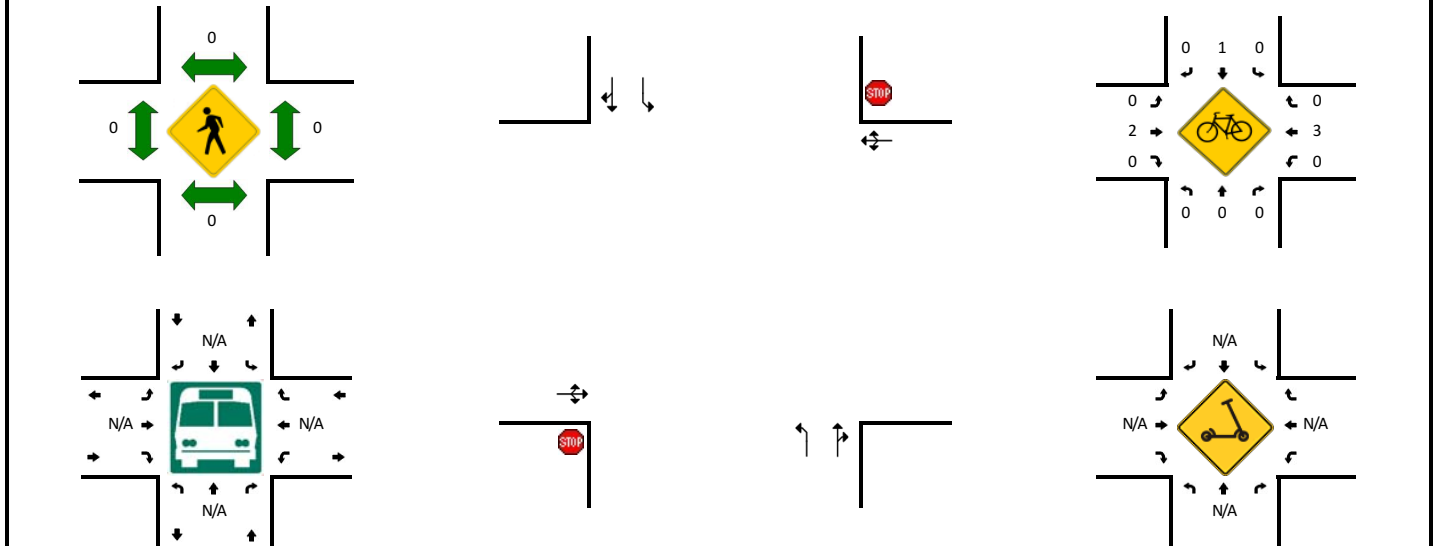
LOCATION: Napier Rd -- 9 Mile Rd

CITY/STATE: Lyon Twp/Novi, MI

QC JOB #: 16233103

DATE: Thu, Jun 1 2023

Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:15 PM -- 5:30 PM



15-Min Count Period Beginning At	Napier Rd (Northbound)				Napier Rd (Southbound)				9 Mile Rd (Eastbound)				9 Mile Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
12:00 AM	1	6	1	0	0	2	0	0	1	1	0	0	0	2	0	0	14	
12:15 AM	3	5	0	0	0	2	1	0	1	0	0	0	0	0	0	0	12	
12:30 AM	1	2	1	0	1	3	1	0	0	0	1	0	0	0	0	0	10	
12:45 AM	1	2	0	0	0	3	0	0	0	0	1	0	2	0	1	0	10	46
1:00 AM	0	2	0	0	1	5	0	0	0	0	0	0	0	0	0	0	8	40
1:15 AM	0	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	4	32
1:30 AM	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	25
1:45 AM	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4	19
2:00 AM	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	13
2:15 AM	2	1	0	0	0	0	0	0	1	0	2	0	0	0	0	0	6	15
2:30 AM	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4	16
2:45 AM	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3	15
3:00 AM	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	17
3:15 AM	0	2	0	0	0	1	0	0	0	0	2	0	0	0	0	0	5	16
3:30 AM	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	15
3:45 AM	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	16
4:00 AM	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	15
4:15 AM	0	1	0	0	0	8	1	0	0	0	0	0	0	0	0	0	10	20
4:30 AM	0	6	0	0	0	9	0	0	0	0	1	0	0	0	0	0	16	33
4:45 AM	0	4	0	0	0	6	0	0	0	0	3	0	0	0	1	0	14	43
5:00 AM	0	7	0	0	0	12	0	0	0	0	3	0	1	0	0	0	23	63
5:15 AM	0	6	1	0	0	18	0	0	0	0	1	0	1	0	0	0	27	80
5:30 AM	0	17	0	0	1	21	1	0	2	0	3	0	1	1	0	0	47	111
5:45 AM	1	21	1	0	0	16	2	0	1	1	6	0	4	0	5	0	58	155
6:00 AM	1	14	0	0	2	33	2	0	2	0	8	0	1	0	3	0	66	198
6:15 AM	1	27	1	0	0	36	0	0	6	2	9	0	4	1	1	0	88	259
6:30 AM	2	32	1	0	6	65	1	1	8	1	17	0	1	0	3	0	138	350
6:45 AM	3	66	1	0	2	48	3	0	11	2	16	0	8	1	7	0	168	460
7:00 AM	4	72	3	0	0	66	1	0	19	8	21	0	5	1	0	0	200	594
7:15 AM	5	53	4	0	2	66	7	0	16	12	12	0	5	0	7	0	189	695
7:30 AM	5	74	2	0	7	81	4	0	16	25	17	0	2	1	8	0	242	799
7:45 AM	4	84	6	0	8	82	3	0	6	16	13	0	0	2	6	0	230	861
8:00 AM	5	53	2	0	5	75	4	0	10	11	15	0	4	0	7	0	191	852
8:15 AM	6	68	2	0	5	69	5	0	15	24	10	0	1	4	6	0	215	878
8:30 AM	5	81	5	0	4	78	7	0	9	5	13	0	3	7	8	0	225	861
8:45 AM	8	65	3	0	2	68	10	0	12	8	12	0	8	9	2	0	207	838
9:00 AM	7	76	4	0	5	78	8	0	10	3	13	0	8	4	6	0	222	869
9:15 AM	6	65	3	0	4	57	7	0	8	4	12	0	4	6	3	0	179	833
9:30 AM	1	52	2	0	6	57	7	0	7	3	8	0	4	5	9	0	161	769

15-Min Count Period Beginning At	Napier Rd (Northbound)				Napier Rd (Southbound)				9 Mile Rd (Eastbound)				9 Mile Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
9:45 AM	7	59	4	0	6	50	4	0	8	0	7	0	5	0	10	0	160	722
10:00 AM	3	66	3	0	5	52	5	0	8	1	4	0	6	2	8	0	163	663
10:15 AM	4	68	4	0	10	66	4	0	3	3	7	0	10	3	7	0	189	673
10:30 AM	7	78	3	0	1	63	7	0	12	1	8	0	8	1	15	0	204	716
10:45 AM	0	63	13	0	5	41	8	0	11	5	5	0	6	4	5	0	166	722
11:00 AM	2	51	3	0	6	59	9	0	8	2	9	0	4	3	6	0	162	721
11:15 AM	3	49	3	0	8	61	8	0	14	3	5	0	9	1	7	0	171	703
11:30 AM	5	64	4	0	5	44	8	0	7	1	3	0	6	3	7	0	157	656
11:45 AM	3	72	2	0	5	68	8	0	5	1	9	0	9	4	7	0	193	683
12:00 PM	2	87	3	0	13	68	7	0	7	2	8	0	4	6	4	0	211	732
12:15 PM	6	86	4	0	6	63	5	0	8	5	5	0	9	6	3	0	206	767
12:30 PM	3	74	5	0	4	53	8	0	7	4	2	0	5	5	5	0	175	785
12:45 PM	4	53	1	0	8	39	8	0	6	1	6	0	3	5	3	0	137	729
1:00 PM	6	48	8	0	6	65	8	0	7	4	7	0	12	4	4	0	179	697
1:15 PM	5	85	8	0	6	68	8	0	7	3	5	0	7	1	10	0	213	704
1:30 PM	7	60	5	0	4	65	6	0	3	2	8	0	11	5	10	0	186	715
1:45 PM	5	74	3	0	5	86	7	0	8	4	6	0	5	3	4	0	210	788
2:00 PM	6	89	6	0	9	60	6	0	11	3	10	0	4	5	10	0	219	828
2:15 PM	5	64	4	1	6	87	15	0	9	3	8	0	7	5	5	0	219	834
2:30 PM	8	82	7	0	6	89	7	0	9	4	9	0	6	7	20	0	254	902
2:45 PM	9	90	6	0	10	82	9	0	6	7	5	0	9	4	5	0	242	934
3:00 PM	9	111	5	0	9	99	11	0	11	5	12	0	16	9	10	0	307	1022
3:15 PM	5	77	5	0	6	120	9	0	4	10	8	0	16	13	5	0	278	1081
3:30 PM	11	107	5	0	5	114	12	0	12	5	11	0	10	17	10	0	319	1146
3:45 PM	15	131	6	0	8	126	11	0	10	4	8	0	9	18	16	0	362	1266
4:00 PM	18	154	7	0	9	87	24	0	6	8	10	0	10	32	10	0	375	1334
4:15 PM	21	140	6	0	7	95	23	0	3	2	8	0	14	27	16	0	362	1418
4:30 PM	12	139	3	0	10	105	25	0	5	5	5	0	17	22	14	0	362	1461
4:45 PM	17	137	10	0	6	140	25	0	8	9	12	0	13	18	18	0	413	1512
5:00 PM	10	138	11	0	9	151	17	0	13	4	17	0	16	22	14	0	422	1559
5:15 PM	26	129	14	0	4	185	23	0	6	12	20	0	9	17	16	0	461	1658
5:30 PM	28	169	10	0	6	156	14	0	10	10	8	0	11	16	12	0	450	1746
5:45 PM	16	138	11	0	6	132	15	0	11	9	14	0	2	13	12	0	379	1712
6:00 PM	6	113	5	0	12	120	13	0	11	13	13	0	4	6	7	0	323	1613
6:15 PM	17	83	3	0	5	95	8	0	5	5	14	0	5	5	4	0	249	1401
6:30 PM	13	87	3	0	8	88	5	0	4	6	14	0	5	2	7	0	242	1193
6:45 PM	20	59	6	0	8	53	12	0	5	1	7	0	3	3	4	0	181	995
7:00 PM	9	65	4	0	9	77	13	0	7	3	7	0	1	2	4	0	201	873
7:15 PM	4	57	3	0	5	63	13	0	2	2	6	0	3	4	4	0	166	790
7:30 PM	22	59	4	0	6	46	11	0	3	3	12	0	0	3	6	0	175	723
7:45 PM	12	75	2	0	9	51	6	0	6	0	4	0	1	1	2	0	169	711
8:00 PM	14	62	5	0	11	54	12	0	6	1	6	0	3	9	6	0	189	699
8:15 PM	23	59	4	0	5	41	16	0	3	3	4	0	4	17	3	0	182	715
8:30 PM	23	44	1	0	4	49	12	0	5	0	6	0	1	6	5	0	156	696
8:45 PM	18	47	0	0	7	41	6	0	3	1	4	0	1	1	3	0	132	659
9:00 PM	7	29	3	0	5	38	7	0	3	1	9	0	1	2	0	0	105	575
9:15 PM	10	33	1	0	2	40	6	0	2	1	8	0	0	2	4	0	109	502
9:30 PM	9	35	11	0	1	44	5	0	5	3	3	0	0	2	5	0	123	469
9:45 PM	12	42	1	0	3	27	2	0	3	0	5	0	1	0	3	0	99	436
10:00 PM	8	39	0	0	2	27	2	0	3	1	3	0	1	0	1	0	87	418
10:15 PM	7	28	3	0	2	8	4	0	5	1	1	0	2	0	2	0	63	372
10:30 PM	4	13	1	0	0	11	1	0	1	0	5	0	0	2	1	0	39	288
10:45 PM	3	9	0	0	0	11	3	0	0	0	3	0	0	0	1	0	30	219
11:00 PM	3	6	0	0	4	14	5	0	2	0	0	0	0	0	1	0	35	167
11:15 PM	1	9	0	0	0	11	1	0	0	0	0	0	1	0	1	0	24	128
11:30 PM	3	9	1	0	0	6	0	0	0	0	1	0	0	0	0	0	20	109
11:45 PM	1	5	2	0	0	6	0	0	0	0	3	0	0	0	1	0	18	97
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	104	516	56	0	16	740	92	0	24	48	80	0	36	68	64	0	1844	
Heavy Trucks	4	28	4		0	16	4		0	4	0		0	0	0		60	
Buses																		
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scooters																		
Comments:																		

Report generated on 6/12/2023 9:48 AM

SOURCE: Quality Counts, LLC (<http://www.qualitycounts.net>) 1-877-580-2212

APPENDIX B

CRASH DATA



Transportation Improvement Association

Crash Detail for 1/1/2018 - 12/31/2023

Criteria: WHERE A.AGENCY_ID = 14 AND cast(A.DATE_VAL as date) BETWEEN '01/01/2018'
AND '12/31/2023' AND A.GeoCoords.STIntersects(GEOMETRY::STGeomFromWKB(GEOGRAPH

#1	Location: NAPIER (0.993) 25 feet Sof 9 MILE RD							Crash ID: 1405994						
Date:	06/04/2018		Day:	Mon	Hour:	5pm	Weather:	clear	Roadway:	dry	Light:	day		
Injy K:	0		Injy A:	0	Injy B:	0	Injy C:	0	Injy 0:	2	How:	rr-end		
CVT:	Novi			Area:			w/i intersection		HBD:	N	Drugs:	N	Complaint #:	180031826
Unit#	Veh Dir	Action Prior	Event 1		Event 2		Event 3		Event 4		Haz Action		Veh Type	Damage
1	S	go straight	veh in transpt		none		none		none		unable to stop		car	ctrfront
2	S	slow/stop on rd	veh in transpt		none		none		none		none		car	ctrrear

UD10: [1405994](#)

#2	Location: NINE MILE (0) 2 feet Wof NAPIER RD							Crash ID: 1483477						
Date:	08/24/2018		Day:	Fri	Hour:	5pm	Weather:	cloudy	Roadway:	dry	Light:	day		
Injy K:	0		Injy A:	1	Injy B:	0	Injy C:	0	Injy 0:	1	How:	angle		
CVT:	Lyon Twp			Area:	w/i intersection			HBD:	N	Drugs:	N	Complaint #:	180159792	
Unit#	Veh Dir	Action Prior	Event 1		Event 2		Event 3		Event 4		Haz Action		Veh Type	Damage
1	E	left turn	veh in transpt		none		none		none		failed to yield		car	lftside
2	S	go straight	veh in transpt		none		none		none		none		car	ctrfront

UD10: [1483477](#)

#3	Location: NAPIER (0.998) 0 feet Xof 9 MILE RD							Crash ID: 1568570						
Date:	11/26/2018		Day:	Mon	Hour:	3pm	Weather:	clear	Roadway:	wet	Light:	day		
Injy K:	0		Injy A:	0	Injy B:	0	Injy C:	0	Injy 0:	2	How:	ss-same		
CVT:	Novi			Area:	w/i intersection			HBD:	N	Drugs:	N	Complaint #:	180065313	
Unit#	Veh Dir	Action Prior	Event 1		Event 2		Event 3		Event 4		Haz Action		Veh Type	Damage
1	N	change lanes	veh in transpt		none		none		none		failed to yield		car	rtside
2	N	go straight	veh in transpt		none		none		none		none		car	lftside

UD10: [1568570](#)

#4	Location: 9 MILE (9.421) 99 feet Eof NAPIER RD							Crash ID: 1823564						
Date:	09/24/2019		Day:	Tue	Hour:	2pm	Weather:	clear	Roadway:	dry	Light:	day		
Injy K:	0		Injy A:	0	Injy B:	0	Injy C:	1	Injy 0:	1	How:	angle		
CVT:	Novi			Area:			inter other		HBD:	N	Drugs:	N	Complaint #:	190188651
Unit#	Veh Dir	Action Prior	Event 1		Event 2		Event 3		Event 4		Haz Action		Veh Type	Damage
1	SE	left turn	veh in transpt		none		none		none		other		car	lftfront
2	SW	stop on road	veh in transpt		none		none		none		none		car	lftfront

