Intersection Control Evaluation

Lor Ray Drive at James Drive

City of North Mankato, Nicollet County, Minnesota

December 2020

SRF No. 020 13559

Intersection Control Evaluation

Lor Ray Drive at James Drive

Proposed Letting Date: TBD

Report Certification:

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Adrian S. Potter — Print Name

42785 — Reg. No.

Adrian S. Potter — Signature

12/15/2020 — Date

Reviewed:

City of North Mankato
City Engineer

12/15/2020 — Date

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Introduction

This report comprises the intersection control evaluation (ICE) results for the Lor Ray Drive at James Drive intersection in the City of North Mankato, Nicollet County, Minnesota (see Figure 1). The purpose of this evaluation was to analyze various intersection control alternatives under existing and future conditions to identify a preferred intersection control alternative. The following intersection control alternatives were considered applicable:

- Side-Street Stop Control
- All-Way Stop Control (existing)
- Traffic Signal Control
- Mini-Roundabout Control

The side-street stop control alternative was defined as the existing intersection geometry with the mainline stop signs removed.

The all-way stop control alternative was defined as the existing control scheme with no changes or improvements. This is also referred to as the "no-build" alternative.

The traffic signal control alternative was defined as the existing intersection geometrics and an altered lane configuration. The new configuration would provide dedicated left-turn lanes and protected/permissive left-turn phasing on all approaches. It should be noted that all protected/permissive approaches in the signalized alternative would involve the installation of flashing yellow arrow (FYA) signal capabilities and phasing updates. The Minnesota Department of Transportation (MnDOT) currently supports using flashing yellow left-turn arrows when applicable due to their ability to increase left-turn efficiency.

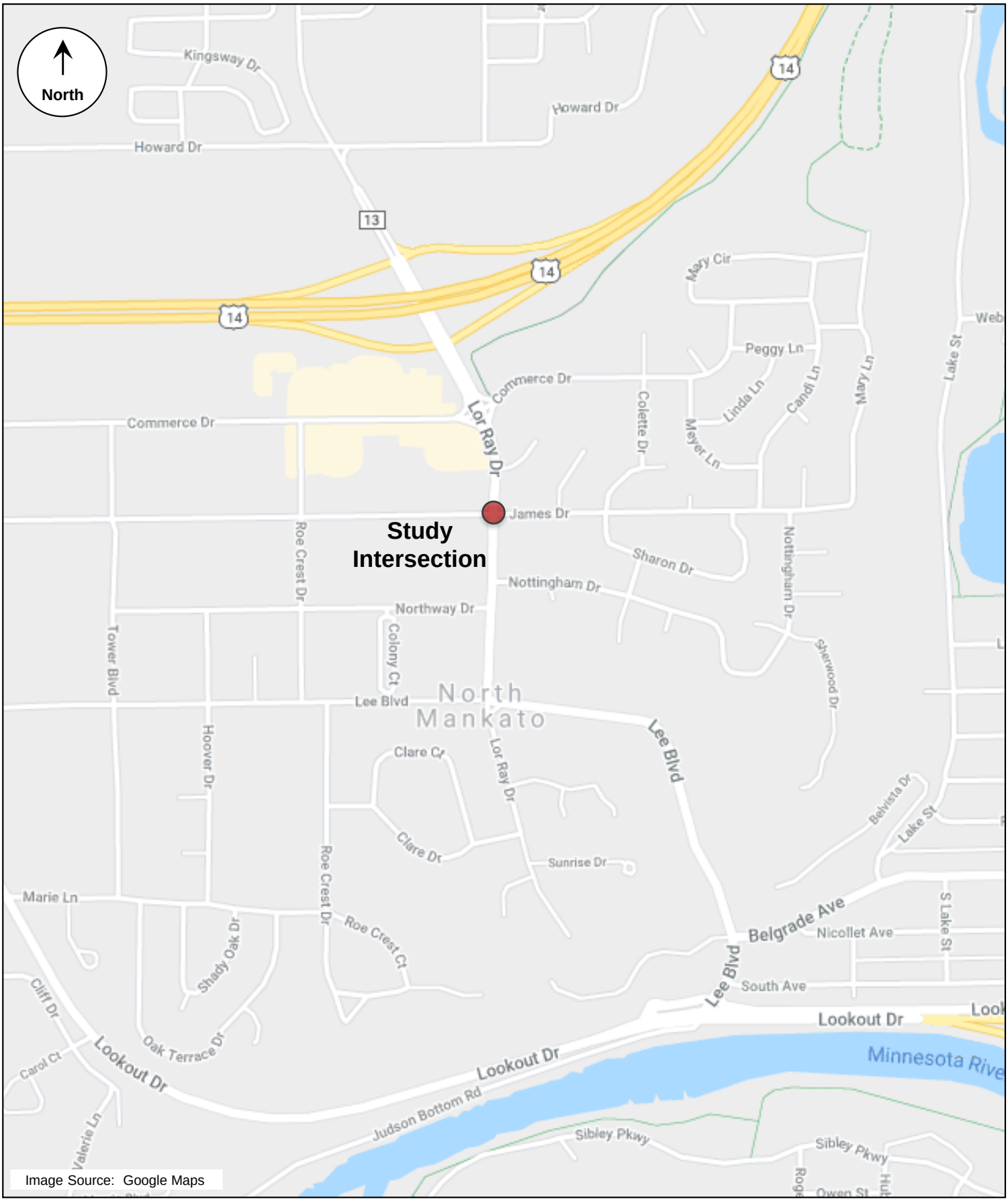
The mini-roundabout alternative was defined as a single-lane mini-roundabout. This alternative would require the complete reconstruction of the subject intersection.

Other potential forms of intersection control were considered qualitatively at the onset of the project but were deemed non-standard based on the nature of the surrounding area or not feasible based on right-of-way constraints.

Detailed warrants, operations, and safety analyses were performed to determine a preferred intersection control alternative. In addition to the above analyses, other factors considered applicable to determining the long-term preferred intersection control included:

- Right-of-Way Considerations
- Pedestrian and Bike Considerations
- Transportation System Considerations
- Planning-Level Cost Considerations

Traffic volumes collected for this report were taken during the COVID-19 pandemic and feature potentially unusual traffic levels and patterns. Adjustments to the traffic volumes used in this report are noted in the Traffic Volumes section.



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Intersection Location

Figure 1

Intersection Control Evaluation
Lor Ray Drive at James Drive
North Mankato, Minnesota