UD10: [1823564](#)



#5 **Location:** NAPIER (0.998) 0 feet Xof 9 MILE RD **Crash ID:** 1987623
Date: 03/12/2020 **Day:** Thu **Hour:** 5pm **Weather:** clear **Roadway:** dry **Light:** day
Injy K: 0 **Injy A:** 0 **Injy B:** 0 **Injy C:** 0 **Injy 0:** 3 **How:** angle
CVT: Novi **Area:** w/i intersection **HBD:** N **Drugs:** N **Complaint #:** 200011853

Unit#	Veh Dir	Action Prior	Event 1	Event 2	Event 3	Event 4	Haz Action	Veh Type	Damage
1	E	left turn	veh in transpt	none	none	none	failed to yield	car	rtside
2	N	go straight	veh in transpt	none	none	none	none	car	ctrfront

UD10: [1987623](#)

#6 **Location:** NAPIER (1.001) 16 feet Nof 9 MILE RD **Crash ID:** 2225249
Date: 02/19/2021 **Day:** Fri **Hour:** 5pm **Weather:** snow **Roadway:** snow **Light:** dawn
Injy K: 0 **Injy A:** 0 **Injy B:** 2 **Injy C:** 0 **Injy 0:** 0 **How:** angle
CVT: Novi **Area:** inter other **HBD:** N **Drugs:** N **Complaint #:** 210010664

Unit#	Veh Dir	Action Prior	Event 1	Event 2	Event 3	Event 4	Haz Action	Veh Type	Damage
1	NE	left turn	veh in transpt	none	none	none	failed to yield	car	lftside
2	SE	go straight	veh in transpt	none	none	none	none	car	ctrfront

UD10: [2225249](#)

#7 **Location:** NAPIER (0.997) 5 feet Sof 9 MILE RD **Crash ID:** 2360316
Date: 08/24/2021 **Day:** Tue **Hour:** 11a **Weather:** clear **Roadway:** dry **Light:** day
Injy K: 0 **Injy A:** 0 **Injy B:** 0 **Injy C:** 0 **Injy 0:** 4 **How:** angle
CVT: Novi **Area:** w/i intersection **HBD:** N **Drugs:** N **Complaint #:** 210175098

Unit#	Veh Dir	Action Prior	Event 1	Event 2	Event 3	Event 4	Haz Action	Veh Type	Damage
1	E	left turn	veh in transpt	none	none	none	failed to yield	car	ctrfront
2	S	go straight	veh in transpt	none	none	none	none	car	rtside

UD10: [2360316](#)

#8 **Location:** NAPIER (0.994) 21 feet Sof 9 MILE RD **Crash ID:** 2536194
Date: 02/26/2022 **Day:** Sat **Hour:** 7pm **Weather:** clear **Roadway:** dry **Light:** dark/unltd
Injy K: 0 **Injy A:** 0 **Injy B:** 0 **Injy C:** 0 **Injy 0:** 1 **How:** single
CVT: Novi **Area:** straight **HBD:** N **Drugs:** N **Complaint #:** 220040831

Unit#	Veh Dir	Action Prior	Event 1	Event 2	Event 3	Event 4	Haz Action	Veh Type	Damage
1	N	go straight	animal	none	none	none	none	car	rtfront

UD10: [2536194](#)

#9	Location: NAPIER (0.998) 0 feet Sof 9 MILE RD							Crash ID: 2652343						
Date:	08/01/2022		Day:	Mon	Hour:	5pm	Weather:	clear	Roadway:	dry	Light:	day		
Injy K:	0		Injy A:	0	Injy B:	0	Injy C:	0	Injy 0:	5	How:	angle		
CVT:	Novi			Area:			inter other		HBD:	N	Drugs:	N	Complaint #:	220169672
Unit#	Veh Dir	Action Prior	Event 1		Event 2		Event 3		Event 4		Haz Action		Veh Type	Damage
1	E	right turn	veh in transpt		none		none		none		failed to yield		car	ctrfront
2	S	go straight	veh in transpt		none		none		none		none		pickup	rtside

UD10: [2652343](#)

#10	Location: 9 MILE (9.43) 49 feet Eof NAPIER RD							Crash ID: 2703614						
Date:	09/30/2022		Day:	Fri	Hour:	7am	Weather:	clear	Roadway:	dry	Light:	day		
Injy K:	0		Injy A:	0	Injy B:	0	Injy C:	1	Injy 0:	1	How:	other		
CVT:	Novi			Area:		straight		HBD:	N	Drugs:	N	Complaint #:	220038339	
Unit#	Veh Dir	Action Prior	Event 1		Event 2		Event 3		Event 4		Haz Action		Veh Type	Damage
1	E	left turn	bicyclist		none		none		none		unknown		car	rtfront
2	E	go straight	veh in transpt		none		none		none		none		uncoded	none

UD10: [2703614](#)

#11	Location: 9 MILE (0.001) 4 feet Wof NAPIER RD							Crash ID: 2772246					
Date:	12/09/2022		Day:	Fri	Hour:	7am	Weather:	cloudy	Roadway:	dry	Light:	dawn	
Injy K:	0		Injy A:	0	Injy B:	0	Injy C:	0	Injy 0:	2	How:	ss-opp	
CVT:	Lyon Twp			Area:	w/i intersection			HBD:	N	Drugs:	N	Complaint #:	220275832
Unit#	Veh Dir	Action Prior	Event 1	Event 2	Event 3	Event 4	Haz Action	Veh Type	Damage				
1	W	left turn	cross ctrline	none	none	none	left of center	car	lftside				
2	E	stop on road	veh in transpt	none	none	none	none	car	lftfront				

UD10: [2772246](#)

#12	Location: NAPIER (1.036) 200 feet Nof 9 MILE RD							Crash ID: 2812235						
Date:	01/25/2023		Day:	Wed	Hour:	2pm	Weather:	snow	Roadway:	snow	Light:	day		
Injy K:	0		Injy A:	0	Injy B:	0	Injy C:	0	Injy 0:	1	How:	single		
CVT:	Novi			Area:			straight		HBD:	N	Drugs:	N	Complaint #:	230020117
Unit#	Veh Dir	Action Prior	Event 1		Event 2		Event 3		Event 4		Haz Action		Veh Type	Damage
1	S	go straight	loss of control		none		none		none		speeding		car	rtrear

UD10: [2812235](#)



#13 **Location:** SB 9 MILE (0.004) 20 feet Wof NAPIER RD

Crash ID: 2969080

Date: 08/13/2023 **Day:** Sun **Hour:** 6pm **Weather:** clear

Roadway: dry **Light:** day

Injy K: 0 **Injy A:** 1 **Injy B:** 0 **Injy C:** 0

Injy 0: 2 **How:** single

CVT: Lyon Twp **Area:** straight

HBD: N **Drugs:** N

Complaint #: 230201369

Unit#	Veh Dir	Action Prior	Event 1	Event 2	Event 3	Event 4	Haz Action	Veh Type	Damage
1	S	go straight	bicyclist	none	none	none	none	car	lftfront
2	W	enter rdwy	veh in transpt	none	none	none	other	uncoded	none

UD10: [2969080](#)

Crash Type

Count	Type
0	uncoded
3	single
0	head-on
0	head-on/lt
6	angle
1	rr-end
0	rr-end/lt
0	rr-end/rt
1	ss-same
1	ss-opp
0	back
1	other
0	unknown
Totals	13

Lighting Conditions

Count	Type
0	uncoded
10	day
2	dawn
0	dusk
0	dark/ltd
1	dark/unltd
0	other
0	unknown
Totals	13

Weather Conditions

Count	Type
0	uncoded
9	clear
2	cloudy
0	fog
0	rain
2	snow
0	wind
0	sleet/hail
0	blowing snow
0	blowing sand
0	smoke
0	unknown
Totals	13

Road Condition

Count	Type
0	uncoded
10	dry
1	wet
0	ice
2	snow
0	mud
0	slush
0	debris
0	water
0	sand
0	oily
0	other
0	unknown
Totals	13

Crashes by Month

Count	Type
1	January
2	February
1	March
0	April
0	May
1	June
0	July
4	August
2	September
0	October
1	November
1	December
Totals	13

Hazardous Action

Count	Type
12	none
1	speeding
0	spd too slow
6	failed to yield
0	disrgd traffic cntrl
0	wrong way
1	left of center
0	imprp passing
0	imprp lane use
0	imprp turn
0	imprp/no signal
0	imprp backing
1	unable to stop
2	other
1	unknown
0	reckls driving
0	carels driving
Totals	24

Unit Type

Count	Type
2	Bicyclist
0	Engineer
22	Vehicle
0	Pedestrian
Totals	24

Crashes by Year

Count	Type
3	2018
1	2019
1	2020
2	2021
4	2022
2	2023
Totals	13

Crash Severity

	Fatal	A	B	C	No Injy	Total
Persons	0	2	2	2	0	6
Crashes	0	2	1	2	8	13

Alcohol in Crashes

	Fatal	A	B	C	PDO	Total
Drinking	0	0	0	0	0	0
Not Drinking	0	2	1	2	8	13
Totals	0	2	1	2	8	13

Crashes per Hour by Day

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total
12a-1a	0	0	0	0	0	0	0	0
1a-2a	0	0	0	0	0	0	0	0
2a-3a	0	0	0	0	0	0	0	0
3a-4a	0	0	0	0	0	0	0	0
4a-5a	0	0	0	0	0	0	0	0
5a-6a	0	0	0	0	0	0	0	0
6a-7a	0	0	0	0	0	0	0	0
7a-8a	0	0	0	0	0	2	0	2
8a-9a	0	0	0	0	0	0	0	0
9a-10a	0	0	0	0	0	0	0	0
10a-11a	0	0	0	0	0	0	0	0
11a-12p	0	0	1	0	0	0	0	1
12p-1p	0	0	0	0	0	0	0	0
1p-2p	0	0	0	0	0	0	0	0
2p-3p	0	0	1	1	0	0	0	2
3p-4p	0	1	0	0	0	0	0	1
4p-5p	0	0	0	0	0	0	0	0
5p-6p	0	2	0	0	1	2	0	5
6p-7p	1	0	0	0	0	0	0	1
7p-8p	0	0	0	0	0	0	1	1
8p-9p	0	0	0	0	0	0	0	0
9p-10p	0	0	0	0	0	0	0	0
10p-11p	0	0	0	0	0	0	0	0
11p-12a	0	0	0	0	0	0	0	0
Totals	1	3	2	1	1	4	1	13

APPENDIX C

OPERATIONAL ANALYSIS – 2023 CONDITIONS

HCM 6th TWSC
4: Napier Rd & 9 Mile Rd

09/25/2023

Intersection						
Int Delay, s/veh	1.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	7	34	279	12	101	337
Future Vol, veh/h	7	34	279	12	101	337
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	83	83	94	94
Heavy Vehicles, %	2	2	4	4	7	7
Mvmt Flow	8	37	336	14	107	359
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	916	343	0	0	350	0
Stage 1	343	-	-	-	-	-
Stage 2	573	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.17	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.263	-
Pot Cap-1 Maneuver	302	700	-	-	1182	-
Stage 1	719	-	-	-	-	-
Stage 2	564	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	275	700	-	-	1182	-
Mov Cap-2 Maneuver	392	-	-	-	-	-
Stage 1	719	-	-	-	-	-
Stage 2	513	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	11.3	0	1.9			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	617	1182	-	
HCM Lane V/C Ratio	-	-	0.071	0.091	-	
HCM Control Delay (s)	-	-	11.3	8.3	-	
HCM Lane LOS	-	-	B	A	-	
HCM 95th %tile Q(veh)	-	-	0.2	0.3	-	

HCM 6th TWSC
6: Napier Rd & 9 Mile Rd

09/25/2023

Intersection						
Int Delay, s/veh	3.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	47	131	27	286	307	16
Future Vol, veh/h	47	131	27	286	307	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	77	77	83	83	94	94
Heavy Vehicles, %	2	2	4	4	7	7
Mvmt Flow	61	170	33	345	327	17
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	747	336	344	0	-	0
Stage 1	336	-	-	-	-	-
Stage 2	411	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.14	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.236	-	-	-
Pot Cap-1 Maneuver	381	706	1204	-	-	-
Stage 1	724	-	-	-	-	-
Stage 2	669	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	371	706	1204	-	-	-
Mov Cap-2 Maneuver	482	-	-	-	-	-
Stage 1	704	-	-	-	-	-
Stage 2	669	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	12.2	0.7		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1204	-	482	706	-	-
HCM Lane V/C Ratio	0.027	-	0.127	0.241	-	-
HCM Control Delay (s)	8.1	-	13.5	11.7	-	-
HCM Lane LOS	A	-	B	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.4	0.9	-	-

HCM 6th TWSC
4: Napier Rd & 9 Mile Rd

09/25/2023

Intersection						
Int Delay, s/veh	3.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	49	133	573	45	60	664
Future Vol, veh/h	49	133	573	45	60	664
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	88	88	84	84	87	87
Heavy Vehicles, %	2	2	4	4	2	2
Mvmt Flow	56	151	682	54	69	763
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1610	709	0	0	736	0
Stage 1	709	-	-	-	-	-
Stage 2	901	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	115	434	-	-	870	-
Stage 1	488	-	-	-	-	-
Stage 2	396	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	106	434	-	-	870	-
Mov Cap-2 Maneuver	238	-	-	-	-	-
Stage 1	488	-	-	-	-	-
Stage 2	365	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	28.4	0		0.8		
HCM LOS	D					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	-		355	870	
HCM Lane V/C Ratio	-	-		0.583	0.079	
HCM Control Delay (s)	-	-		28.4	9.5	
HCM Lane LOS	-	-		D	A	
HCM 95th %tile Q(veh)	-	-		3.5	0.3	

HCM 6th TWSC
6: Napier Rd & 9 Mile Rd

09/25/2023

Intersection						
Int Delay, s/veh	2.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	37	92	154	552	632	79
Future Vol, veh/h	37	92	154	552	632	79
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	85	85	84	84	87	87
Heavy Vehicles, %	3	3	4	4	2	2
Mvmt Flow	44	108	183	657	726	91
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1795	772	817	0	-	0
Stage 1	772	-	-	-	-	-
Stage 2	1023	-	-	-	-	-
Critical Hdwy	6.43	6.23	4.14	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.327	2.236	-	-	-
Pot Cap-1 Maneuver	88	398	802	-	-	-
Stage 1	454	-	-	-	-	-
Stage 2	345	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	68	398	802	-	-	-
Mov Cap-2 Maneuver	190	-	-	-	-	-
Stage 1	350	-	-	-	-	-
Stage 2	345	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	20.9	2.4		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	802	-	190	398	-	-
HCM Lane V/C Ratio	0.229	-	0.229	0.272	-	-
HCM Control Delay (s)	10.8	-	29.5	17.4	-	-
HCM Lane LOS	B	-	D	C	-	-
HCM 95th %tile Q(veh)	0.9	-	0.9	1.1	-	-

Lanes, Volumes, Timings

4: Napier Rd & 9 Mile Rd

09/25/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	47	76	55	7	7	27	20	279	12	25	307	16
Future Volume (vph)	47	76	55	7	7	27	20	279	12	25	307	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	100		0	100		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.937			0.882			0.994			0.993	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1745	0	1770	1643	0	1736	1816	0	1687	1763	0
Flt Permitted	0.733			0.650			0.496			0.489		
Satd. Flow (perm)	1365	1745	0	1211	1643	0	906	1816	0	868	1763	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		71			29			6			7	
Link Speed (mph)		55			30			45			30	
Link Distance (ft)		1001			1156			288			381	
Travel Time (s)		12.4			26.3			4.4			8.7	
Peak Hour Factor	0.77	0.77	0.77	0.93	0.93	0.93	0.83	0.83	0.83	0.94	0.94	0.94
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	7%	7%	7%
Adj. Flow (vph)	61	99	71	8	8	29	24	336	14	27	327	17
Shared Lane Traffic (%)												
Lane Group Flow (vph)	61	170	0	8	37	0	24	350	0	27	344	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes			Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	22.5	22.5		22.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)	22.5	22.5		22.5	22.5		22.5	22.5		22.5	22.5	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	18.0	18.0		18.0	18.0		18.0	18.0		18.0	18.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effect Green (s)	18.0	18.0		18.0	18.0		18.0	18.0		18.0	18.0	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.40	0.40		0.40	0.40	

Lanes, Volumes, Timings

4: Napier Rd & 9 Mile Rd

09/25/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.11	0.23		0.02	0.05		0.07	0.48		0.08	0.49	
Control Delay	9.2	6.6		8.4	4.9		9.0	12.6		9.2	12.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	9.2	6.6		8.4	4.9		9.0	12.6		9.2	12.7	
LOS	A	A		A	A		A	B		A	B	
Approach Delay		7.3			5.5			12.4			12.5	
Approach LOS		A			A			B			B	

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 45

Control Type: Pretimed

Maximum v/c Ratio: 0.49

Intersection Signal Delay: 10.9

Intersection LOS: B

Intersection Capacity Utilization 37.5%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Napier Rd & 9 Mile Rd

 Ø2 (R)	 Ø4
22.5 s	22.5 s
 Ø6 (R)	 Ø8
22.5 s	22.5 s

Lanes, Volumes, Timings

4: Napier Rd & 9 Mile Rd

09/25/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	35	57	49	73	60	81	573	45	25	632	79
Future Volume (vph)	37	35	57	49	73	60	81	573	45	25	632	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	100		0	100		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.907			0.932			0.989			0.983	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	1673	0	1770	1736	0	1736	1807	0	1770	1831	0
Flt Permitted	0.661			0.687			0.162			0.219		
Satd. Flow (perm)	1219	1673	0	1280	1736	0	296	1807	0	408	1831	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		67			68			11			17	
Link Speed (mph)		55			30			45			30	
Link Distance (ft)		1001			1156			288			381	
Travel Time (s)		12.4			26.3			4.4			8.7	
Peak Hour Factor	0.85	0.85	0.85	0.88	0.88	0.88	0.84	0.84	0.84	0.87	0.87	0.87
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Adj. Flow (vph)	44	41	67	56	83	68	96	682	54	29	726	91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	44	108	0	56	151	0	96	736	0	29	817	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes			Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60		60	15		9	60		9	15		60
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	22.5	22.5		22.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)	22.6	22.6		22.6	22.6		37.4	37.4		37.4	37.4	
Total Split (%)	37.7%	37.7%		37.7%	37.7%		62.3%	62.3%		62.3%	62.3%	
Maximum Green (s)	18.1	18.1		18.1	18.1		32.9	32.9		32.9	32.9	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	18.1	18.1		18.1	18.1		32.9	32.9		32.9	32.9	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.55	0.55		0.55	0.55	

Lanes, Volumes, Timings

4: Napier Rd & 9 Mile Rd

09/25/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.12	0.20		0.15	0.26		0.59	0.74		0.13	0.81	
Control Delay	16.3	8.6		16.6	10.8		29.2	15.9		8.4	19.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	16.3	8.6		16.6	10.8		29.2	15.9		8.4	19.2	
LOS	B	A		B	B		C	B		A	B	
Approach Delay		10.8			12.4			17.4			18.8	
Approach LOS		B			B			B			B	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 60

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Pretimed

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 17.0

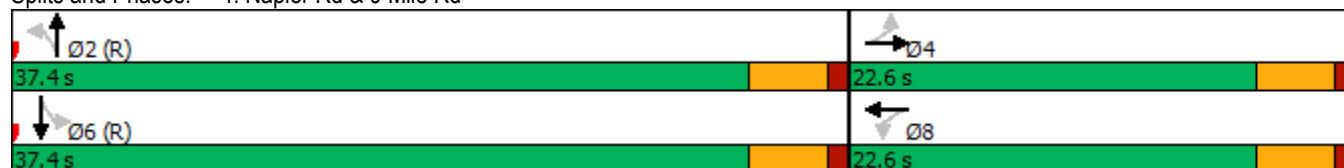
Intersection LOS: B

Intersection Capacity Utilization 69.2%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 4: Napier Rd & 9 Mile Rd



Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	Napier NB	0	0	12.00	1	13.00	1	20.90	33.00	52.00
2	9 Mile EB	90	0	12.00	1	13.00	1	62.00	62.00	44.00
3	Napier SB	180	0	12.00	1	14.00	1	20.40	34.70	48.00
4	9 Mile WB	270	0	12.00	1	14.00	1	9.00	193.00	48.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	Napier NB	110.00	20.00	1	14.00	1	12.00	1
2	9 Mile EB	150.00	20.00	1	13.20	1	12.00	1
3	Napier SB	110.00	20.00	1	13.00	1	12.00	1
4	9 Mile WB	150.00	20.00	1	13.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	Napier NB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	9 Mile EB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	Napier SB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	9 Mile WB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0

Operational Results

2023 AM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)				Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR
			Entry	Bypass	Entry	Bypass		Entry	Bypass	
1	Napier NB	None	320		40		392	931		0.3442
2	9 Mile EB	None	183		315		45	921		0.1992
3	Napier SB	None	358		147		351	993		0.3610
4	9 Mile WB	None	42		390		115	936		0.0451

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Napier NB	None	8.09		8.09	1.69		A		A
2	9 Mile EB	None	6.59		6.59	0.92		A		A
3	Napier SB	None	8.18		8.18	1.60		A		A
4	9 Mile WB	None	4.36		4.36	0.13		A		A

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	Napier NB	0	0	12.00	1	13.00	1	20.90	33.00	52.00
2	9 Mile EB	90	0	12.00	1	13.00	1	62.00	62.00	44.00
3	Napier SB	180	0	12.00	1	14.00	1	20.40	34.70	48.00
4	9 Mile WB	270	0	12.00	1	14.00	1	9.00	193.00	48.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	Napier NB	110.00	20.00	1	14.00	1	12.00	1
2	9 Mile EB	150.00	20.00	1	13.20	1	12.00	1
3	Napier SB	110.00	20.00	1	13.00	1	12.00	1
4	9 Mile WB	150.00	20.00	1	13.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	Napier NB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	9 Mile EB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	Napier SB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	9 Mile WB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0

Operational Results

2023 PM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Napier NB	None	699		147		729	883		0.7918	
2	9 Mile EB	None	129		703		143	728		0.1771	
3	Napier SB	None	736		153		679	989		0.7439	
4	9 Mile WB	None	182		694		195	782		0.2326	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Napier NB	None	22.32		22.32	16.24		C		C
2	9 Mile EB	None	7.52		7.52	0.74		A		A
3	Napier SB	None	18.02		18.02	11.23		C		C
4	9 Mile WB	None	7.94		7.94	0.99		A		A

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	Napier NB	0	0	12.00	1	14.00	1	70.00	52.80	54.00
2	9 Mile EB	90	0	12.00	1	13.00	1	14.40	66.30	47.00
3	Napier SB	180	0	12.00	1	13.00	1	40.00	45.50	35.00
4	9 Mile WB	270	0	12.00	1	13.00	1	11.00	72.40	49.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	Napier NB	100.00	20.00	1	14.00	1	12.00	1
2	9 Mile EB	110.00	20.00	1	13.20	1	12.00	1
3	Napier SB	110.00	20.00	1	13.00	1	12.00	1
4	9 Mile WB	120.00	20.00	1	13.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	Napier NB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	9 Mile EB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	Napier SB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	9 Mile WB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0

Operational Results

2023 AM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)				Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR
			Entry	Bypass	Entry	Bypass		Entry	Bypass	
1	Napier NB	None	320		40		392	1036		0.3093
2	9 Mile EB	None	183		315		45	897		0.2044
3	Napier SB	None	358		147		351	1017		0.3524
4	9 Mile WB	None	42		390		115	868		0.0486

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Napier NB	None	7.13		7.13	1.43		A		A
2	9 Mile EB	None	6.79		6.79	0.95		A		A
3	Napier SB	None	7.94		7.94	1.54		A		A
4	9 Mile WB	None	4.71		4.71	0.15		A		A

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	Napier NB	0	0	12.00	1	14.00	1	70.00	52.80	54.00
2	9 Mile EB	90	0	12.00	1	13.00	1	14.40	66.30	47.00
3	Napier SB	180	0	12.00	1	13.00	1	40.00	45.50	35.00
4	9 Mile WB	270	0	12.00	1	13.00	1	11.00	72.40	49.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	Napier NB	100.00	20.00	1	14.00	1	12.00	1
2	9 Mile EB	110.00	20.00	1	13.20	1	12.00	1
3	Napier SB	110.00	20.00	1	13.00	1	12.00	1
4	9 Mile WB	120.00	20.00	1	13.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	Napier NB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	9 Mile EB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	Napier SB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	9 Mile WB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0

Operational Results

2023 PM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Napier NB	None	699		147		728	984		0.7100	
2	9 Mile EB	None	129		702		143	699		0.1846	
3	Napier SB	None	736		153		678	1014		0.7261	
4	9 Mile WB	None	182		693		195	716		0.2541	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Napier NB	None	15.77		15.77	9.51		C		C
2	9 Mile EB	None	7.89		7.89	0.79		A		A
3	Napier SB	None	16.79		16.79	10.11		C		C
4	9 Mile WB	None	8.76		8.76	1.13		A		A

APPENDIX D

OPERATIONAL ANALYSIS – 2043 CONDITIONS

HCM 6th TWSC
4: Napier Rd & 9 Mile Rd

01/30/2024

Intersection						
Int Delay, s/veh	1.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	38	329	13	112	399
Future Vol, veh/h	8	38	329	13	112	399
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	83	83	94	94
Heavy Vehicles, %	2	2	4	4	7	7
Mvmt Flow	9	41	396	16	119	424
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	1066	404	0	0	412	0
Stage 1	404	-	-	-	-	-
Stage 2	662	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.17	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.263	-
Pot Cap-1 Maneuver	246	647	-	-	1120	-
Stage 1	674	-	-	-	-	-
Stage 2	513	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	220	647	-	-	1120	-
Mov Cap-2 Maneuver	344	-	-	-	-	-
Stage 1	674	-	-	-	-	-
Stage 2	459	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	12	0	1.9			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	561	1120	-	
HCM Lane V/C Ratio	-	-	0.088	0.106	-	
HCM Control Delay (s)	-	-	12	8.6	-	
HCM Lane LOS	-	-	B	A	-	
HCM 95th %tile Q(veh)	-	-	0.3	0.4	-	

HCM 6th TWSC
6: Napier Rd & 9 Mile Rd

01/30/2024

Intersection						
Int Delay, s/veh	3.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	52	145	30	337	366	18
Future Vol, veh/h	52	145	30	337	366	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	77	77	83	83	94	94
Heavy Vehicles, %	2	2	4	4	7	7
Mvmt Flow	68	188	36	406	389	19
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	877	399	408	0	-	0
Stage 1	399	-	-	-	-	-
Stage 2	478	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.14	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.236	-	-	-
Pot Cap-1 Maneuver	319	651	1140	-	-	-
Stage 1	678	-	-	-	-	-
Stage 2	624	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	309	651	1140	-	-	-
Mov Cap-2 Maneuver	433	-	-	-	-	-
Stage 1	656	-	-	-	-	-
Stage 2	624	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	13.3	0.7		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1140	-	433	651	-	-
HCM Lane V/C Ratio	0.032	-	0.156	0.289	-	-
HCM Control Delay (s)	8.3	-	14.8	12.8	-	-
HCM Lane LOS	A	-	B	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.5	1.2	-	-

HCM 6th TWSC
4: Napier Rd & 9 Mile Rd

01/30/2024

Intersection						
Int Delay, s/veh	6.3					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	54	146	719	50	67	758
Future Vol, veh/h	54	146	719	50	67	758
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	88	88	84	84	87	87
Heavy Vehicles, %	2	2	4	4	2	2
Mvmt Flow	61	166	856	60	77	871
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1911	886	0	0	916	0
Stage 1	886	-	-	-	-	-
Stage 2	1025	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	75	343	-	-	745	-
Stage 1	403	-	-	-	-	-
Stage 2	346	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	67	343	-	-	745	-
Mov Cap-2 Maneuver	190	-	-	-	-	-
Stage 1	403	-	-	-	-	-
Stage 2	310	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	54.9	0		0.8		
HCM LOS	F					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	-	282	745	-	
HCM Lane V/C Ratio	-	-	0.806	0.103	-	
HCM Control Delay (s)	-	-	54.9	10.4	-	
HCM Lane LOS	-	-	F	B	-	
HCM 95th %tile Q(veh)	-	-	6.4	0.3	-	

HCM 6th TWSC
6: Napier Rd & 9 Mile Rd

01/30/2024

Intersection

Int Delay, s/veh 3.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	41	102	169	696	723	87
Future Vol, veh/h	41	102	169	696	723	87
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	85	85	84	84	87	87
Heavy Vehicles, %	3	3	4	4	2	2
Mvmt Flow	48	120	201	829	831	100

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	2112	881	931
Stage 1	881	-	-
Stage 2	1231	-	-
Critical Hdwy	6.43	6.23	4.14
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.43	-	-
Follow-up Hdwy	3.527	3.327	2.236
Pot Cap-1 Maneuver	56	344	727
Stage 1	403	-	-
Stage 2	274	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	~ 41	344	727
Mov Cap-2 Maneuver	148	-	-
Stage 1	292	-	-
Stage 2	274	-	-

Approach	EB	NB	SB
HCM Control Delay, s	26.6	2.3	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	727	-	148	344	-	-
HCM Lane V/C Ratio	0.277	-	0.326	0.349	-	-
HCM Control Delay (s)	11.8	-	40.7	21	-	-
HCM Lane LOS	B	-	E	C	-	-
HCM 95th %tile Q(veh)	1.1	-	1.3	1.5	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lanes, Volumes, Timings

4: Napier Rd & 9 Mile Rd

01/30/2024

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	84	61	8	8	30	22	307	13	28	338	18
Future Volume (vph)	52	84	61	8	8	30	22	307	13	28	338	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	100		0	100		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.937			0.883			0.994			0.992	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1745	0	1770	1645	0	1736	1816	0	1687	1761	0
Flt Permitted	0.730			0.639			0.456			0.448		
Satd. Flow (perm)	1360	1745	0	1190	1645	0	833	1816	0	796	1761	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		79			32			6			7	
Link Speed (mph)		55			30			45			45	
Link Distance (ft)		1001			1156			288			381	
Travel Time (s)		12.4			26.3			4.4			5.8	
Peak Hour Factor	0.77	0.77	0.77	0.93	0.93	0.93	0.83	0.83	0.83	0.94	0.94	0.94
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	7%	7%	7%
Adj. Flow (vph)	68	109	79	9	9	32	27	370	16	30	360	19
Shared Lane Traffic (%)												
Lane Group Flow (vph)	68	188	0	9	41	0	27	386	0	30	379	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes			Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60		60	15		9	60		9	15		60
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	22.5	22.5		22.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)	22.5	22.5		22.5	22.5		22.5	22.5		22.5	22.5	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	18.0	18.0		18.0	18.0		18.0	18.0		18.0	18.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effect Green (s)	18.0	18.0		18.0	18.0		18.0	18.0		18.0	18.0	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.40	0.40		0.40	0.40	

Lanes, Volumes, Timings

4: Napier Rd & 9 Mile Rd

01/30/2024

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.12	0.25		0.02	0.06		0.08	0.53		0.09	0.54	
Control Delay	9.3	6.6		8.4	4.8		9.3	13.4		9.5	13.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	9.3	6.6		8.4	4.8		9.3	13.4		9.5	13.6	
LOS	A	A		A	A		A	B		A	B	
Approach Delay		7.3			5.4			13.1			13.3	
Approach LOS		A			A			B			B	

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 45

Control Type: Pretimed

Maximum v/c Ratio: 0.54

Intersection Signal Delay: 11.5

Intersection LOS: B

Intersection Capacity Utilization 40.3%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4: Napier Rd & 9 Mile Rd