Intersection Characteristics

Existing Conditions

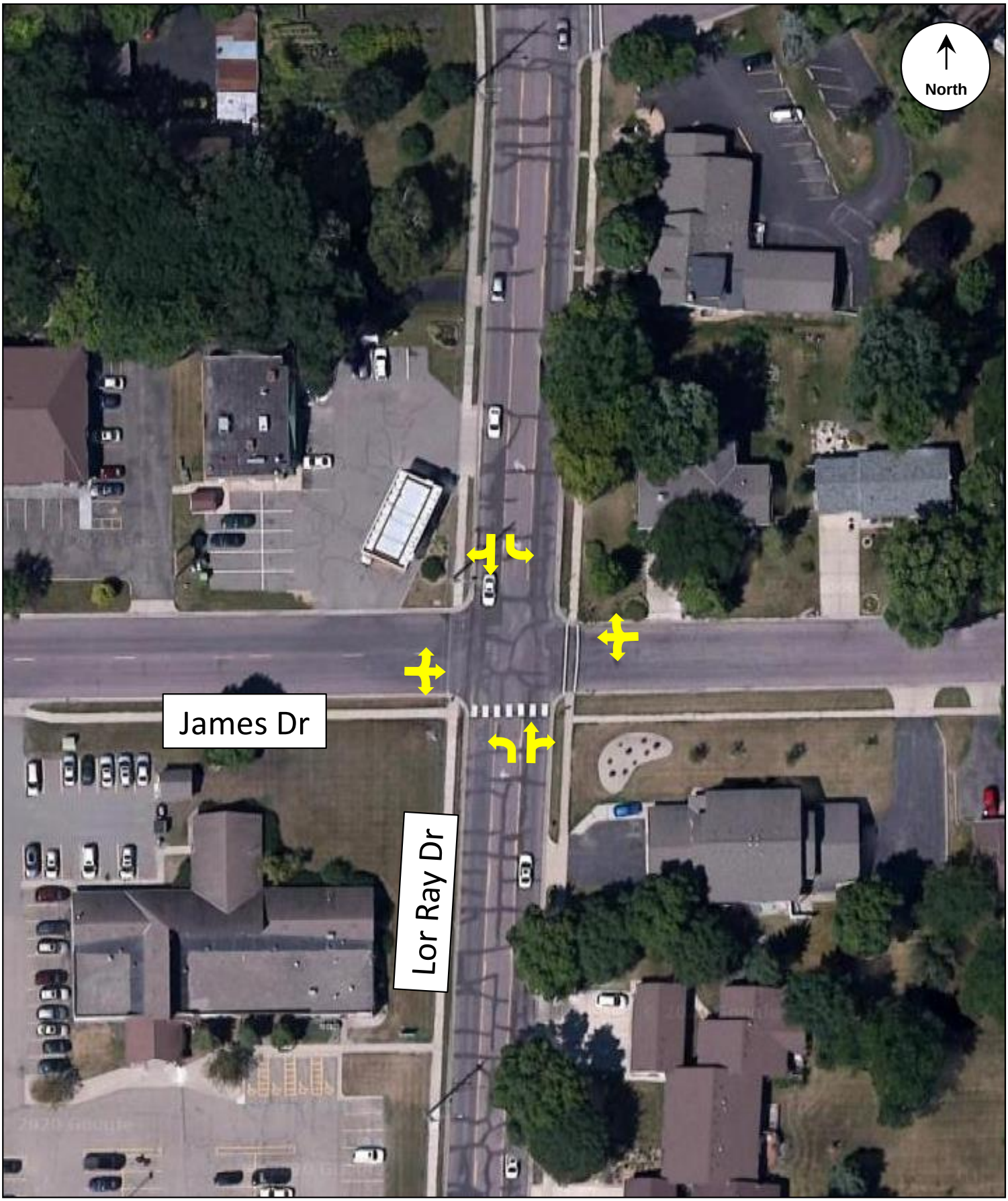
The Lor Ray Drive at James Drive intersection currently operates under all-way stop control. Lor Ray Drive is a three-lane undivided roadway with a two-way continuous left turn lane and a posted speed limit of 30 mph. James Drive is a two-lane undivided roadway with a statutory speed limit of 30 mph (no posted speed limit). The adjacent area is comprised of commercial businesses in the western quadrants and residential land uses in the eastern quadrants. Lor Ray Drive connects to US Highway 14 approximately 1,300 feet north of the subject intersection.

The area east of the subject intersection is comprised entirely of residential and recreational land use while the area to the west is comprised of commercial land use including several large office and manufacturing businesses. A Shell gas station and a Mayo Clinic building are located in the northwest and southwest corners of the intersection, respectively.

Current intersection geometrics are listed below in Table 1 and shown in Figure 2.

Table 1. Existing Conditions

Approach	Lane Configurations
Northbound Lor Ray Drive	One left-turn lane and one shared thru/right-turn lane
Southbound Lor Ray Drive	One left-turn lane and one shared thru/right-turn lane
Eastbound James Drive	One shared left-turn/thru/right-turn lane
Westbound James Drive	One shared left-turn/thru/right-turn lane



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Existing Conditions

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Figure 2

Crash History

The most recent crash data available (from 2015 through 2019) were obtained from the MnDOT Crash Mapping Analysis Tool (MnCMAT2). When measuring crash data, the critical crash rate determined by MnDOT is defined using the statewide average rate and the specific volume of the subject intersection to determine a point at which a high crash rate is considered statistically significant. If a crash rate exceeds the critical rate, it is highly recommended that action is taken to improve the safety at that intersection.

Nine total crashes were reported at the subject intersection during the five-year analysis period. This results in a crash rate of 0.44 crashes per million entering vehicles, which is above the statewide average rate of 0.35 but below the critical rate of 0.71 for similar intersections. The fatal and serious injury crash rate for the intersection was 0.00 crashes per 100 million entering vehicles. This is below both the statewide average rate of 0.57 and below the critical rate of 5.16 for similar intersections. A summary of the crash data is shown below and in Table 2:

- Crash Severity:
  - 9 – Property Damage Only Crashes
- Crash Type:
  - 4 – Angle Crashes
  - 1 – Left-Turn Crash
  - 1 – Lost Control Crash
  - 3 – Rear-End Crashes