 Ø2 (R)	 Ø4
22.5 s	22.5 s
 Ø6 (R)	 Ø8
22.5 s	22.5 s

Lanes, Volumes, Timings
4: Napier Rd & 9 Mile Rd

01/30/2024

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	39	63	54	80	66	89	630	50	28	695	87
Future Volume (vph)	41	39	63	54	80	66	89	630	50	28	695	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	100		0	100		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.907			0.932			0.989			0.983	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	1673	0	1770	1736	0	1736	1807	0	1770	1831	0
Flt Permitted	0.652			0.680			0.121			0.168		
Satd. Flow (perm)	1203	1673	0	1267	1736	0	221	1807	0	313	1831	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		74			71			11			17	
Link Speed (mph)		55			30			45			45	
Link Distance (ft)		1001			1156			288			381	
Travel Time (s)		12.4			26.3			4.4			5.8	
Peak Hour Factor	0.85	0.85	0.85	0.88	0.88	0.88	0.84	0.84	0.84	0.87	0.87	0.87
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Adj. Flow (vph)	48	46	74	61	91	75	106	750	60	32	799	100
Shared Lane Traffic (%)												
Lane Group Flow (vph)	48	120	0	61	166	0	106	810	0	32	899	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes			Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60		60	15		9	60		9	15		60
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	22.5	22.5		22.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)	22.5	22.5		22.5	22.5		37.5	37.5		37.5	37.5	
Total Split (%)	37.5%	37.5%		37.5%	37.5%		62.5%	62.5%		62.5%	62.5%	
Maximum Green (s)	18.0	18.0		18.0	18.0		33.0	33.0		33.0	33.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effect Green (s)	18.0	18.0		18.0	18.0		33.0	33.0		33.0	33.0	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.55	0.55		0.55	0.55	

Lanes, Volumes, Timings

4: Napier Rd & 9 Mile Rd

01/30/2024

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.13	0.22		0.16	0.29		0.88	0.81		0.19	0.89	
Control Delay	16.6	8.6		16.9	11.3		76.0	19.5		10.1	25.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	16.6	8.6		16.9	11.3		76.0	19.5		10.1	25.1	
LOS	B	A		B	B		E	B		B	C	
Approach Delay		10.9			12.8			26.1			24.6	
Approach LOS		B			B			C			C	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 60

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 65

Control Type: Pretimed

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 23.0

Intersection LOS: C

Intersection Capacity Utilization 74.2%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 4: Napier Rd & 9 Mile Rd

 Ø2 (R)		 Ø4
37.5 s		22.5 s
 Ø6 (R)		 Ø8
37.5 s		22.5 s

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	Napier NB	0	0	12.00	1	13.00	1	20.90	33.00	52.00
2	9 Mile EB	90	0	12.00	1	13.00	1	62.00	62.00	44.00
3	Napier SB	180	0	12.00	1	14.00	1	20.40	34.70	48.00
4	9 Mile WB	270	0	12.00	1	14.00	1	9.00	193.00	48.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	Napier NB	110.00	20.00	1	14.00	1	12.00	1
2	9 Mile EB	150.00	20.00	1	13.20	1	12.00	1
3	Napier SB	110.00	20.00	1	13.00	1	12.00	1
4	9 Mile WB	150.00	20.00	1	13.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	Napier NB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	9 Mile EB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	Napier SB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	9 Mile WB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0

Operational Results

2043 AM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Napier NB	None	352		45		433	928		0.3795	
2	9 Mile EB	None	203		347		50	905		0.2243	
3	Napier SB	None	396		163		387	985		0.4015	
4	9 Mile WB	None	47		430		128	916		0.0517	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Napier NB	None	8.56		8.56	1.98		A		A
2	9 Mile EB	None	7.03		7.03	1.09		A		A
3	Napier SB	None	8.77		8.77	1.91		A		A
4	9 Mile WB	None	4.54		4.54	0.16		A		A

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	Napier NB	0	0	12.00	1	13.00	1	20.90	33.00	52.00
2	9 Mile EB	90	0	12.00	1	13.00	1	62.00	62.00	44.00
3	Napier SB	180	0	12.00	1	14.00	1	20.40	34.70	48.00
4	9 Mile WB	270	0	12.00	1	14.00	1	9.00	193.00	48.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	Napier NB	110.00	20.00	1	14.00	1	12.00	1
2	9 Mile EB	150.00	20.00	1	13.20	1	12.00	1
3	Napier SB	110.00	20.00	1	13.00	1	12.00	1
4	9 Mile WB	150.00	20.00	1	13.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	Napier NB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	9 Mile EB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	Napier SB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	9 Mile WB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0

Operational Results

2043 PM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Napier NB	None	769		162		801	876		0.8778	
2	9 Mile EB	None	143		770		158	695		0.2058	
3	Napier SB	None	810		169		744	982		0.8252	
4	9 Mile WB	None	200		763		215	747		0.2676	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Napier NB	None	33.58		33.58	33.11		D		D
2	9 Mile EB	None	8.24		8.24	0.88		A		A
3	Napier SB	None	24.72		24.72	20.18		C		C
4	9 Mile WB	None	8.67		8.67	1.21		A		A

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	Napier NB	0	0	12.00	1	14.00	1	70.00	52.80	54.00
2	9 Mile EB	90	0	12.00	1	13.00	1	14.40	66.30	47.00
3	Napier SB	180	0	12.00	1	13.00	1	40.00	45.50	35.00
4	9 Mile WB	270	0	12.00	1	13.00	1	11.00	72.40	49.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	Napier NB	100.00	20.00	1	14.00	1	12.00	1
2	9 Mile EB	110.00	20.00	1	13.20	1	12.00	1
3	Napier SB	110.00	20.00	1	13.00	1	12.00	1
4	9 Mile WB	120.00	20.00	1	13.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	Napier NB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	9 Mile EB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	Napier SB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	9 Mile WB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0

Operational Results

2043 AM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Napier NB	None	352		45		433	1033		0.3409	
2	9 Mile EB	None	203		347		50	880		0.2305	
3	Napier SB	None	396		163		387	1009		0.3919	
4	9 Mile WB	None	47		430		128	848		0.0559	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Napier NB	None	7.51		7.51	1.66		A		A
2	9 Mile EB	None	7.25		7.25	1.13		A		A
3	Napier SB	None	8.50		8.50	1.83		A		A
4	9 Mile WB	None	4.92		4.92	0.17		A		A

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	Napier NB	0	0	12.00	1	14.00	1	70.00	52.80	54.00
2	9 Mile EB	90	0	12.00	1	13.00	1	14.40	66.30	47.00
3	Napier SB	180	0	12.00	1	13.00	1	40.00	45.50	35.00
4	9 Mile WB	270	0	12.00	1	13.00	1	11.00	72.40	49.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	Napier NB	100.00	20.00	1	14.00	1	12.00	1
2	9 Mile EB	110.00	20.00	1	13.20	1	12.00	1
3	Napier SB	110.00	20.00	1	13.00	1	12.00	1
4	9 Mile WB	120.00	20.00	1	13.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	Napier NB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	9 Mile EB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	Napier SB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	9 Mile WB	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0

Operational Results

2043 PM Peak - 60 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	Napier NB	None	769		162		801	977		0.7869	
2	9 Mile EB	None	143		772		158	662		0.2159	
3	Napier SB	None	810		169		746	1005		0.8058	
4	9 Mile WB	None	200		763		215	681		0.2938	

Delays, Queues and Level of Service

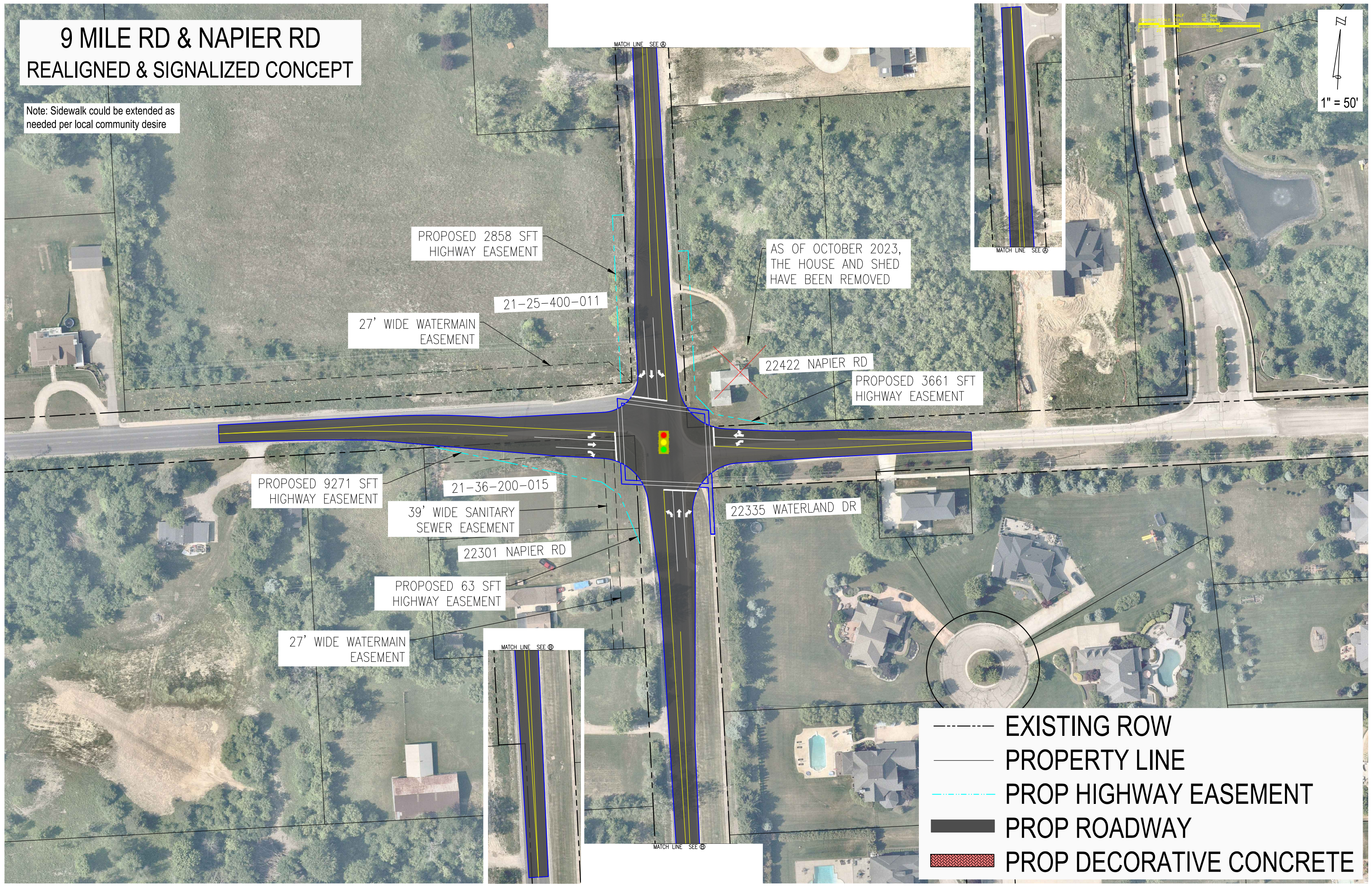
Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	Napier NB	None	20.43		20.43	15.99		C		C
2	9 Mile EB	None	8.74		8.74	0.99		A		A
3	Napier SB	None	22.42		22.42	17.63		C		C
4	9 Mile WB	None	9.68		9.68	1.41		A		A

APPENDIX E

CONCEPT RENDERINGS

9 MILE RD & NAPIER RD REALIGNED & SIGNALIZED CONCEPT

Note: Sidewalk could be extended as needed per local community desire

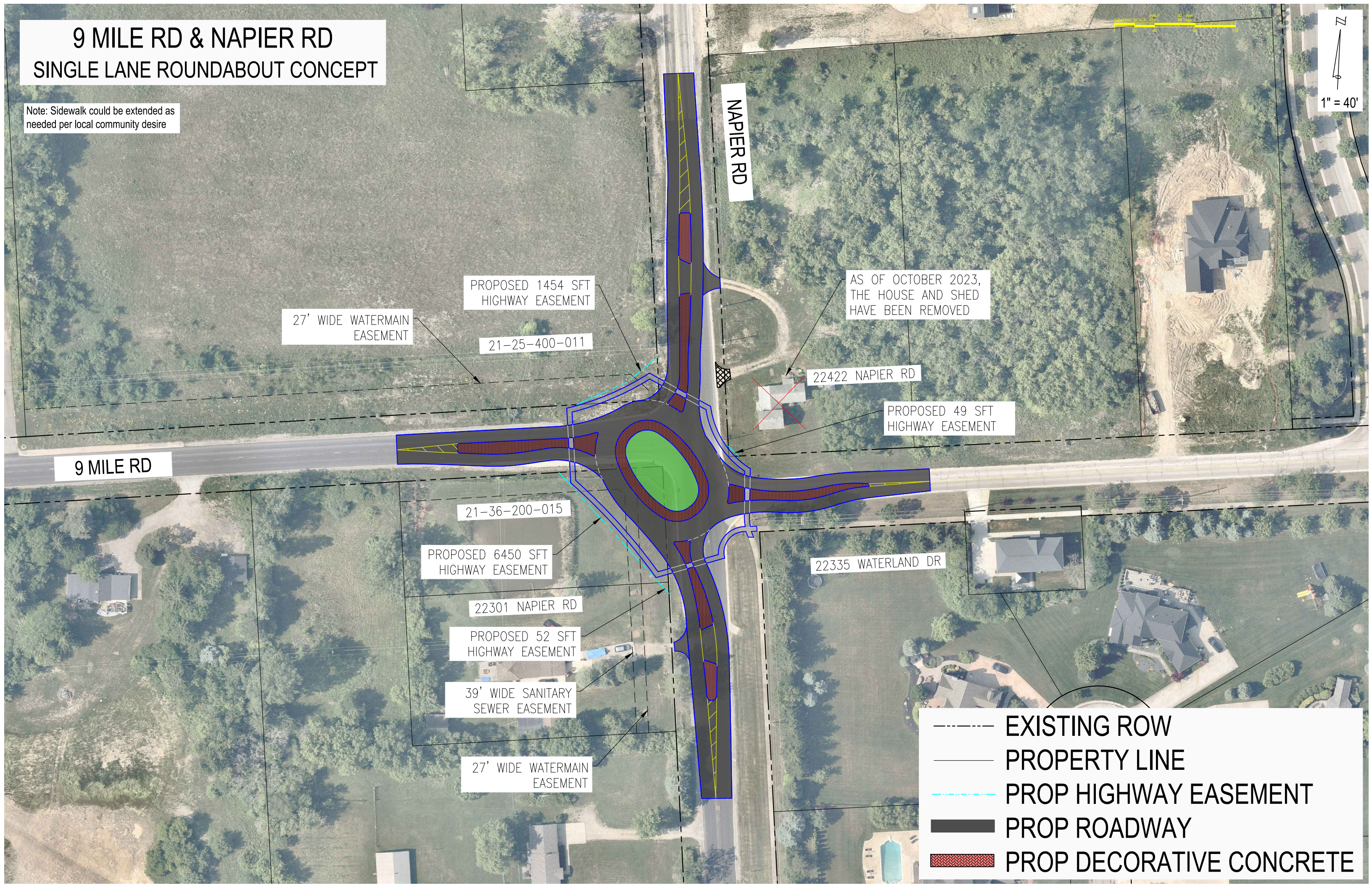


9 MILE RD & NAPIER RD

SINGLE LANE ROUNDABOUT CONCEPT

Note: Sidewalk could be extended as needed per local community desire

1" = 40'

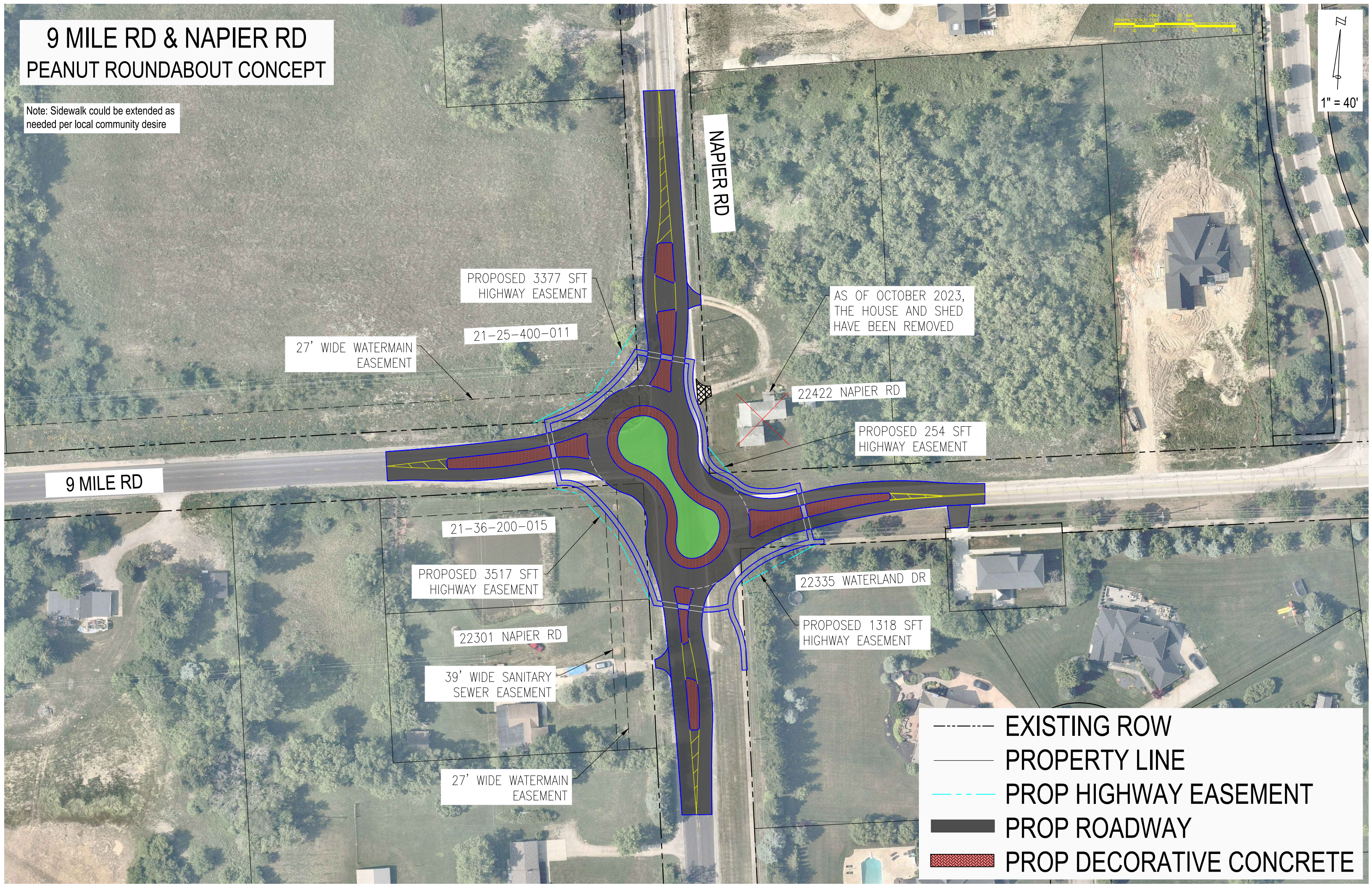


9 MILE RD & NAPIER RD PEANUT ROUNABOUT CONCEPT

Note: Sidewalk could be extended as needed per local community desire

GRAPHIC SCALE 0 20 40 60 80 100

1" = 40'



PROPOSED 3377 SFT
HIGHWAY EASEMENT

21-25-400-011

27' WIDE WATERMAIN
EASEMENT

AS OF OCTOBER 2023,
THE HOUSE AND SHED
HAVE BEEN REMOVED

22422 NAPIER RD

PROPOSED 254 SFT
HIGHWAY EASEMENT

9 MILE RD

21-36-200-015

PROPOSED 3517 SFT
HIGHWAY EASEMENT

22301 NAPIER RD

39' WIDE SANITARY
SEWER EASEMENT

27' WIDE WATERMAIN
EASEMENT

22335 WATERLAND DR

PROPOSED 1318 SFT
HIGHWAY EASEMENT

- EXISTING ROW
- PROPERTY LINE
- - - - - PROP HIGHWAY EASEMENT
- PROP ROADWAY
- PROP DECORATIVE CONCRETE

APPENDIX F

Projected Costs

9 Mile Rd & Napier Rd: Realigned & Signalized Concept

Item	Qty	Unit	Unit Price	Amount
Mobilization	1	LSUM	\$ 304,000.00	\$ 304,000.00
HMA surface, Rem	8740	Syd	\$ 8.00	\$ 69,920.00
Curb and Gutter, Rem	1710	Ft	\$ 15.00	\$ 25,650.00
Sidewalk, Rem	500	Syd	\$ 20.00	\$ 10,000.00
Excavation	4000	Cyd	\$ 30.00	\$ 120,000.00
Embankment	900	Cyd	\$ 25.00	\$ 22,500.00
Agg Base, 10 inch (Road)	10000	Syd	\$ 30.00	\$ 300,000.00
Agg Base, 6 inch (Sidewalk & Drives)	200	Syd	\$ 16.00	\$ 3,200.00
HMA (9 inch)	5000	Ton	\$ 140.00	\$ 700,000.00
Curb and Gutter	5000	Ft	\$ 40.00	\$ 200,000.00
Sidewalk, Conc, 4 inch	930	SFt	\$ 7.50	\$ 6,975.00
Drainage	1	LSUM	\$ 300,000.00	\$ 300,000.00
Permanent Marking and Signing	1	LSUM	\$ 35,000.00	\$ 35,000.00
MOT	1	LSUM	\$ 50,000.00	\$ 50,000.00
Traffic Signal	1	LSUM	\$ 475,000.00	\$ 475,000.00
ROW acquisition	1	LSUM	\$ 93,897.58	\$ 93,897.58
Restoration	1450	Syd	\$ 10.00	\$ 14,500.00
subtotal				\$ 2,730,642.58
Contingency			25%	\$ 682,660.64
TOTAL CONSTRUCTION COST				\$ 3,413,303.22

9 Mile Rd & Napier Rd: Single Lane Roundabout Concept

Item	Qty	Unit	Unit Price	Amount
Mobilization	1	LSUM	\$ 178,000.00	\$ 178,000.00
HMA surface, Rem	4900	Syd	\$ 8.00	\$ 39,200.00
Curb and Gutter, Rem	1500	Ft	\$ 15.00	\$ 22,500.00
Sidewalk, Rem	200	Syd	\$ 20.00	\$ 4,000.00
Excavation	2100	Cyd	\$ 30.00	\$ 63,000.00
Embankment	400	Cyd	\$ 25.00	\$ 10,000.00
Agg Base, 10 inch (Road)	5000	Syd	\$ 30.00	\$ 150,000.00
Agg Base, 6 inch(Sidewalk & Drives)	400	Syd	\$ 16.00	\$ 6,400.00
HMA (9 inch)	2000	Ton	\$ 140.00	\$ 280,000.00
HMA (4 inch Drives)	20	Ton	\$ 200.00	\$ 4,000.00
Conc, Pavt, Misc, Decorative Colored, 8 inch (Truck Pad)	300	Syd	\$ 140.00	\$ 42,000.00
Conc, Pavt, Misc, Decorative Colored, 6 inch (Islands)	1000	Syd	\$ 120.00	\$ 120,000.00
Curb and Gutter	3900	Ft	\$ 40.00	\$ 156,000.00
Sidewalk, Conc, 4 inch	2500	Sft	\$ 7.50	\$ 18,750.00
Drainage	1	LSUM	\$ 300,000.00	\$ 300,000.00
Permanent Marking and Signing	1	LSUM	\$ 35,000.00	\$ 35,000.00
Lighting	1	LSUM	\$ 50,000.00	\$ 50,000.00
MOT	1	LSUM	\$ 50,000.00	\$ 50,000.00
ROW acquistition	1	LSUM	\$ 57,445.06	\$ 57,445.06
Restoration	1200	Syd	\$ 10.00	\$ 12,000.00
subtotal				\$ 1,598,295.06
Contingency			25%	\$ 399,573.76
TOTAL CONSTRUCTION COST				\$ 1,997,868.82

9 Mile Rd & Napier Rd: Peanut Roundabout Concept

Item	Qty	Unit	Unit Price	Amount
Mobilization	1	LSUM	\$ 209,000.00	\$ 209,000.00
HMA surface, Rem	5000	Syd	\$ 8.00	\$ 40,000.00
Curb and Gutter, Rem	1600	Ft	\$ 15.00	\$ 24,000.00
Sidewalk, Rem	1300	Syd	\$ 20.00	\$ 26,000.00
Excavation	2200	Cyd	\$ 30.00	\$ 66,000.00
Embankment	300	Cyd	\$ 25.00	\$ 7,500.00
Agg Base, 10 inch (Road)	6000	Syd	\$ 30.00	\$ 180,000.00
Agg Base, 6 inch(Sidewalk & Drives)	600	Syd	\$ 16.00	\$ 9,600.00
HMA (9 inch)	3000	Ton	\$ 140.00	\$ 420,000.00
HMA (4 inch Drives)	30	Ton	\$ 200.00	\$ 6,000.00
Conc, Pavt, Misc, Decorative Colored, 8 inch (Truck Pad)	500	Syd	\$ 140.00	\$ 70,000.00
Conc, Pavt, Misc, Decorative Colored, 6 inch (Islands)	1000	Syd	\$ 120.00	\$ 120,000.00
Curb and Gutter	3800	Ft	\$ 40.00	\$ 152,000.00
Sidewalk, Conc, 4 inch	4040	Sft	\$ 7.50	\$ 30,300.00
Drainage	1	LSUM	\$ 300,000.00	\$ 300,000.00
Permanent Marking and Signing	1	LSUM	\$ 35,000.00	\$ 35,000.00
Lighting	1	LSUM	\$ 50,000.00	\$ 50,000.00
MOT	1	LSUM	\$ 50,000.00	\$ 50,000.00
ROW acquisition	1	LSUM	\$ 65,274.44	\$ 65,274.44
Restoration	1300	Syd	\$ 10.00	\$ 13,000.00
subtotal				\$ 1,873,674.44
Contingency			25%	\$ 468,418.61
TOTAL CONSTRUCTION COST				\$ 2,342,093.05

APPENDIX G

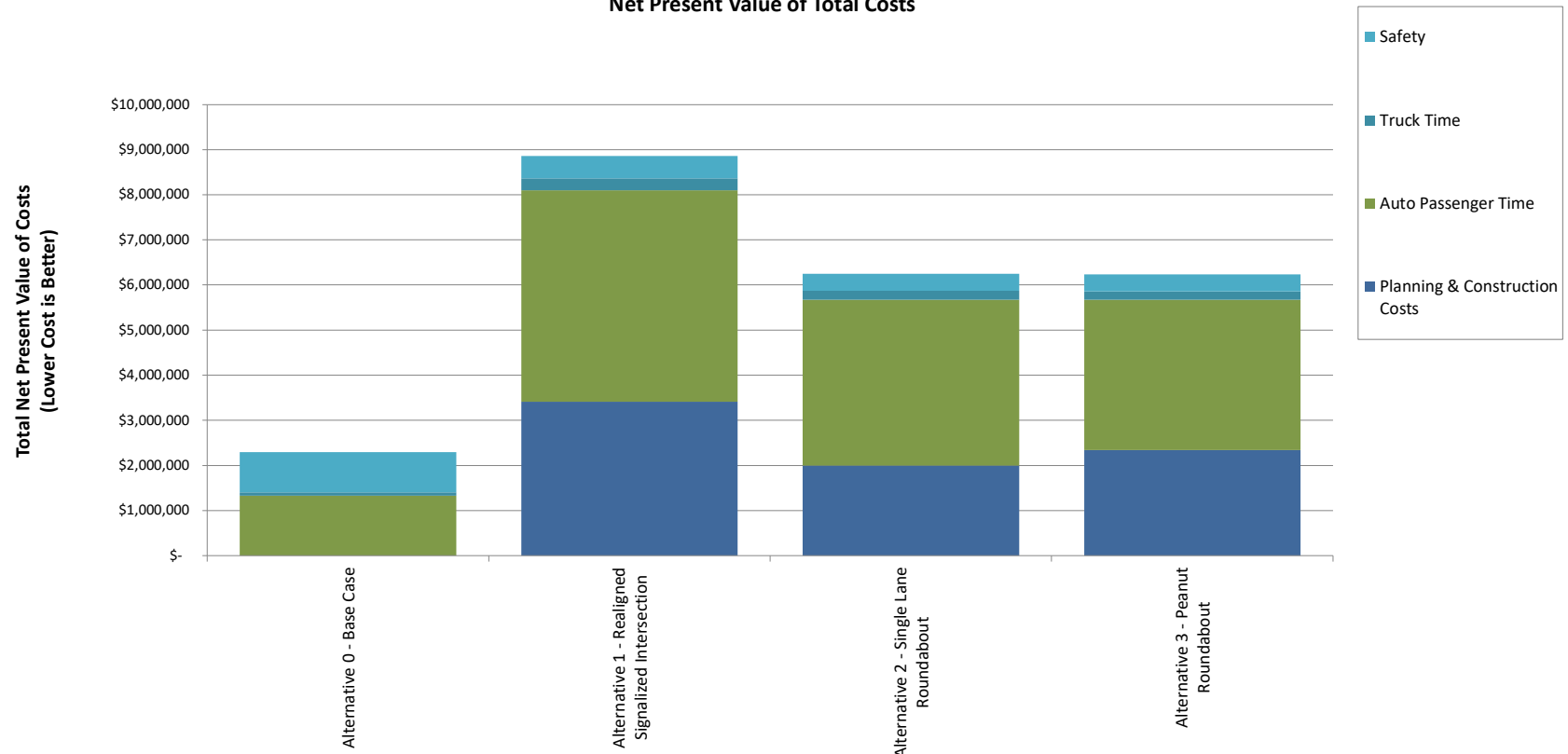
BENEFIT AND COST EVALUATION

Analysis Summary

Cost Categories	Net Present Value of Costs			
	Alternative 0 - Base Case	Alternative 1 - Realigned Signalized Intersection	Alternative 2 - Single Lane Roundabout	Alternative 3 - Peanut Roundabout
Planning & Construction Costs	\$ -	\$ 3,413,303	\$ 1,997,869	\$ 2,342,093
Post-Opening Costs	\$ -	\$ -	\$ -	\$ -
Auto Passenger Time	\$ 1,330,938	\$ 4,687,790	\$ 3,672,696	\$ 3,331,549
Auto Passenger Reliability	--	--	--	--
Truck Time	\$ 74,236	\$ 261,473	\$ 204,854	\$ 185,826
Truck Reliability	--	--	--	--
Transit Passenger Time	--	--	--	--
Transit Passenger Reliability	--	--	--	--
Bicyclist Time	--	--	--	--
Pedestrian Time	--	--	--	--
Safety	\$ 891,750	\$ 499,380	\$ 374,535	\$ 374,535
Greenhouse Gases	--	--	--	--
Criteria Pollutants	--	--	--	--
Total cost	\$2,296,925	\$8,861,947	\$6,249,954	\$6,234,003

Benefit Categories	Net Present Value of Benefits Relative to Base Case			
		Alternative 1 - Realigned Signalized Intersection	Alternative 2 - Single Lane Roundabout	Alternative 3 - Peanut Roundabout
Auto Passenger Time		\$ (3,356,852)	\$ (2,341,759)	\$ (2,000,611)
Auto Passenger Reliability				
Truck Time		\$ (187,237)	\$ (130,618)	\$ (111,589)
Truck Reliability				
Transit Passenger Time				
Transit Passenger Reliability				
Bicyclist Time				
Pedestrian Time				
Safety		\$ 392,370	\$ 517,215	\$ 517,215
Greenhouse Gases				
Criteria Pollutants				
Net Present Value of Benefits		\$ (3,151,719)	\$ (1,955,161)	\$ (1,594,985)
Net Present Value of Costs		\$ 3,413,303	\$ 1,997,869	\$ 2,342,093
Present Value of Net Benefits		\$ (6,565,022)	\$ (3,953,030)	\$ (3,937,078)
Benefit-Cost Ratio		-0.92	-0.98	-0.68

Net Present Value of Total Costs



APPENDIX H

TIME OF RETURN EVALUATION

NUMBER OF CRASHES OR INJURED PERSONS.