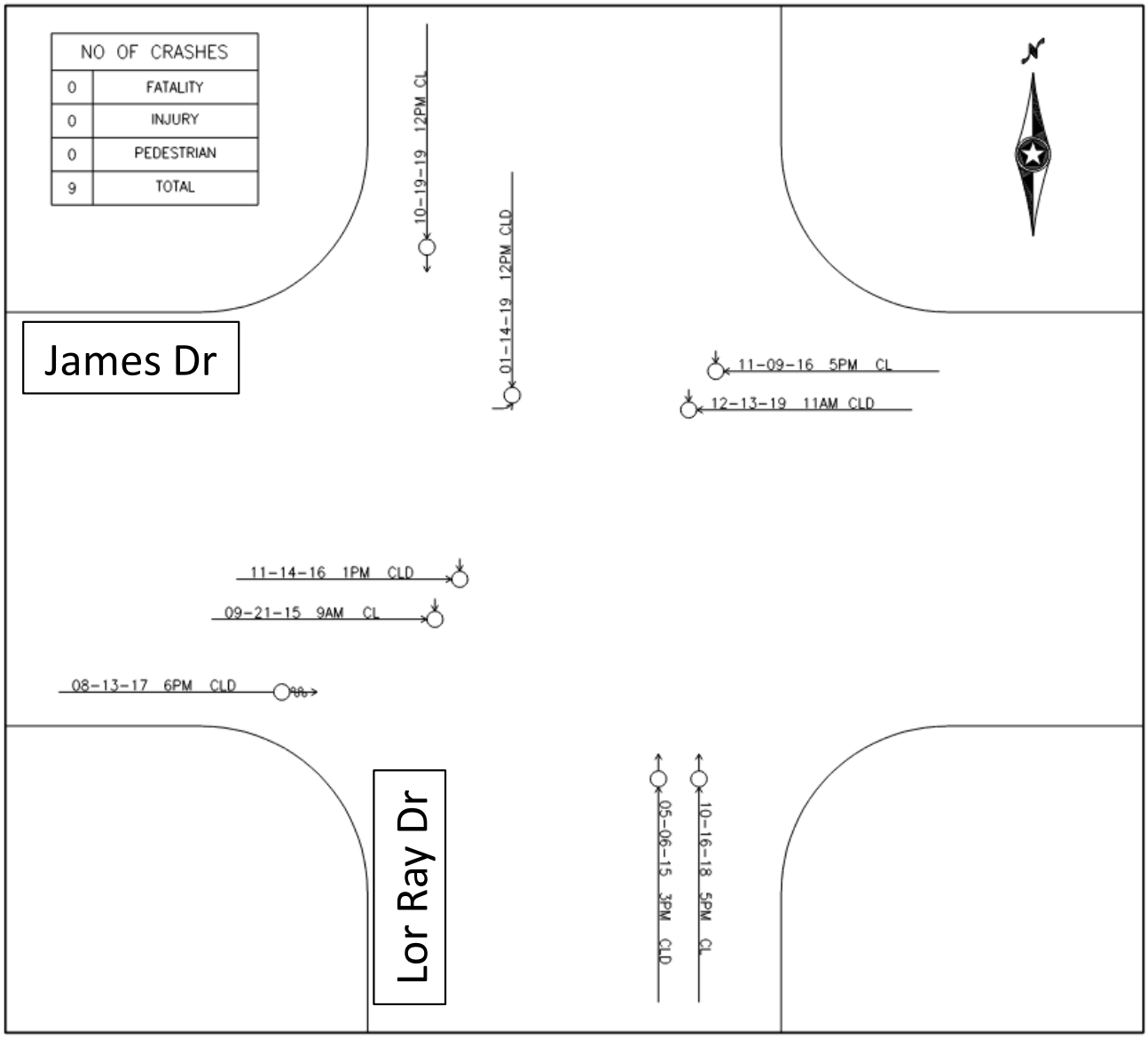
Table 2. Crash History Summary

Location	Number of Crashes	Daily Entering Volume	Total Crash Rate (1)			Fatal & Serious Injury Crash Rate (2)		
			Calculated	Average	Critical	Calculated	Average	Critical
Lor Ray Drive at James Drive	9	11,215	0.44	0.35	0.71	0.00	0.57	5.16

(1) Intersection crash rates are expressed in crashes per million entering vehicles.
(2) Intersection crash rates are expressed in crashes per 100 million entering vehicles.

The detailed crash reports for all crashes were examined to determine if any directional trends existed in the data. A collision diagram can be seen in Figure 3. The detailed crash summaries can be found in the Appendix.

Of the three rear end crashes, two involved northbound traffic while one involved southbound traffic. Thus, all rear-end crashes occurred on mainline approaches. This could be a result of mainline drivers not expecting the all-way stop control at the subject intersection. Every angle or left-turn type crash consisted of a vehicle from one of the minor approaches entering the intersection and being struck by a mainline vehicle. This also could be an indication of mainline traffic not expecting the all-way stop control condition.



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Collision Diagram (2015-2019)

Figure 3

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Lor Ray Drive at James Drive
North Mankato, Minnesota

Future Conditions

Future lane configurations were developed to accommodate projected traffic volumes. For the side-street and all-way stop control alternatives, the lane configuration was assumed to match the existing intersection layout.

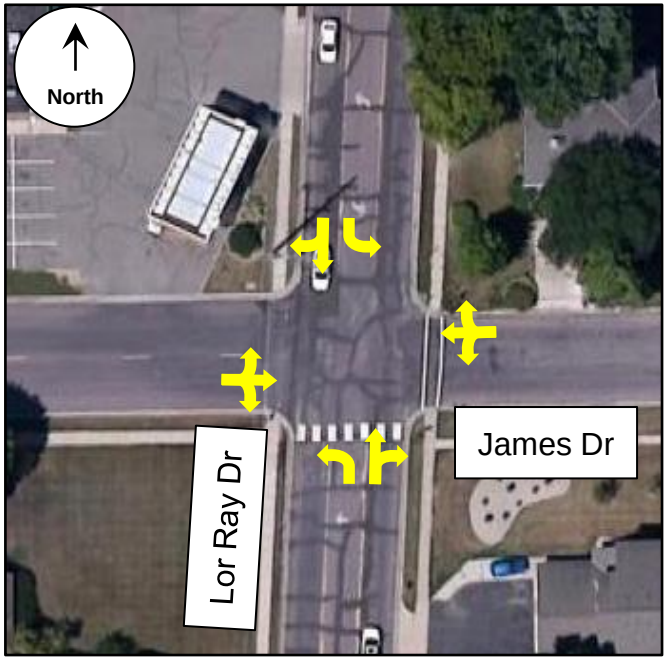
For the traffic signal control alternative, the lane configuration was adjusted to provide dedicated left-turn lanes on all approaches. The change to this lane configuration can be performed by revising pavement markings without any geometric changes; therefore, a formal alternative concept drawing was not developed.

For the mini-roundabout control alternative, a single-lane mini-roundabout was assumed. The proposed lane configurations are listed in Table 3 and can be seen in Figure 4. The full concept layout for the mini-roundabout control alternative can be found in the Appendix.

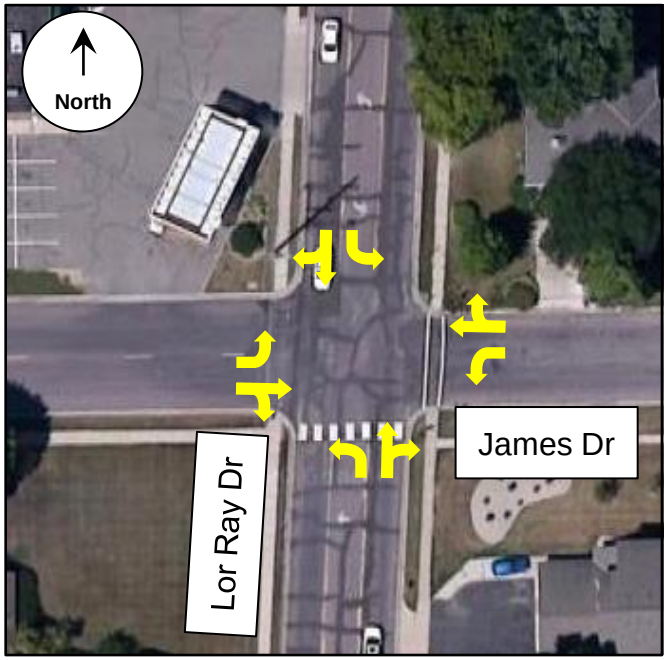
It should be noted that the concept layout in this report was designed to alleviate potential access concerns at the adjacent properties. However, if the mini-roundabout alternative is selected, additional emphasis should be placed on resolving potential access issues. Specifically, final design should focus on ensuring access to the northeast and northwest quadrants.

Table 3. Future Intersection Lane Configurations

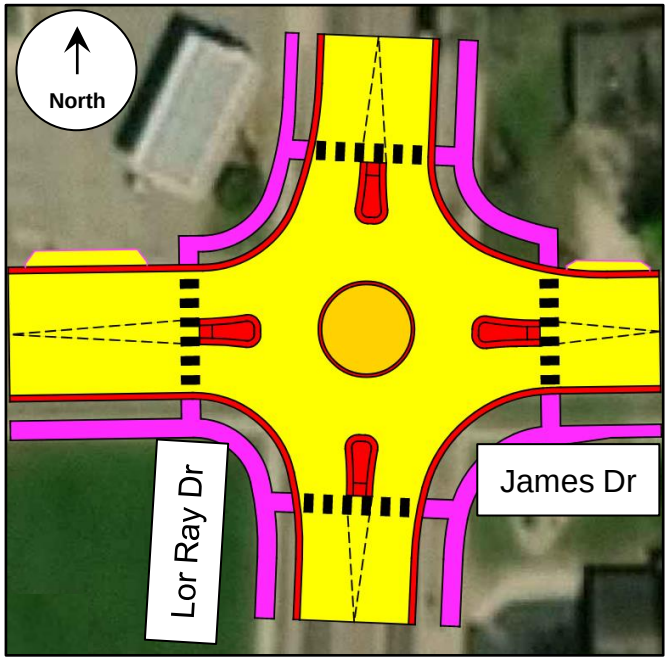
Approach	Side-Street Stop Control and All-Way Stop Control (existing)	Traffic Signal Control	Mini-Roundabout Control
Northbound Lor Ray Drive	• One left-turn lane • One share thru/right-turn lane	• One left-turn lane • One shared thru/right-turn lane	• One shared left-turn/thru/ right-turn lane
Southbound Lor Ray Drive	• One left-turn lane • One share thru/right-turn lane	• One left-turn lane • One shared thru/right-turn lane	• One shared left-turn/thru/ right-turn lane
Eastbound James Drive	• One shared left-turn/thru/right-turn lane	• One left-turn lane • One shared thru/right-turn lane	• One shared left-turn/thru/ right-turn lane
Westbound James Drive	• One shared left-turn/thru/right-turn lane	• One left-turn lane • One shared thru/right-turn lane	• One shared left-turn/thru/ right-turn lane