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
	2018	2019	2020	2021	2022
Angle	%REDUCTION	65%	Box Span Signal - Upgrade from Stop Control		
Number of Crashes	1	1	1	0	0
PDO+C Inj Crashes	0	1	1	0	0
B-Injured Persons	0	0	0	0	0
A-Injured or Killed Persons	1	0	0	0	0
Rear-End (Increases Crashes)	%REDUCTION	-25%	0		
Number of Crashes	1	0	0	0	0
PDO+C Inj Crashes	1	0	0	0	0
B-Injured Persons	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0
All Other Non Rear-End Crash	%REDUCTION	20%	0		
Number of Crashes	1	0	0	0	0
PDO+C Inj Crashes	1	0	0	0	0
B-Injured Persons	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0
	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
PDO+C Inj Crashes	0	0	0	0	0
B-Injured Persons	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0
	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
PDO+C Inj Crashes	0	0	0	0	0
B-Injured Persons	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0

of A-injuries: 1 For reference only
 # of Fatalities: 0 For reference only; "Q" accounts

PROJECT COST ESTIMATE : \$3,413,303 for the risk of a fatality.
 ADTb (before-volume) 1.0 If unknown, enter "0" (zero).
 ADTa (after-volume) 1.1 You may change these
 # OF YEARS OF DATA: 3.00 default ADT values.
 RATE OF INFLATION: 2.50% 3 to 5 years should be used.
 AREA TYPE: Rural "Rural", "Urban", or "Between"

REMARKS:

RCOC Intersection Study
 9 Mile at Napier
 0
 0
 Signal

COMPUTED BENEFITS DERIVED THROUGH CRASH REDUCTION

TOR 2024
 Date 21-Feb-24
 Project: RCOC Intersection Study
 City/Twp. Novi/Lyon
 Prepared By: OHM Advisors
 County Oakland
 PR: 0 PR MP Range: 0

The method of evaluating crash costs, used below, is given on page 67 of Roy Jorgensen's report of Highway Safety Improvement Criteria, 1966 edition. This same method is given in the Bureau of Public Roads IM21-3-67. In 1994 we have adapted the Q formula to blend Fatalities and A-injuries only.

In the following analysis the costs provided by the National Safety Council are :

2019 NSC VALUES:

Death \$1,659,000 =FATCOST
 Disabling (A) injury: \$96,200 =ACOST
 B-injury: \$27,800 =BCOST
 PDO and/or Minor Injury Crash: \$12,200 =PDOCOST

BTOTAL = ADTa / ADTb x [(Q x R1) + (BCOST x R2) + (PDOCOST x R3)]

WHERE:

BTOTAL = Total Benefit in Dollars Over Years Used \$272,245
 ADTa = Average traffic volume after the improvement 1.1
 ADTb = Average traffic volume before the improvement 1.0
 R1 = Reduction in fatalities and A-Injuries Combined. 0.7
 R2 = Reduction in B-Injury crashes: 0.0
 R3 = Reduction in PDO and C-injury crashes: 1.3
 Q = [FATCOST + ((I/F) x INJCOST)] / [1 + (I/F)]
 = [1,659,000 + (4.99 x 96,200)] / [1 + 4.99] \$357,300
 for AREA TYPE "Rural"
 I/F = 4.99

Q-Reference	Q	A-Injuries	Fatalities	I/F
RURAL	\$357,300	6,197	1,243	4.99
URBAN	\$310,100	10,153	1,610	6.31
BETWEEN	\$328,400	16,350	2,853	5.73

Data from Safety Programs Unit
 3-Year Statewide Non-Trunkline Crash Figures Used.
 (*From 1-1-2016 Through 12-31-2020).

Time of Return (T.O.R.) is based on 3 years of data.

NOINFB =No-Inflation Annual Benefit=BTOTAL/years \$90,748

With an inflation rate of 2.50%

B=Annual Benefit=Present Value (with Inflation) \$116,165

C = Project Cost \$3,413,303

TOR=C/B=COST/ANNUAL BENEFIT= 29.38

NUMBER OF CRASHES OR INJURED PERSONS.

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
	2021	2022	2023	2024	2025
Fatal and A-Injury Reduction	%REDUCTION	78%	Roundabout		
Number of Crashes	0	0	1	0	0
A-Injured or Killed Persons	0	0	1	0	0
Minor Crash Reduction	%REDUCTION	57%	0		
Number of Crashes	2	4	1	0	0
	1	4	1	0	0
	2	0	0	0	0
	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0
	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0
	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0

of A-injuries: 1 For reference only
of Fatalities: 0 For reference only; "Q" accounts

PROJECT COST ESTIMATE : \$1,997,869 for the risk of a fatality.
ADTb (before-volume) 1.0 If unknown, enter "0" (zero).
ADTa (after-volume) 1.1 You may change these
OF YEARS OF DATA: 3.00 default ADT values.
RATE OF INFLATION: 2.50% 3 to 5 years should be used.
AREA TYPE: Rural "Rural", "Urban", or "Between"

REMARKS:

RCOC Intersection Study
9 Mile at Napier
0
0
Single Lane Roundabout

COMPUTED BENEFITS DERIVED THROUGH CRASH REDUCTION

TOR 2024 Date 21-Feb-24
Project: RCOC Intersection Study City/Twp. Novi/Lyon
Prepared By: OHM Advisors County Oakland
PR: 0 PR MP Range: 0

The method of evaluating crash costs, used below, is given on page 67 of Roy Jorgensen's report of Highway Safety Improvement Criteria, 1966 edition. This same method is given in the Bureau of Public Roads IM21-3-67. In 1994 we have adapted the Q formula to blend Fatalities and A-injuries only.

In the following analysis the costs provided by the National Safety Council are :

2019 NSC VALUES:

Death \$1,659,000 =FATCOST
Disabling (A) injury: \$96,200 =ACOST
B-injury: \$27,800 =BCOST
PDO and/or Minor Injury Crash: \$12,200 =PDOCOST

$$BTOTAL = ADTa / ADTb \times [(Q \times R1) + (BCOST \times R2) + (PDOCOST \times R3)]$$

WHERE:

BTOTAL = Total Benefit in Dollars Over Years Used \$387,321
ADTa = Average traffic volume after the improvement 1.1
ADTb = Average traffic volume before the improvement 1.0
R1 = Reduction in fatalities and A-Injuries Combined. 0.8
R2 = Reduction in B-Injury crashes: 1.1
R3 = Reduction in PDO and C-injury crashes: 3.4
Q = [FATCOST + ((I/F) x INJCOST)] / [1 + (I/F)]
= [1,659,000 + (4.99 x 96,200)] / [1 + 4.99] \$357,300
for AREA TYPE "Rural"
I/F = 4.99

Q-Reference	Q	A-Injuries	Fatalities	I/F
RURAL	\$357,300	6,197	1,243	4.99
URBAN	\$310,100	10,153	1,610	6.31
BETWEEN	\$328,400	16,350	2,853	5.73

Data from Safety Programs Unit
3-Year Statewide Non-Trunkline Crash Figures Used.
(*From 1-1-2016 Through 12-31-2020).

Time of Return (T.O.R.) is based on 3 years of data.

NOINFB =No-Inflation Annual Benefit=BTOTAL/years \$129,107

With an inflation rate of 2.50%

B=Annual Benefit=Present Value (with Inflation) \$165,268

C = Project Cost \$1,997,869

TOR=C/B=COST/ANNUAL BENEFIT= 12.09

NUMBER OF CRASHES OR INJURED PERSONS.

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
	2021	2022	2023	2024	2025
Fatal and A-Injury Reduction	%REDUCTION	78%	Roundabout		
Number of Crashes	0	0	1	0	0
A-Injured or Killed Persons	0	0	1	0	0
Minor Crash Reduction	%REDUCTION	57%	0		
Number of Crashes	2	4	1	0	0
	1	4	1	0	0
	2	0	0	0	0
	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0
	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0
	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0

of A-injuries: 1 For reference only
 # of Fatalities: 0 For reference only; "Q" accounts

PROJECT COST ESTIMATE : \$2,342,093 for the risk of a fatality.
 ADTb (before-volume) 1.0 If unknown, enter "0" (zero).
 ADTa (after-volume) 1.1 You may change these
 # OF YEARS OF DATA: 3.00 default ADT values.
 RATE OF INFLATION: 2.50% 3 to 5 years should be used.
 AREA TYPE: Rural "Rural", "Urban", or "Between"

REMARKS:

RCOC Intersection Study
 9 Mile at Napier
 0
 0
 Peanut Roundabout

COMPUTED BENEFITS DERIVED THROUGH CRASH REDUCTION

TOR 2024 Date 21-Feb-24
 Project: RCOC Intersection Study City/Twp. Novi/Lyon
 Prepared By: OHM Advisors County Oakland
 PR: 0 PR MP Range: 0

The method of evaluating crash costs, used below, is given on page 67 of Roy Jorgensen's report of Highway Safety Improvement Criteria, 1966 edition. This same method is given in the Bureau of Public Roads IM21-3-67. In 1994 we have adapted the Q formula to blend Fatalities and A-injuries only.

In the following analysis the costs provided by the National Safety Council are :

2019 NSC VALUES:

Death \$1,659,000 =FATCOST
 Disabling (A) injury: \$96,200 =ACOST
 B-injury: \$27,800 =BCOST
 PDO and/or Minor Injury Crash: \$12,200 =PDOCOST

BTOTAL = ADTa / ADTb x [(Q x R1) + (BCOST x R2) + (PDOCOST x R3)]

WHERE:

BTOTAL = Total Benefit in Dollars Over Years Used \$387,321
 ADTa = Average traffic volume after the improvement 1.1
 ADTb = Average traffic volume before the improvement 1.0
 R1 = Reduction in fatalities and A-Injuries Combined. 0.8
 R2 = Reduction in B-Injury crashes: 1.1
 R3 = Reduction in PDO and C-injury crashes: 3.4
 Q = [FATCOST + ((I/F) x INJCOST)] / [1 + (I/F)]
 = [1,659,000 + (4.99 x 96,200)] / [1 + 4.99] \$357,300
 for AREA TYPE "Rural"
 I/F = 4.99

Q-Reference	Q	A-Injuries	Fatalities	I/F
RURAL	\$357,300	6,197	1,243	4.99
URBAN	\$310,100	10,153	1,610	6.31
BETWEEN	\$328,400	16,350	2,853	5.73

Data from Safety Programs Unit
 3-Year Statewide Non-Trunkline Crash Figures Used.
 (*From 1-1-2016 Through 12-31-2020).

Time of Return (T.O.R.) is based on 3 years of data.

NOINFB =No-Inflation Annual Benefit=BTOTAL/years \$129,107

With an inflation rate of 2.50%

B=Annual Benefit=Present Value (with Inflation) \$165,268

C = Project Cost \$2,342,093

TOR=C/B=COST/ANNUAL BENEFIT= 14.17

APPENDIX I

STAKEHOLDER MEETING

Stakeholder Meeting Debrief

9 MILE AND NAPIER

Date: August 9, 2023

Attendance:

Name:	Representing:	E-Mail:
John Katers	OHM Advisors	john.katers@ohm-advisors.com
Taryn Juidici	OHM Advisors	taryn.juidici@ohm-advisors.com
Hannah Pfeiffer	OHM Advisors	hannah.pfeiffer@ohm-advisors.com
Leslie Zawada	Lyon Twp	Leslie@CESInc.US
TJ Connolly	RCOC	tconnolly@rcoc.org
Alex Rucinski	RCOC	arucinski@rcoc.org
Danielle Deneau	RCOC	ddeneau@rcoc.org
Carissa Markel	RCOC	cmarkel@rcoc.org
Alex Rucinski	RCOC	arucinski@rcoc.org
Brad Knight	RCOC	bknight@rcoc.org
Ben Croy	City of Novi	bcroy@cityofnovi.org
Jeff Herczeg	City of Novi	jherczeg@cityofnovi.org

Known Existing Issues / Concerns

- Road Users
 - Most users are commuter traffic and are familiar with the area and the roadway
 - Gravel haulers are limited to using Napier Road; truck weight restriction signs on 9 Mile Rd
- Safety and Operations
 - Crash history includes seven crashes within the last three years. More concern about the likely amount of “near misses” that are not reported as crashes
 - New housing developments being built between the intersection and 8 Mile Road
 - Possibility of a new housing development in northwest corner of the intersection
 - East and west movements through the intersection are awkward; how most of the near misses happen
 - Poor sight distance looking north going westbound due to crest curve on Napier Road
 - No known time of day concerns
 - Sight obstruction concerns for eastbound movement looking north during seasons where vegetation is growing on the northwest corner parcel
 - County-wide transit plans in the future could extend to the intersection
 - Pathway required for new development in northwest corner if approved and possible future pathway connectivity to Villa Barr Park, north of the intersection
 - High attraction sports complex located south of the intersection
 - Potentially historical property in northeast corner of the intersection

Proposed Solutions

- Potential for a roundabout at this location
 - Offset intersection makes roundabout a feasible solution
 - Local residents are requesting a roundabout solution



- **Multiple roundabout shapes will be considered**
- **Realignment of offset intersection**
 - **Added cost of signalization**
 - **Site constraints make things more difficult**
- **Signalization is another option to consider**
 - **Split phasing will be considered**

Comparison Report

Current Search Options

County: Oakland County
City or Township: Novi
From Date: 1/1/2022
To Date: 12/31/2022

Graph: 

Previous Search Options

County: Oakland County
City or Township: Novi
From Date: 1/1/2023
To Date: 12/31/2023
Graph: 

Crash Type		Crashes By Month	
Type	# Crashes	Month	# Crashes
Uncoded/errors	0 (0%) 0 (0%)	January	132 (8%) 141 (7%)
Single Motor Vehicle	267 (16%) 261 (13%)	February	150 (9%) 109 (6%)
Head On	13 (1%) 8 (0%)	March	96 (6%) 183 (9%)
Head On - Left Turn	34 (2%) 35 (2%)	April	132 (8%) 170 (9%)
Angle	262 (16%) 334 (17%)	May	147 (9%) 193 (10%)
Rear End	704 (42%) 847 (43%)	June	173 (10%) 175 (9%)
Rear End - Left Turn	6 (0%) 11 (1%)	July	117 (7%) 155 (8%)
Rear End - Right Turn	17 (1%) 18 (1%)	August	154 (9%) 174 (9%)
Sideswipe - Same Direction	259 (16%) 323 (16%)	September	127 (8%) 147 (7%)
Sideswipe - Opposit Direction	13 (1%) 31 (2%)	October	144 (9%) 183 (9%)
Backing	31 (2%) 22 (1%)	November	148 (9%) 196 (10%)
Other	60 (4%) 73 (4%)	December	150 (9%) 142 (7%)
Unknown	4 (0%) 5 (0%)	Total	Search: 1,670 Prev Search: 1,968
Total	Search: 1,670 Prev Search: 1,968		
Crash Level		Crashes By Day of Week	
Type	# Crashes	Day of Week	# Crashes
Fatal	4 (0%) 1 (0%)	Sunday	147 (9%) 199 (10%)
Inj. (A)	13 (1%) 17 (1%)	Monday	238 (14%) 280 (14%)
Inj. (B)	92 (6%) 123 (6%)	Tuesday	252 (15%) 331 (17%)
Inj. (C)	230 (14%) 220 (11%)	Wednesday	259 (16%) 320 (16%)
PDO	1,331 (80%) 1,607 (82%)	Thursday	249 (15%) 292 (15%)
Inj. Other	0 (0%) 0 (0%)	Friday	331 (20%) 318 (16%)
Total	Search: 1,670 Prev Search: 1,968	Saturday	194 (12%) 228 (12%)
		Total	Search: 1,670 Prev Search: 1,968
Road Condition		Crashes By Hour of Day	
Condition	# Crashes	Hour of Day	# Crashes
Uncoded/errors	0 (0%) 0 (0%)	0000	19 (1%) 14 (1%)
		0100	10 (1%) 9 (0%)