Side-Street Stop and All-Way Stop Alternatives



Traffic Signal Alternative



Roundabout Alternative

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Proposed Lane Configurations

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Figure 4

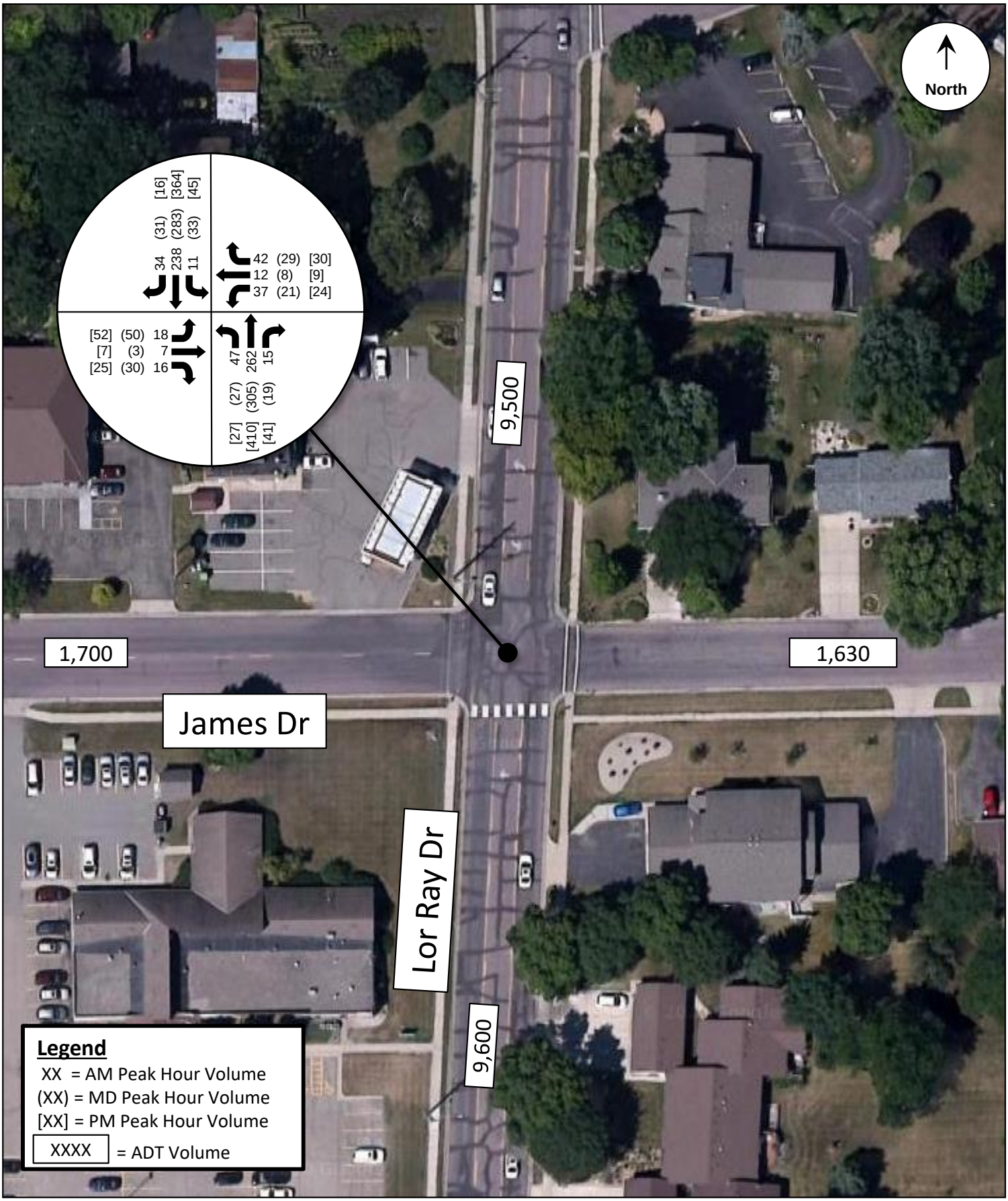
Traffic Volumes

Existing peak hour volumes at the study intersection were collected in September 2020 by SRF. This data collection occurred during the COVID-19 pandemic which is still ongoing at the time of this report. Due to the circumstances, additional inspection of the data was conducted in order to approximate non-pandemic traffic levels.

Earlier in the pandemic, traffic patterns were observed to have shifted significantly away from typical AM and PM peak hour distributions. However, this more recent data shows that typical pattern being reestablished. The data collected for this report exhibits three distinct peaks during the AM, midday (MD), and PM periods. Thus, the traffic patterns for the subject intersection were not adjusted by time of day. Additionally, the total number of vehicles entering the intersection was compared to the 2019 intersection ADT. Based on this comparison, volume data for this report was increased uniformly by 6% to approximate the ADT levels.

Adjusted peak hour turning movement volumes are summarized in Figure 5. The unadjusted turning movement counts are shown in the Appendix.

Future traffic volumes were projected for Year 2040 using the adjusted peak hour volumes and an annual growth of 1.0% percent. This growth rate was gathered from the *Long Range Transportation Plan (LRTP) 2045 Update* (Mankato/North Mankato Area Planning Organization, 2020). The projected volumes are summarized in Figure 6.



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Existing Volumes

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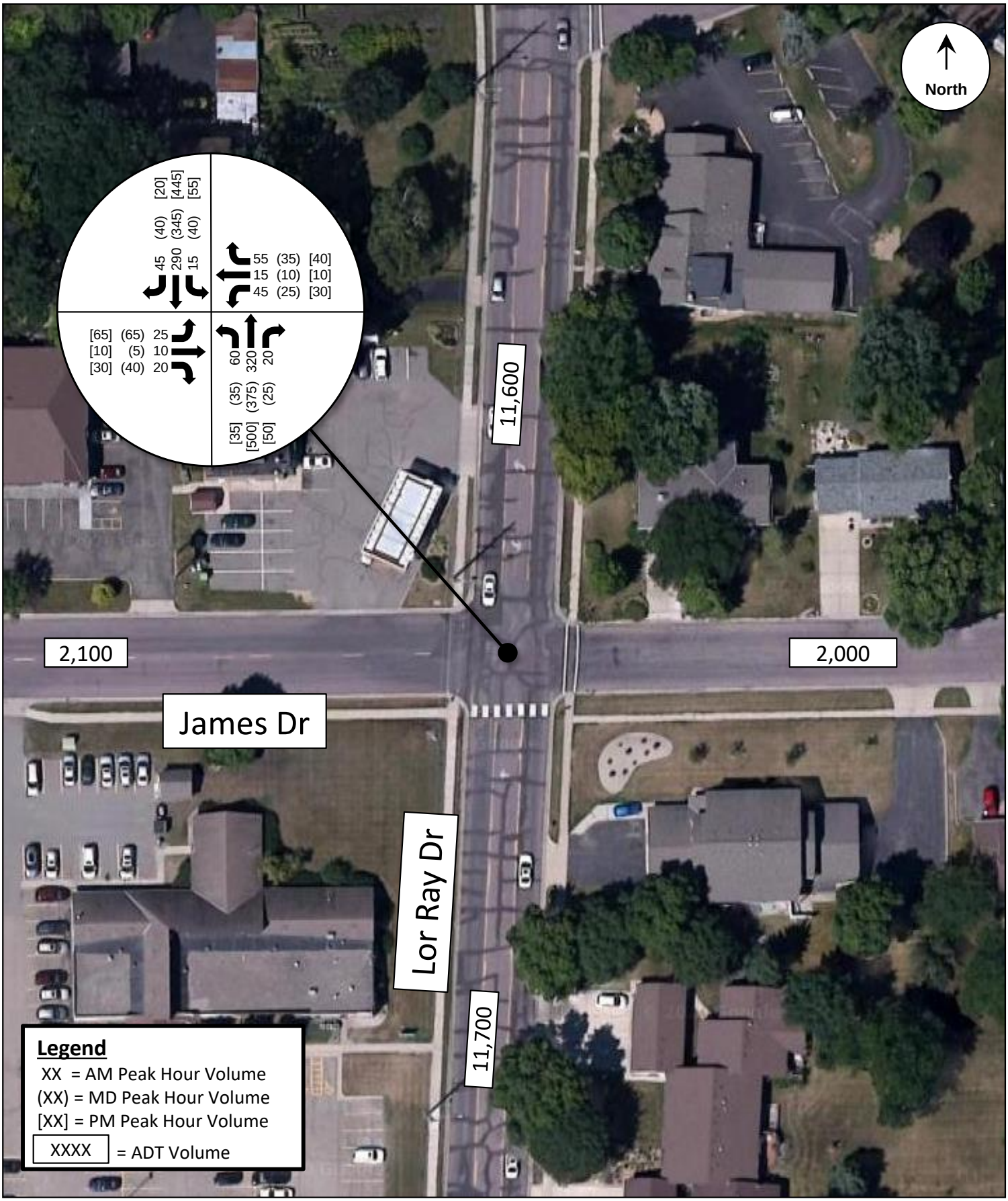
Figure 5



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Forecast Year 2040 Volumes

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Figure 6

Analysis of Alternatives

Warrants Analysis

A warrants analysis was performed for the traffic signal control alternatives as outlined in the September 2020 *Minnesota Manual on Uniform Traffic Control Devices* (MN MUTCD). Analysis of signal warrants 1-3 was performed utilizing existing and 2040 volumes. Signal warrants 4-9 were investigated and determined to not be applicable to the subject intersection.

The lane geometry and approach speeds assumed for the warrants analysis are shown in Table 4. The proposed traffic signal alternative lane configuration was assumed for the warrants analysis since the goal of the analysis was to determine whether or not the proposed signal is justified.

Table 4. Warrants Analysis Assumptions

Approach	Geometry	Speed Limit
Northbound Lor Ray Drive	Two or more approach lanes	30 mph
Southbound Lor Ray Drive	Two or more approach lanes	30 mph
Eastbound James Drive	Two or more approach lanes	30 mph
Westbound James Drive	Two or more approach lanes	30 mph

For the analysis, right-turning vehicles on the minor approaches were included as these turns would not be given a dedicated lane under the proposed signalized conditions and thus significantly impact the thru-movement on both minor approaches.

The 70 percent traffic volume factor was not used for the warrants analysis, as proposed conditions did not met the necessary criteria of the City of North Mankato having a population less than 10,000. Table 5 provides a summary of the warrants analysis results, while the detailed volume-based warrants analysis is included in the Appendix.

In addition to the signal warrants, Multiway Stop Applications Warrant Condition C (MWSA C) was also evaluated as outlined in the MN MUTCD. The results of the MWSA warrants analysis are also shown in Table 5.

It should be noted that this warrants analysis was developed using the adjusted traffic volumes collected during the pandemic.

Table 5. Existing Warrants Analysis Summary

MN MUTCD Warrant	Hours Required	Existing Volumes		2040 Volumes	
		Hours Met	Warrant Met?	Hours Met	Warrant Met?
MWSA C: Minimum Volumes	8	0	No	0	No
Warrant 1A: Minimum Vehicular Volume	8	0	No	0	No
Warrant 1B: Interruption of Continuous Traffic	8	0	No	0	No
Warrant 1C: Combination of Warrants	8	0	No	0	No
Warrant 2: Four-Hour Volume	4	0	No	0	No
Warrant 3B: Peak Hour Volume	1	0	No	0	No
Warrants 4-9	Not Applicable				

The results of the warrants analysis indicate the intersection does not satisfy any MN MUTCD Signal Warrants with either existing or 2040 volumes. The analysis also indicates that the intersection does not satisfy MWSA Condition C with either existing or 2040 volumes.

Based on these results, the traffic signal control alternative was removed from consideration. Unwarranted traffic signals carry the potential to create new problems within transportation systems. These potential problems include increased delays, decreased safety, and rerouting of vehicles onto less-appropriate roadways to avoid the signal. It should be noted that the subject intersection failed to satisfy the volume requirements of any signal warrant for even one of the required hours. This indicates that the subject intersection is significantly below the signal warrants requirements.

Despite the subject intersection also not satisfying the MWSA warrants, the all-way stop control alternative was not eliminated from consideration due its role as the existing form of control at the subject intersection.

Operations Analysis

For the operations analysis, the AM, MD, and PM peak hour adjusted turning movements gathered from the intersection were used.

Operational analysis of all alternatives was performed using PTV VISSIM software. VISSIM is a microscopic simulation program that can be used to model complex traffic solutions.

The operations analysis identifies a Level of Service (LOS) which indicates how well an intersection is operating based on delay per vehicle. Delay is calculated based on procedures outlined in the Highway Capacity Manual (HCM). Intersections are given a ranking from LOS A to LOS F. LOS A indicates the best traffic operation and LOS F indicates an intersection where demand exceeds capacity. LOS A through LOS D are considered acceptable because the intersection would be operating under capacity. LOS E indicates the intersection is operating at capacity.

A summary of the operational analysis with existing and 2040 volumes can be seen in Table 6 and Table 7, respectively. The detailed operations analysis results are shown in the Appendix.

Table 6. Operations Analysis Results: Delay – Existing Conditions

Alternative	Analysis Tool	AM Peak Hour		MD Peak Hour		PM Peak Hour	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Side-Street Stop Control	VISSIM	4 / 18	A / C	5 / 28	A / D	8 / 57	A / F
All-Way Stop Control (existing)	VISSIM	11 / 11	B / B	12 / 14	B / B	22 / 30	C / D
Mini-Roundabout Control	VISSIM	2 / 2	A / A	2 / 3	A / A	4 / 4	A / A

Note: Overall results are followed by the worst-approach results.

Table 7. Operations Analysis Results: Delay – 2040 Conditions

Alternative	Analysis Tool	AM Peak Hour		MD Peak Hour		PM Peak Hour	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Side-Street Stop Control	VISSIM	7 / 33	A / D	11 / 72	B / F	34 / 421	D / F
All-Way Stop Control (existing)	VISSIM	13 / 14	B / B	18 / 20	C / C	89 / 165	F / F
Mini-Roundabout Control	VISSIM	3 / 3	A / A	3 / 4	A / A	5 / 6	A / A

Note: Overall results are followed by the worst-approach results.

Operations analysis results of existing and 2040 volumes indicate that both the all-way and side-street stop control alternatives are expected to fail in operations by 2040. While the side-street stop control alternative is expected to have acceptable overall delays through 2040, it is expected to have LOS F worst-approach delays with both existing, and 2040 PM volumes. The all-way stop control alternative is expected to perform with acceptable delays except with 2040 PM volumes where it is expected to

have LOS F overall and worst-approach delay. The mini-roundabout control alternative is expected to operate with acceptable delays under all conditions.

Intersection queuing was also examined during the operations analysis. Queuing is the term for the behavior of traffic flows when demand exceeds capacity. Queuing occurs when a line of vehicles begins to form in front of a traffic feature such as a red light or a stop sign. Maximum vehicle queueing results with existing and 2040 volumes can be seen in Tables 8 and 9, respectively.