Dry	1,323 (79%) 1,492 (76%)	0200	15 (1%) 10 (1%)
Oily	0 (0%) 0 (0%)	0300	16 (1%) 10 (1%)
Wet	179 (11%) 332 (17%)	0400	8 (0%) 5 (0%)
Ice	56 (3%) 41 (2%)	0500	8 (0%) 19 (1%)
Snow	98 (6%) 79 (4%)	0600	35 (2%) 39 (2%)
Mud, Dirt, Gravel	1 (0%) 4 (0%)	0700	75 (4%) 83 (4%)
Slush	6 (0%) 4 (0%)	0800	91 (5%) 107 (5%)
Debris	0 (0%) 0 (0%)	0900	72 (4%) 95 (5%)
Water (Standing / Moving)	0 (0%) 1 (0%)	1000	72 (4%) 93 (5%)
Sand	0 (0%) 0 (0%)	1100	91 (5%) 110 (6%)
Other	0 (0%) 0 (0%)	1200	104 (6%) 154 (8%)
Unknown	7 (0%) 15 (1%)	1300	114 (7%) 114 (6%)
Total	Search: 1,670 Prev Search: 1,968	1400	128 (8%) 145 (7%)
Construction Type		1500	146 (9%) 167 (8%)
Type	# Crashes	1600	161 (10%) 193 (10%)
Construction / Maintenance	183 (99%) 301 (99%)	1700	170 (10%) 219 (11%)
Utility	1 (1%) 2 (1%)	1800	114 (7%) 140 (7%)
Total	Search: 184 Prev Search: 303	1900	77 (5%) 91 (5%)
Traffic Device		2000	47 (3%) 62 (3%)
Type	# Crashes	2100	39 (2%) 42 (2%)
Uncoded/Errors	0 (0%) 0 (0%)	2200	32 (2%) 31 (2%)
Signal	634 (38%) 710 (36%)	2300	26 (2%) 16 (1%)
Stop Sign	83 (5%) 98 (5%)	Unknown	0 (0%) 0 (0%)
Stop Sign with Flashing Beacon	2 (0%) 1 (0%)	Total	Search: 1,670 Prev Search: 1,968
Yield Sign	22 (1%) 16 (1%)	Crashes By Time Period	
None	929 (56%) 1,143 (58%)	Time Period	# Crashes
Total	Search: 1,670 Prev Search: 1,968	12 MID-7 AM	111 (7%) 106 (5%)
Vehicle Type		7 AM-9 AM	166 (10%) 190 (10%)
Type	# Vehicles	9 AM-4 PM	727 (44%) 878 (45%)
Uncoded/errors	49 (2%) 70 (2%)	4 PM-6 PM	331 (20%) 412 (21%)
Passenger Car, SUV, Van	2,770 (86%) 3,255 (84%)	6 PM-12 MID	335 (20%) 382 (19%)
Other	8 (0%) 9 (0%)	Total	Search: 1,670 Prev Search: 1,968
Truck / Bus	109 (3%) 139 (4%)	Day-Night Ratio	2.74
Motorhome	3 (0%) 7 (0%)	Light Condition	
Pickup Truck	275 (9%) 365 (9%)	Condition	# Crashes

Small Truck (< 10,000)	7 (0%) 21 (1%)	Uncoded/errors	0 (0%) 0 (0%)
Motorcycle	10 (0%) 9 (0%)	Daylight	1,267 (76%) 1,516 (77%)
Moped / Goped	0 (0%) 0 (0%)	Dawn	27 (2%) 27 (1%)
Go-Cart / Golf Cart	0 (0%) 0 (0%)	Dusk	29 (2%) 49 (2%)
Snowmobile	0 (0%) 0 (0%)	Dark - Lighted	192 (11%) 202 (10%)
Off Road Vehicle (ATV)	1 (0%) 0 (0%)	Dark - Unlighted	150 (9%) 158 (8%)
Total	Search: 3,232 Prev Search: 3,875	Other	0 (0%) 1 (0%)
		Unknown	5 (0%) 15 (1%)
		Total	Search: 1,670 Prev Search: 1,968

Unit Type	
Type	# Units
Bicyclist	4 (0%) 8 (0%)
Engineer	0 (0%) 0 (0%)
Vehicle	3,224 (100%) 3,861 (100%)
Pedestrian	4 (0%) 6 (0%)
Total	Search: 3,232 Prev Search: 3,875

Alcohol Involved	
Alcohol	# Crashes
No	1,627 (97%) 1,936 (98%)
Yes	43 (3%) 32 (2%)
Total	Search: 1,670 Prev Search: 1,968

Weather	
Weather	# Crashes
Uncoded/errors	0 (0%) 0 (0%)
Clear	1,169 (70%) 1,331 (68%)
Smoke	2 (0%) 0 (0%)
Cloudy	266 (16%) 309 (16%)
Fog	2 (0%) 5 (0%)
Rain	90 (5%) 192 (10%)
Snow	115 (7%) 96 (5%)
Severe Crosswinds	2 (0%) 0 (0%)
Sleet / Hail	2 (0%) 6 (0%)
Blowing Snow	14 (1%) 9 (0%)
Blowing Sand, Soil, Dirt	0 (0%) 0 (0%)
Unknown	8 (0%) 20 (1%)
Total	Search: 1,670 Prev Search: 1,968

Hazardous Action	
Action	# Crashes
None	1,626 (50%) 1,955 (50%)
Speed To Fast	95 (3%) 86 (2%)
Improper / No Signal	1 (0%) 1 (0%)
Improper Backing	31 (1%) 26 (1%)
Unable To Stop	675 (21%) 805 (21%)
Other	96 (3%) 79 (2%)
Unknown	164 (5%) 193 (5%)
Reckless Driving	8 (0%) 6 (0%)
Careless Driving	28 (1%) 25 (1%)

Speed To Slow	0 (0%) 0 (0%)
Failed To Yield	313 (10%) 402 (10%)
Disregard Traffic Control	56 (2%) 57 (1%)
Drove Wrong Way	1 (0%) 2 (0%)
Drove Left Of Center	8 (0%) 14 (0%)
Improper Passing	14 (0%) 20 (1%)
Improper Lane Use	91 (3%) 158 (4%)
Improper Turn	25 (1%) 46 (1%)
Total	Search: 3,232 Prev Search: 3,875

Top 10 Harmful Events	
Event	# Crashes
Motor Vehicle in Transport	3,024 (85%) 3,725 (88%)
Loss of Control	170 (5%) 143 (3%)
Animal	106 (3%) 109 (3%)
Ran Off Roadway - Right	72 (2%) 71 (2%)
Parked Motor Vehicle	38 (1%) 0 (0%)
Ran Off Roadway - Left	37 (1%) 38 (1%)
Concrete Barrier	36 (1%) 34 (1%)
Ditch	34 (1%) 27 (1%)
Tree	29 (1%) 27 (1%)
Other Non-Fixed Object	26 (1%) 35 (1%)
Total	Search: 3,572 Prev Search: 4,233

Fatalities	
Type	# Fatalities
Driver	3 (75%) 1 (100%)
Passenger	1 (25%) 0 (0%)
Total	Search: 4 Prev Search: 1

Injury Severity	
Type	# of Persons
Fatal Injury(K)	4 (1%) 1 (0%)
Suspected Serious Injury (A)	18 (4%) 18 (4%)
Suspected Minor Injury (B)	112 (24%) 143 (31%)
Possible Injury (C)	335 (71%) 301 (65%)
Total	Search: 469 Prev Search: 463



Transportation Improvement Association

City of Novi Intersection Ranking Report 2021-2023

Rank	Road Juris	Score	Road 1	Road 2	Traffic Volume	* Volume Year	Total Crashes	Freq Pts	Crashes /MEV	Crash Rate Pts	Total Injuries	Injury Crash Pts	AADT Source
1	3	89	W 8 Mile Rd	Haggerty Rd	56,350	2022	125	24	2.03	19	22	46	
2	5	84	W 13 Mile Rd	M5	54,738	2019	98	19	1.64	15	24	50	
3	2	83	Beck Rd	I 96 Interchange Ramps	39,440	s 2023	118	22	2.73	25	17	36	SCATS
4	2	83	W 14 Mile Rd	M5	71,703	s 2022	135	25	1.72	16	20	42	SCATS
5	3	80	W 8 Mile Rd	Beck Rd	32,750	2022	85	16	2.37	22	20	42	
6	1	71	W 10 Mile Rd	Novi Rd	39,990	2022	83	16	1.90	17	18	38	
7	3	65	Beck Rd	W 10 Mile Rd	37,311	2022	74	14	1.81	17	16	34	
8	1	59	Grand River Ave	Novi Rd	37,440	2022	74	14	1.81	17	13	28	
9	2	55	Novi Rd	Fountain Walk Ave	55,095	2022	67	13	1.11	10	15	32	
10	3	54	Grand River Ave	Beck Rd	52,190	2022	91	17	1.59	15	10	22	
11	3	50	W Oaks Dr	Novi Rd	88,353	2023	56	11	0.58	5	16	34	
12	1	42	W 12 Mile Rd	Haggerty Rd	50,350	2019	49	10	0.89	8	11	24	
13	3	37	W 12 Mile Rd	Novi Rd	37,240	2022	37	7	0.91	8	10	22	
14	3	37	W 12 Mile Rd	W Park Dr	23,069	2022	23	5	0.91	8	11	24	
15	3	35	Grand River Ave	Taft Rd	23,350	2022	34	7	1.33	12	7	16	
16	3	33	W 13 Mile Rd	Haggerty Rd	28,320	2019	35	7	1.13	10	7	16	
17	3	32	Taft Rd	W 10 Mile Rd	24,640	2022	27	5	1.00	9	8	18	
18	3	31	Grand River Ave	Meadowbrook Rd	37,760	2023	40	8	0.97	9	6	14	
19	3	31	W 9 Mile Rd	Novi Rd	25,530	2022	28	6	1.00	9	7	16	
20	2	29	E I 96/Novi RAMP	Novi Rd	46,761	2022	41	8	0.80	7	6	14	
21	5	29	W 12 Mile Rd	Meadowbrook Rd	47,744	s 2023	35	7	0.67	6	7	16	SCATS
22	1	28	10 Mile Rd	Napier Rd	16,180	2018	37	7	2.09	19	1	2	
23	3	27	Novi Rd	Crescent Blvd	0		45	9	0.00	0	8	18	
24	3	26	Mall Driveway	Novi Rd	32,135	s 2023	36	7	1.02	9	4	10	SCATS
25	6	25	Beck Rd	9 Mile Rd	22,239	s 2022	16	3	0.66	6	7	16	SCATS
26	3	24	Meadowbrook Rd	W 10 Mile Rd	25,293	s 2022	27	5	0.97	9	4	10	SCATS
27	2	24	W 12 Mile Rd	N M 5/12 Mile RAMP	27,538	2022	23	5	0.76	7	5	12	
28	1	22	Grand River Ave	12 Mile Rd	27,257	2022	22	5	0.74	7	4	10	
29	3	22	Main St	Town Center Dr	0		19	4	0.00	0	8	18	
30	2	22	W 12 Mile Rd	S M 5 CD/12 Mile RAMP	24,600	2023	18	4	0.67	6	5	12	

* e: Estimated s: SCATS

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Transportation Improvement Association

City of Novi Intersection Ranking Report 2021-2023

Rank	Road Juris	Score	Road 1	Road 2	Traffic Volume	* s	Volume Year	Total Crashes	Freq Pts	Crashes /MEV	Crash Rate Pts	Total Injuries	Injury Crash Pts	AADT Source
31	6	19	Novi Rd	W 13 Mile Rd	20,180	s	2022	17	4	0.77	7	3	8	SCATS
32	6	19	W Park Dr	Treatment Plant Access Rd	11,853	s	2023	7	2	0.54	5	5	12	SCATS
33	3	18	9 Mile Rd	Napier Rd	10,034		2018	10	2	0.91	8	3	8	
34	6	16	11 Mile Rd	Beck Rd	23,913	s	2022	14	3	0.53	5	3	8	SCATS
35	3	15	Wixom Rd	W 10 Mile Rd	0			14	3	0.00	0	5	12	
36	5	13	Meadowbrook Rd	W 9 Mile Rd	0			16	3	0.00	0	4	10	
37	3	13	W 12 Mile Rd	Cabot Dr	14,063	s	2022	8	2	0.52	5	2	6	SCATS
38	3	12	W 8 Mile Rd	Meadowbrook Rd	0			21	4	0.00	0	3	8	
39	6	11	Sandstone Dr	Novi Rd	9,463	s	2023	8	2	0.77	7	1	2	SCATS
40	6	10	11 Mile Rd	Taft Rd	0			8	2	0.00	0	3	8	
41	6	10	W 9 Mile Rd	Taft Rd	6,466		2022	5	1	0.71	7	1	2	
42	3	9	Haggerty Rd	Village Wood Dr	22,254	s	2019	4	1	0.16	2	2	6	SCATS
43	6	8	W 11 Mile Rd	Meadowbrook Rd	0			9	2	0.00	0	2	6	
44	6	6	S Lake Dr	W Park Dr	7,428	s	2023	4	1	0.49	5	0	0	SCATS
45	3	5	Grand River Ave	Crescent Blvd	18,640		2022	5	1	0.24	2	1	2	
46	6	3	12 1/2 Mile Rd	Novi Rd	0			4	1	0.00	0	1	2	
47	3	3	Bayview Dr	W Park Dr	0			2	1	0.00	0	1	2	
48	6	3	Cabot Dr	W 13 Mile Rd	0			2	1	0.00	0	1	2	
49	6	3	Meadowbrook Rd	W 13 Mile Rd	11,099		2023	2	1	0.16	2	0	0	
50	3	3	Napier Rd	12 Mile Rd				5	1	0.00	0	1	2	
51	6	3	W 13 Mile Rd	S Lake Dr	0			4	1	0.00	0	1	2	
52	3	2	W 12 Mile Rd	Taft Rd	0			10	2	0.00	0	0	0	
53	6	1	11 Mile Rd	Wixom Rd	0			3	1	0.00	0	0	0	
54	3	1	W 8 Mile Rd	Garfield Rd	0			4	1	0.00	0	0	0	
55	1	0	11 Mile Rd	Napier Rd	6,805		2022	0	0	0.00	0	0	0	
56	6	0	Garfield Rd	9 Mile Rd	0			0	0	0.00	0	0	0	

* e: Estimated s: SCATS

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Transportation Improvement Association