Table 8. Operations Analysis Results: Queuing – Existing Conditions

Alternative	Analysis Tool	Maximum Queuing (feet)											
		AM Peak Hour				MD Peak Hour				PM Peak Hour			
		NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
Side-Street Stop Control	VISSIM	24	7	68	89	16	18	104	66	19	26	130	84
All-Way Stop Control (existing)	VISSIM	131	134	59	75	168	159	73	60	337	231	74	64
Mini-Roundabout Control	VISSIM	56	61	20	42	74	69	33	29	132	106	37	38

Table 9. Operations Analysis Results: Queuing – 2040 Conditions

Alternative	Analysis Tool	Maximum Queuing (feet)											
		AM Peak Hour				MD Peak Hour				PM Peak Hour			
		NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
Side-Street Stop Control	VISSIM	27	13	80	122	28	24	175	86	25	35	481	124
All-Way Stop Control (existing)	VISSIM	172	174	63	83	240	249	85	66	1058	430	83	70
Mini-Roundabout Control	VISSIM	81	77	24	47	103	86	39	40	186	147	41	52

The queuing results indicate that the existing all-way stop control is expected to result in significant queuing on both the mainline and minor approaches with both existing and 2040 volumes. In particular, mainline queuing in the PM peak period is expected to be extreme in both directions. The side-street stop alternative is expected minimize mainline queuing but significantly increase minor-approach queues with both existing and 2040 volumes. The mini-roundabout alternative is expected retain the queuing trends of the all-way stop alternative while decreasing queuing on all approaches.

Safety Analysis

The Surrogate Safety Model (SSAM) is a software used to quantify near-miss traffic conflicts. The program uses the vehicle trajectory output provided by VISSIM to identify the conflict type. As part of the operations analysis, SSAM was used to evaluate the existing intersection conditions and compare them to future conditions. While the analysis often overestimates the number of conflicts, the percentage difference between alternatives is helpful in assessing the safety of the intersection. It should be noted that this data was based off 10 simulation runs.

A summary of the conflicts by conflict type with existing and 2040 volumes can be seen in Tables 10 and 11, respectively. These results are the sums of the AM, MD, and PM peak hour analyses. Full SSAM data broken down by peak hour can be seen in the Appendix.

Table 10. SSAM Total Predicted Crashes by Conflict Type – Existing Conditions

Alternative	Conflict Type			
	Crossing	Rear End	Lane Change	Total
Side-Street Stop Control	45	215	2	262
All-Way Stop Control (existing)	347	6,838	114	7,299
Mini-Roundabout Control	26	394	24	444

Table 11. SSAM Total Predicted Crashes by Conflict Type – 2040 Conditions

Alternative	Conflict Type			
	Crossing	Rear End	Lane Change	Total
Side-Street Stop Control	74	1,133	6	1,213
All-Way Stop Control (existing)	557	32,657	188	33,402
Mini-Roundabout Control	19	805	19	843

The SSAM results indicate that the existing all-way stop control is expected to result in a high number of rear-end conflicts. This matches the recent crash history at the subject intersection where three of the nine crashes were rear-ends.

The percentage change in conflicts compared to the existing all-way stop control can be seen in Table 12.

Table 12. SSAM Total Predicted Crashes by Conflict Type – Existing Conditions

Alternative	Year	Conflict Type			
		Crossing	Rear End	Lane Change	Total
Side-Street Stop Control	Existing	- 87%	- 97%	- 98%	- 96%
All-Way Stop Control (existing)		-	-	-	-
Mini-Roundabout Control		- 93%	- 94%	- 79%	- 94%
Side-Street Stop Control	2040	- 79%	- 83%	- 95%	- 83%
All-Way Stop Control (existing)		+ 61%	+ 378%	+ 65%	+ 358%
Mini-Roundabout Control		- 95%	- 88%	- 83%	- 89%

Based on this analysis, the results between both the existing and 2040 side-street stop and mini-roundabout alternatives are similar. Both alternatives are expected to significantly reduce conflicts at the subject intersection over the existing all-way stop control.

It should also be noted that five of the nine recorded crashes at the subject intersection were angle or left-turn crashes which are related to crossing conflicts. Based on this analysis, the mini-roundabout alternative is expected to most effectively reduce crossing conflicts. Thus, the mini-roundabout alternative is expected to be the most effective at mitigating the most common crash types at the subject intersection.

Right-of-Way Considerations

The side-street and all-way stop alternatives are not expected to require additional right-of-way as the geometrics of the intersection would not be changed with either alternative. The mini-roundabout alternative is also not expected to require additional right-of-way. Generally, mini-roundabouts are designed with areas of mountable curb in order to accommodate truck turning movements. Further evaluation during final design of the preferred alternative will be required to determine actual right-of-way needs.

Pedestrian and Bike Considerations

The current intersection contains crosswalk markings across the northbound, eastbound, and westbound approaches. However, the existing markings are not consistent between the approaches and the pedestrian ramps only support crossings on the minor approaches. If the side-street or all-way stop control alternatives are selected, reconstruction of the intersection pedestrian facilities would be recommended to ensure ADA compliance.

The side-street stop alternative is expected to present significant risk to pedestrians crossing the mainline approaches due to the uncontrolled nature of mainline traffic as well as the existing lack of proper pedestrian facilities.

The all-way stop control alternative is expected to reduce the risk of pedestrians crossing the mainline approaches. However, based on the crash history at the subject intersection, there appears to be a trend of mainline drivers failing to stop at the intersection. This trend could significantly decrease pedestrian safety if pedestrians assume incoming mainline vehicles will stop.

Pedestrian safety when crossing all approaches would be increased within the mini-roundabout alternative. The design of a mini-roundabout allows pedestrians to cross one direction of traffic at a time with a small refuge space in the middle of each leg of the mini-roundabout. These short crossing distances and reduced travel speeds of vehicle traffic can improve pedestrian safety. However, pedestrian routes may be slightly longer since they are kept to the outside of the inscribed circle.

All alternatives would be accessible to bicycle traffic. However, within the side-street stop alternative, bikers would face similar problems to pedestrians when trying to cross the mainline traffic. The all-way stop control and mini-roundabout control alternatives would provide bikers with increased safety due to slower vehicle traffic on all approaches. This increase in safety would allow for improved bicycle connectivity along the Lor Ray Drive corridor.

Transportation System Considerations

Currently, the subject intersection operates with all-way stop control. Both stop-controlled alternatives are expected to be familiar forms of traffic control to drivers in the area. Roundabouts are also a common form of traffic control in Minnesota and are not expected to cause driver confusion.

While southbound queuing within all alternatives is not expected to impact the intersection of Lor Ray Drive at Commerce Drive to the north, northbound 2040 PM queuing within the all-way stop control alternative is expected to extend far enough south to potentially impact both Nottingham Drive and Northway Drive.

All alternatives could be designed to accommodate a variety of transit stops and operations without adverse impact on the services. Further evaluation will be required during final design of the preferred alternative to identify which transit services will be incorporated and how they will be included.

Access to the adjacent properties in the northeast and northwest quadrants is a concern for the mini-roundabout alternative. While the alternative should be able to offer full access to these properties, emphasis should be placed on mitigating this issue during the potential final design of the mini-roundabout alternative.

Planning-Level Cost Considerations

The estimate for the side-street stop alternative was developing based on the need to remove two of the existing stop signs. No additional construction would be required for this alternative.

An estimate was not developed for the all-way stop control due to its role as the existing form of intersection control. Thus, there is no cost to retaining all-way stop control at the subject intersection.

The estimate for the mini-roundabout alternative was developed using the concept layout shown in Figure 4. Both the full version of this layout and the detailed cost estimate breakdown can be seen in the Appendix. Areas within this layout were used to calculate estimated construction costs.

Table 13. Planning-Level Cost Summary

Alternative	Initial Capital Costs	Operation/Maintenance Costs (annual)
Side-Street Stop Control	$1,000	< $200
All-Way Stop Control (existing)	-	< $200
Mini-Roundabout Control	$357,000	$500 - $1,000

Based off the cost estimates developed for both alternatives, construction costs of the mini-roundabout control alternative are expected to be significantly more than the side-street stop alternative. Maintenance for the mini-roundabout alternative is also expected to be more costly than the side-street or all-way stop alternatives.

Conclusions

The following intersection control evaluation (ICE) conclusions and recommendations are provided for the Lor Ray Drive at James Drive intersection in North Mankato, Nicollet County, Minnesota:

- *Warrants Analysis*
  The results of the warrants analyses indicate that the intersection does not satisfy any signal warrants with existing and 2040 volumes. The traffic signal control alternative was removed from consideration based on the lack of satisfied signal warrants.

  MWSA Condition C was also not satisfied with existing or 2040 volumes. Consideration of the all-way stop control alternative was continued due to its role as the existing form of intersection control.

- *Operations Analysis*
  Operations analysis results of existing volumes indicate that both the side-street stop and mini-roundabout alternatives are expected to perform with acceptable levels of service. Operations analysis results of 2040 volumes indicate that only the mini-roundabout alternative is expected to perform with an acceptable level of service.

  Queuing results indicate that the side-street stop alternative is expected to significantly increase minor-approach queuing while the mini-roundabout alternative is expected to result in decreased queueing on all approaches.

- *Safety Analysis*
  Both the side-street stop and mini-roundabout alternatives are expected to significantly reduce conflicts at the subject intersection. The mini-roundabout is expected to have the greatest effect on crossing conflicts which would reduce the high number of angle and left-turn crashes at the subject intersection.

- *Right-of-Way Considerations*
  All alternatives are not expected to require additional right-of-way. The mini-roundabout alternative is expected to be able to accommodate truck turns using mountable curb areas.

- *Pedestrian and Bike Considerations*
  The side-street stop alternative is expected to result in a significant decrease in pedestrian safety when crossing the mainline approaches. The all-way stop alternative is expected to provide increased pedestrian safety. However, the crash history indicates that mainline drivers may not be obeying the stop signs which could put pedestrians in danger. The mini-roundabout is expected to reduce traffic speeds through the intersection and decrease pedestrian crossing distances, thus increasing pedestrian safety.

  While all alternatives would be accessible to bicycle traffic, the all-way stop and mini-roundabout alternatives would offer increased safety to bikers.

- *Transportation System Considerations*
  It is expected that drivers will be familiar with both forms of stop control. Roundabouts should also be a familiar form of traffic control in the area.

  Mainline queuing is not expected to impact intersections north of the subject intersection. However, 2040 PM queuing could impact intersections to the south.

  All alternatives could be designed to facilitate a variety of transit service.

  Emphasis should be placed on alleviating access concerns at adjacent properties during potential final design of the mini-roundabout alternative.

- *Planning-Level Cost Considerations*
  The cost for the side-street stop alternative is minimal due to the limited changes required to transition the intersection to side-street stop control. There is no cost associated with the all-way stop alternative due to its role as the existing form of intersection control. The cost for the mini-roundabout alternative is significantly higher than the other alternatives.

Recommended Intersection Control

A decision matrix was developed to help evaluate the key factors and is presented in Table 14.

Mini-roundabout control is recommended for the subject intersection. This is due to the expected safety and operations benefits offered by the mini-roundabout.

While both the side-street stop and mini-roundabout alternatives are expected to reduce conflicts and improve intersection safety, the mini-roundabout is expected to be more effective at mitigating the angle and left-turn crashes at the subject intersection. Roundabouts significantly reduce angle and left-turn crashes due to their geometry. Thus, the mini-roundabout alternative is expected to be the most effective crash-mitigation alternative.

The side-street stop alternative is expected to perform with LOS F worst-approach delays with both existing and 2040 volumes. The side-street stop alternative is also expected to result in a significant queuing increase on the minor-approaches. These results indicate that the conversion of the intersection to side-street stop control would improve operations for mainline traffic at the expense of minor-approach traffic which would experience extreme delays and queuing.

The all-way stop alternative is also expected to perform with LOS F worst-approach delays with 2040 volumes. It is also expected to perform with the highest overall delays of the three alternatives across all scenarios. Additionally, mainline queuing within the all-way stop alternative is expected to be significant with existing volumes and become extreme by 2040. These results indicate that the existing all-way stop is expected to cause sub-optimal operations and queuing with existing volumes that will worsen over time until the intersection reaches its capacity, LOS E, by 2040.

The mini-roundabout alternative is expected to perform with acceptable levels of service through 2040 and the lowest overall and worst-approach delays across all scenarios. While queuing is expected to be moderate within the mini-roundabout, all queuing is expected to be significantly less than queuing within the all-way stop alternative.

The mini-roundabout alternative is also expected to be able to fit within the existing intersection footprint without requiring any additional right-of-way.

The mini-roundabout alternative is also expected to provide the greatest increase to pedestrian safety, especially when crossing the mainline approaches.

It should be noted that the final design of the mini-roundabout should be developed with an emphasis on maintaining access to the adjacent properties in the northeast and northwest quadrants.

Therefore, the mini-roundabout alternative is expected to benefit overall intersection safety, operations, and pedestrian safety without impacting the surrounding businesses or residences.

Table 14. Alternative Decision Matrix

Factor		Side-Street Stop Control	All-Way Stop Control (existing)	Mini-Roundabout Control	Recommended Alternative(s) Based on Factor
Warrant Analysis	Existing	• N/A	• AWSC warrants not met	• N/A	
	2040	• N/A	• AWSC warrants not met	• N/A	
Operational Analysis	Existing	• Worst-approach LOS F	• Acceptable LOS	• Acceptable LOS	Mini-Roundabout Control
	2040	• Worst-approach LOS F	• Overall LOS E • Worst-approach LOS F	• Acceptable LOS	
Safety Analysis	Pro(s):	• Reduced Conflicts	• N/A	• Reduced Conflicts • Addresses trends in crash history	Side-Street Stop Control Mini-Roundabout Control
	Con(s):	• Does not address trends in crash history	• Increased conflicts • Above statewide average crash rate	• N/A	
Right-of-Way Considerations	Pro(s):	• No additional right-of-way required	• No additional right-of-way required	• No additional right-of-way required	All Alternatives
	Con(s):	• N/A	• N/A	• N/A	
Pedestrian Considerations	Pro(s):	• N/A	• Controlled mainline traffic	• Shortened pedestrian crossings • Slower entering traffic	All-Way Stop Control (existing) Mini-Roundabout Control
	Con(s):	• Uncontrolled mainline traffic • Sub-optimal existing facilities	• Sub-optimal existing facilities	• N/A	
Transportation System Considerations	Pro(s):	• Familiar form of traffic control	• Familiar form of traffic control	• Familiar form of traffic control	Side-Street Stop Control Mini-Roundabout Control
	Con(s):	• N/A	• NB queuing impacts adjacent intersections	• N/A	
Planning-Level Cost Considerations	Pro(s):	• Inexpensive	• Inexpensive	• N/A	Side-Street Stop Control All-Way Stop Control (existing)
	Con(s):	• N/A	• N/A	• Higher construction and maintenance costs	

Appendix

- Existing Intersection Turning Movement Data
- Detailed Crash Reports (2015-2019)
- Mini-Roundabout Concept Layout
- Existing Warrants Analysis
- 2040 Warrants Analysis
- Detailed Operations Analysis Memo
- SSAM Results Memo
- Mini-Roundabout Detailed Cost Estimate