City of Novi Link Ranking Report 2021-2023

Rd Jur	On Road	From Road	To Road	Dir	Seg Len	CVT	Total Crash	Freq Rank	CR/MI	CR/MI Rank	F	A	B	C	PD	Sev %	Sev Rank	AADT Vol	* AADT Date	Crash Rate	Rate Rank	AADT Source
7	Novi Rd	TWELVE MILE	I96		0.52	Novi	133	1	257.25	2	0	1	11	19	102	8.33	3	36,126	2023	19.51	2	
7	Novi Rd	I96	GRAND RIVER		0.39	Novi	119	2	305.91	1	0	0	3	17	99	0.00	9	31,397	2023	26.69	1	
7	Grand River Ave	MEADOWBROOK	HAGGERTY		1.01	Novi	99	3	97.54	5	0	1	14	15	69	2.08	8	20,799	2023	12.85	8	
7	Grand River Ave	NOVI	MEADOWBROOK		0.99	Novi	93	4	93.84	6	0	0	4	14	75	0.00	10	22,660	2023	11.35	10	
7	Grand River Ave	TAFT	NOVI		1.00	Novi	77	5	77.39	10	0	0	6	10	61	0.00	11	20,440	2022	10.37	13	
7	Grand River Ave	TWELVE MILE (E LEG)	BECK		0.86	Novi	73	6	84.69	7	0	1	4	11	57	2.22	7	21,870	2022	10.61	12	
7	Haggerty Rd	EIGHT MILE	NINE MILE (NOVI)		0.96	Novi	71	7	73.88	11	0	0	3	12	56	0.00	12	24,120	2023	8.39	19	
7	W 12 Mile Rd	MEADOWBROOK	HAGGERTY		1.04	Novi	69	8	66.28	14	0	0	4	8	57	0.00	13	13,590	2023	13.36	7	
10	W 8 Mile Rd	HAGGERTY	MEADOWBROOK		0.82	Novi	66	9	80.68	8	0	0	8	8	50	0.00	14	31,600	2022	7.00	26	
7	W 10 Mile Rd	TAFT	NOVI		0.93	Novi	63	10	67.60	12	0	0	4	11	48	0.00	15	20,883	2023	8.87	17	
7	W 12 Mile Rd	TAFT	NOVI		0.99	Novi	58	11	58.59	17	0	0	4	5	49	0.00	16	26,420	2023	6.08	29	
7	Novi Rd	GRAND RIVER	TEN MILE		0.91	Novi	57	12	62.91	15	1	1	3	9	43	0.00	17	12,790	2022	13.48	6	
7	W 10 Mile Rd	NOVI	MEADOWBROOK		0.93	Novi	50	13	54.00	18	0	0	5	12	33	0.00	18	17,345	2023	8.53	18	
7	S Pontiac Trl	BECK	WALLED LAKE LMT (NOVI)		0.83	Novi	49	14	58.89	16	0	0	6	9	34	0.00	19	17,790	2023	9.07	16	
9	W 13 Mile Rd	HAGGERTY	MEADOWBROOK		0.97	Novi	48	15	49.54	19	0	1	5	5	37	6.25	6	12,781	2023	10.62	11	
9	Beck Rd	WIXOM LMT	PONTIAC TR (NOVI)		0.33	Novi	45	16	137.20	3	0	1	3	11	30	0.00	20	23,060	2019	16.30	3	
7	Grand River Ave	BECK	TAFT		0.99	Novi	44	17	44.49	20	0	0	5	5	34	0.00	21	20,150	2022	6.05	30	
7	W 12 Mile Rd	MEADOWBROOK	HAGGERTY		0.97	Novi	43	18	44.47	21	0	0	2	3	38	0.00	22	23,848	2023	5.11	36	
7	W 12 Mile Rd	BECK	TAFT		0.95	Novi	42	19	44.26	22	0	0	1	8	33	0.00	23	16,860	2023	7.19	24	

* e: Estimated s: SCATS

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Transportation Improvement Association

City of Novi Link Ranking Report 2021-2023

Rd Jur	On Road	From Road	To Road	Dir	Seg Len	CVT	Total Crash	Freq Rank	CR/MI	CR/MI Rank	F	A	B	C	PD	Sev %	Sev Rank	AADT Vol	*	AADT Date	Crash Rate	Rate Rank	AADT Source
9	Beck Rd	ELEVEN MILE	GRAND RIVER		0.60	Novi	40	20	66.67	13	0	0	2	6	32	0.00	24	22,140		2022	8.25	21	
9	Wixom Rd	ELEVEN MILE	NOVI LMT		0.96	Novi	38	21	39.42	23	0	0	2	3	33	0.00	25	8,796		2023	12.28	9	
7	Haggerty Rd	GRAND RIVER	TWELVE MILE (NO)		1.66	Novi	35	22	21.14	40	0	2	3	3	27	0.00	26	14,585		2023	3.97	43	
9	Beck Rd	TEN MILE	ELEVEN MILE		0.92	Novi	35	23	37.92	25	0	0	1	4	30	0.00	27	18,040		2022	5.76	31	
7	W 10 Mile Rd	WIXOM	BECK		0.95	Novi	32	24	33.76	26	0	1	2	9	20	7.14	5	16,852		2023	5.49	32	
7	Haggerty Rd	NINE MILE	TEN MILE (NOVI)		0.93	Novi	30	25	32.43	29	0	0	2	5	23	0.00	28	17,593		2023	5.05	37	
8	N M 5	FOURTEEN MILE	THIRTEEN MILE		1.03	Novi	30	26	28.99	33	0	0	1	2	27	0.00	29	34,575	s	2023	2.30	53	SCATS
7	Haggerty Rd	THIRTEEN MILE	FOURTEEN MILE (NOV)		1.00	Novi	29	27	29.15	32	0	0	4	4	21	0.00	30	12,813		2023	6.23	27	
7	Novi Rd	NINE MILE	TEN MILE		0.92	Novi	29	28	31.49	30	0	0	2	4	23	0.00	31	18,741		2023	4.60	39	
7	W 12 Mile Rd	NOVI	MEADOWBROOK		0.93	Novi	29	29	31.28	31	0	0	3	3	23	0.00	32	26,260		2023	3.26	47	
7	W 10 Mile Rd	BECK	TAFT		0.93	Novi	27	30	28.97	34	0	1	3	3	20	7.69	4	14,850		2022	5.34	33	
10	W 8 Mile Rd	GRISWALD	MEADOWBROOK		0.68	Novi	26	31	38.01	24	0	1	4	5	16	0.00	33	0			0.00	73	
7	S Pontiac Trl	WALLED LAKE LMT	WEST (NOVI)		0.32	Novi	26	32	80.25	9	0	1	0	5	20	0.00	34	16,120		2019	13.64	5	
7	W 12 Mile Rd	END OF BLVD	NOVI		0.71	Novi	24	33	33.76	27	0	0	1	4	19	0.00	35	9,760		2022	9.48	15	
7	Beck Rd	GRAND RIVER	TWELVE MILE		0.21	Novi	22	34	106.80	4	0	0	0	1	21	0.00	36	37,488		2023	7.80	22	
7	W 12 Mile Rd	NOVI	MEADOWBROOK		1.00	Novi	22	35	21.91	38	0	0	1	3	18	0.00	37	26,260		2023	2.29	54	
9	Old Novi Rd	TWELVE MILE	THIRTEEN MILE		0.93	Novi	21	36	22.60	36	0	0	0	3	18	0.00	38	6,022		2023	10.28	14	
7	W 10 Mile Rd	MEADOWBROOK	HAGGERTY		0.96	Novi	20	37	20.90	41	0	0	1	2	17	0.00	39	16,238		2023	3.53	45	
9	W 13 Mile Rd	MEADOWBROOK	NOVI		0.91	Novi	20	38	22.00	37	0	0	2	2	16	0.00	40	4,366		2023	13.81	4	

* e: Estimated s: SCATS

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Rd Jur	On Road	From Road	To Road	Dir	Seg Len	CVT	Total Crash	Freq Rank	CR/MI	CR/MI Rank	F	A	B	C	PD	Sev %	Sev Rank	AADT Vol	* AADT Date	Crash Rate	Rate Rank	AADT Source
9	W Park Dr	West	PONTIAC TR		1.35	Novi	19	39	14.13	48	0	0	1	0	18	0.00	41	4,631	2023	8.36	20	
8	S M 5	FOURTEEN MILE	THIRTEEN MILE		1.03	Novi	18	40	17.41	43	0	0	1	2	15	0.00	42	57,917	2023	0.82	70	
7	Napier Rd	ELEVEN MILE	TWELVE MILE (NOVI)		0.92	Novi	17	41	18.52	42	1	0	3	2	11	14.29	2	6,840	2022	7.42	23	
9	Beck Rd	NORTHVILLE LMT	9 MILE (NOVI)		0.46	Novi	15	42	32.61	28	0	2	0	0	13	16.67	1	21,090	s 2023	4.24	41	SCATS
7	W 10 Mile Rd	NAPIER	WIXOM		0.94	Novi	14	43	14.96	47	0	0	0	0	14	0.00	43	27,793	2023	1.47	68	
9	Beck Rd	NINE MILE	TEN MILE		0.93	Novi	14	44	15.10	46	0	0	2	1	11	0.00	44	18,522	2023	2.23	55	
9	Novi Rd	THIRTEEN MILE	FOURTEEN MILE		1.04	Novi	14	45	13.49	49	0	0	1	0	13	0.00	45	9,540	2022	3.87	44	
9	Beck Rd	8 MILE	NORTHVILLE LMT (NOVI)		0.47	Novi	13	46	27.96	35	0	0	1	1	11	0.00	46	17,566	2023	4.36	40	
9	W 9 Mile Rd	MEADOWBROOK	NOVI		0.92	Novi	12	47	13.03	50	0	1	0	0	11	0.00	47	11,660	2023	3.06	48	
9	9 Mile Rd	NOVI	TAFT		0.90	Novi	10	48	11.06	52	0	0	0	1	9	0.00	48	4,220	2022	7.18	25	
9	Novi Rd	NOVI	13 MILE RD		0.62	Novi	10	49	16.05	45	1	0	0	1	8	0.00	49	9,446	2023	4.66	38	
9	Taft Rd	TEN MILE	ELEVEN MILE		0.93	Novi	10	50	10.81	53	0	0	1	0	9	0.00	50	4,840	2022	6.12	28	
7	Haggerty Rd	TWELVE MILE	THIRTEEN MILE N		0.92	Novi	8	51	8.67	55	0	0	2	1	5	0.00	51	14,270	2023	1.66	66	
7	W 8 Mile Rd	GARFIELD	NAPIER		0.93	Novi	8	52	8.57	56	0	0	1	0	7	0.00	52	10,960	2022	2.14	58	
9	9 Mile Rd	HAGGERTY	MEADOWBROOK		0.96	Novi	8	53	8.32	57	0	0	1	1	6	0.00	53	10,900	2023	2.09	61	
9	Meadowbrook Rd	ELEVEN MILE	TWELVE MILE		0.91	Novi	7	54	7.68	58	0	0	0	1	6	0.00	54	10,736	s 2023	1.96	63	SCATS
9	Meadowbrook Rd	NINE MILE	TEN MILE		0.92	Novi	7	55	7.60	59	0	0	0	2	5	0.00	55	9,416	s 2023	2.21	56	SCATS
9	Meadowbrook Rd	TEN MILE	GRAND RIVER		0.56	Novi	7	56	12.59	51	0	0	1	0	6	0.00	56	8,512	2023	4.05	42	
7	Napier Rd	NINE MILE	TEN MILE (NOVI)		0.85	Novi	6	57	7.09	61	0	0	1	1	4	0.00	57	9,160	2022	2.12	59	

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7	Napier Rd	NINE MILE	TEN MILE		0.85	RCOC	6	58	7.09	62	0	0	1	1	4	0.00	58	9,160	2022	2.12	60	
9	E Lake Dr	THIRTEEN MILE	FOURTEEN MILE		1.15	Novi	6	59	5.19	65	0	0	0	0	6	0.00	59	2,784	2023	5.11	35	
7	Napier Rd	EIGHT MILE	NINE MILE (NOVI)		0.91	Novi	5	60	5.49	64	0	0	0	0	5	0.00	60	9,000	2022	1.67	65	
9	Meadowbrook Rd	GRAND RIVER	ELEVEN MILE		0.29	Novi	5	61	17.12	44	0	0	0	2	3	0.00	61	9,080	2023	5.17	34	
9	S Lake Dr	WEST	NOVI		1.29	Novi	5	62	3.89	70	0	0	0	2	3	0.00	62	3,696	2023	2.88	50	
7	Haggerty Rd	TEN MILE	GRAND RIVER (NOVI)		0.18	Novi	4	63	21.74	39	0	0	0	0	4	0.00	63	17,300	2023	3.44	46	
7	Novi Rd	GALWAY	NINE MILE (NOVI)		0.43	Novi	4	64	9.28	54	0	0	0	0	4	0.00	64	16,440	2022	1.55	67	
9	Meadowbrook Rd	EIGHT MILE	NINE MILE		0.92	Novi	4	65	4.33	68	0	0	1	0	3	0.00	65	0		0.00	82	
9	Taft Rd	NINE	TEN MILE		0.93	Novi	4	66	4.31	69	0	0	1	0	3	0.00	66	5,956	2023	1.98	62	
9	11 Mile Rd	BECK	TAFT		0.93	Novi	3	67	3.23	72	0	0	0	0	3	0.00	67	3,842	2023	2.30	52	
9	W 9 Mile Rd	TAFT	BECK		0.90	Novi	3	68	3.33	71	0	0	0	0	3	0.00	68	0		0.00	88	
9	Wixom Rd	TEN MILE	ELEVEN MILE		0.42	Novi	3	69	7.18	60	0	0	0	0	3	0.00	69	0		0.00	92	
7	Napier Rd	TEN MILE	ELEVEN MILE (NOVI)		0.86	Novi	2	70	2.33	75	0	0	0	0	2	0.00	70	5,990	2023	1.07	69	
7	W 14 Mile Rd	DECKER	WALLED LAKE DR (NOVI)		0.29	Novi	2	71	6.99	63	0	0	0	0	2	0.00	71	6,280	2023	3.05	49	
9	12 Mile Rd	NAPIER	GRAND RIVER (NOVI)		0.78	Novi	2	72	2.55	74	0	0	0	0	2	0.00	72	2,660	s 2023	2.63	51	SCATS
9	Seeley Rd	GRAND RIVER	ELEVEN MILE		0.42	Novi	2	73	4.72	66	0	0	0	1	1	0.00	73	0		0.00	84	
9	Taft Rd	NORTHVILLE LMT	NINE MILE		0.46	Novi	2	74	4.35	67	0	0	0	0	2	0.00	74	0		0.00	86	
9	W 11 Mile Rd	GRAND RIVER	MEADOWBROOK		0.63	Novi	2	75	3.17	73	0	0	0	0	2	0.00	75	4,442	2023	1.95	64	
9	W Park Dr	TWELVE MILE	WEST		0.88	Novi	2	76	2.27	76	0	0	0	1	1	0.00	76	12,539	2023	0.50	72	

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9	11 Mile Rd	WIXOM	BECK		0.92	Novi	1	77	1.09	77	0	0	0	0	1	0.00	77	3,804	s	2023	0.78	71	SCATS
9	9 Mile Rd	BECK	GARFIELD		1.10	Novi	1	78	0.91	80	0	0	0	0	1	0.00	78	1,149		2023	2.17	57	
9	9 Mile Rd	GARFIELD	NAPIER		0.97	Novi	1	79	1.03	78	0	0	0	0	1	0.00	79	0			0.00	78	
9	Garfield Rd	EIGHT MILE	NINE MILE		1.08	Novi	1	80	0.92	79	0	0	0	0	1	0.00	80	0			0.00	81	
7	12 Mile Rd	GRAND RIVER	I96 (NOVI)		0.58	Novi	0	81	0.00	81	0	0	0	0	1	0.00	81	4,215		2023	0.00	74	
7	W 14 Mile Rd	M-5 N	HAGGERTY		0.46	RCOC	0	82	0.00	82	0	0	0	0	1	0.00	82	0			0.00	75	
7	W 14 Mile Rd	M-5 N	HAGGERTY		0.46	Novi	0	83	0.00	83	0	0	0	0	1	0.00	83	0			0.00	76	
7	W 14 Mile Rd	M-5 S	DECKER (NOVI)		0.79	Novi	0	84	0.00	84	0	0	0	0	1	0.00	84	0			0.00	77	
9	Center St	NOVI LMT	NINE MILE		0.48	Novi	0	85	0.00	85	0	0	0	0	1	0.00	85	0			0.00	79	
9	Dixon Rd	12 MILE	12 1/2 MILE		0.41	Novi	0	86	0.00	86	0	0	0	0	1	0.00	86	0			0.00	80	
9	Meadowbrook Rd	TWELVE MILE	THIRTEEN MILE		0.92	Novi	0	87	0.00	87	0	0	0	0	1	0.00	87	5,053		2023	0.00	83	
9	Taft Rd	ELEVEN MILE	GRAND RIVER		0.25	Novi	0	88	0.00	88	0	0	0	0	1	0.00	88	5,400		2022	0.00	85	
9	W 11 Mile Rd	MEADOWBROOK	SEELEY		0.45	Novi	0	89	0.00	89	0	0	0	0	1	0.00	89	0			0.00	87	
9	W 9 Mile Rd	TAFT	BECK		0.05	Novi	0	90	0.00	90	0	0	0	0	1	0.00	90	0			0.00	89	
9	West Rd	NOVI LMT	W PARK		0.23	Novi	0	91	0.00	91	0	0	0	0	1	0.00	91	5,471		2023	0.00	90	
9	Wixom Rd	TEN MILE	DELMONT		0.43	Novi	0	92	0.00	92	0	0	0	0	1	0.00	92	0			0.00	91	

* e: Estimated s: SCATS