Existing Intersection Turning Movement Data

Leg	James Dr					James Dr					Lor Ray Dr					Lor Ray Dr						
Direction	Eastbound					Westbound					Northbound					Southbound						
Start Time	Left	Thru	Right	U-Turn	**App Total**	Left	Thru	Right	U-Turn	**App Total**	Left	Thru	Right	U-Turn	**App Total**	Left	Thru	Right	U-Turn	**App Total**	**Int Total**	
2020-09-22 13:00:00	6	3	7	0	**16**	5	4	9	0	**18**	5	60	4	0	**69**	7	63	3	0	**73**	**176**	
2020-09-22 13:15:00	9	2	4	0	**15**	7	2	7	0	**16**	5	62	5	0	**72**	3	70	7	0	**80**	**183**	
2020-09-22 13:30:00	4	1	7	0	**12**	5	0	6	0	**11**	8	78	8	0	**94**	1	77	9	0	**87**	**204**	
2020-09-22 13:45:00	8	0	8	0	**16**	2	2	7	0	**11**	10	69	4	0	**83**	2	61	8	0	**71**	**181**	
2020-09-22 14:00:00	16	1	10	0	**27**	3	0	4	0	**7**	9	58	5	0	**72**	5	76	3	0	**84**	**190**	
2020-09-22 14:15:00	10	1	6	0	**17**	5	1	7	0	**13**	3	60	6	0	**69**	8	66	9	0	**83**	**182**	
2020-09-22 14:30:00	24	1	4	0	**29**	6	1	1	0	**8**	3	63	2	0	**68**	6	53	4	0	**63**	**168**	
2020-09-22 14:45:00	8	1	2	0	**11**	6	5	4	0	**15**	8	73	8	0	**89**	7	61	7	0	**75**	**190**	
2020-09-22 15:00:00	11	9	7	0	**27**	3	1	3	0	**7**	10	81	6	0	**97**	4	66	4	0	**74**	**205**	
2020-09-22 15:15:00	9	0	7	0	**16**	3	3	10	0	**16**	7	86	8	0	**101**	14	102	3	0	**119**	**252**	
2020-09-22 15:30:00	15	0	5	0	**20**	7	1	10	0	**18**	9	96	5	0	**110**	14	111	5	0	**130**	**278**	
2020-09-22 15:45:00	9	2	7	0	**18**	9	0	6	0	**15**	3	119	10	0	**132**	10	91	4	0	**105**	**270**	
2020-09-22 16:00:00	14	3	8	0	**25**	7	1	9	0	**17**	6	95	7	0	**108**	8	88	1	0	**97**	**247**	
2020-09-22 16:15:00	7	0	3	0	**10**	8	2	5	0	**15**	6	89	5	0	**100**	5	61	5	0	**71**	**196**	
2020-09-22 16:30:00	18	3	4	0	**25**	7	2	6	0	**15**	6	68	8	0	**82**	12	77	6	0	**95**	**217**	
2020-09-22 16:45:00	7	3	4	0	**14**	3	4	5	0	**12**	9	99	6	0	**114**	7	88	5	0	**100**	**240**	
2020-09-22 17:00:00	16	1	9	0	**26**	10	0	7	0	**17**	8	84	14	0	**106**	12	90	4	0	**106**	**255**	
2020-09-22 17:15:00	10	1	3	0	**14**	3	2	9	0	**14**	8	75	8	0	**91**	10	87	0	0	**97**	**216**	
2020-09-22 17:30:00	11	1	3	0	**15**	8	1	6	0	**15**	1	111	4	0	**116**	7	72	4	0	**83**	**229**	
2020-09-22 17:45:00	6	0	9	0	**15**	5	2	2	0	**9**	5	84	6	0	**95**	8	81	1	0	**90**	**209**	
2020-09-22 18:00:00	5	0	4	0	**9**	4	1	2	0	**7**	1	74	5	0	**80**	9	62	2	0	**73**	**169**	
2020-09-22 18:15:00	4	3	7	0	**14**	2	2	7	0	**11**	7	68	6	0	**81**	7	58	0	0	**65**	**171**	
2020-09-22 18:30:00	1	1	3	0	**5**	3	0	6	0	**9**	1	70	7	0	**78**	5	43	1	0	**49**	**141**	
2020-09-22 18:45:00	0	1	3	0	**4**	4	1	6	0	**11**	1	71	12	0	**84**	8	61	1	0	**70**	**169**	
2020-09-22 19:00:00	4	1	3	0	**8**	2	1	5	0	**8**	3	87	5	0	**95**	8	51	0	0	**59**	**170**	
2020-09-22 19:15:00	1	1	3	0	**5**	0	0	5	0	**5**	2	34	3	0	**39**	5	65	2	0	**72**	**121**	
2020-09-22 19:30:00	3	0	3	0	**6**	5	1	5	0	**11**	0	33	1	0	**34**	10	46	1	0	**57**	**108**	
2020-09-22 19:45:00	0	0	3	0	**3**	2	0	2	0	**4**	6	46	0	0	**52**	6	41	2	0	**49**	**108**	
2020-09-22 20:00:00	2	0	0	0	**2**	2	0	4	0	**6**	2	26	4	0	**32**	5	32	1	0	**38**	**78**	
2020-09-22 20:15:00	0	1	2	0	**3**	0	1	1	0	**2**	2	23	3	0	**28**	3	25	2	0	**30**	**63**	
2020-09-22 20:30:00	1	0	0	0	**1**	2	0	2	0	**4**	0	17	0	0	**17**	2	44	0	0	**46**	**68**	
2020-09-22 20:45:00	3	0	2	0	**5**	1	0	4	0	**5**	0	26	2	0	**28**	4	29	0	0	**33**	**71**	
2020-09-22 21:00:00	2	1	0	0	**3**	1	0	0	0	**1**	2	19	2	0	**23**	2	42	3	0	**47**	**74**	
2020-09-22 21:15:00	0	0	0	0	**0**	0	0	2	0	**2**	2	15	1	0	**18**	5	27	0	0	**32**	**52**	
2020-09-22 21:30:00	1	0	1	0	**2**	2	0	1	0	**3**	1	14	4	0	**19**	2	18	3	0	**23**	**47**	
2020-09-22 21:45:00	0	0	1	0	**1**	3	0	1	0	**4**	8	10	2	0	**20**	0	22	1	0	**23**	**48**	
2020-09-22 22:00:00	5	0	8	0	**13**	2	0	1	0	**3**	1	12	1	0	**14**	1	20	0	0	**21**	**51**	
2020-09-22 22:15:00	3	0	4	0	**7**	1	0	0	0	**1**	0	8	0	0	**8**	1	16	0	0	**17**	**33**	
2020-09-22 22:30:00	3	0	1	0	**4**	0	0	1	0	**1**	0	7	1	0	**8**	0	11	0	0	**11**	**24**	
2020-09-22 22:45:00	1	0	1	0	**2**	1	0	0	0	**1**	0	6	0	0	**6**	0	9	1	0	**10**	**19**	
2020-09-23 00:00:00	1	0	0	0	**1**	0	0	0	0	**0**	0	8	0	0	**8**	1	10	1	0	**12**	**21**	
2020-09-23 00:15:00	0	0	0	0	**0**	0	0	0	0	**0**	0	6	2	0	**8**	2	9	0	0	**11**	**19**	
2020-09-23 00:30:00	1	0	0	0	**1**	0	0	0	0	**0**	1	6	0	0	**7**	2	5	0	0	**7**	**15**	
2020-09-23 00:45:00	1	0	0	0	**1**	0	0	0	0	**0**	0	8	0	0	**8**	1	4	0	0	**5**	**14**	
2020-09-23 01:00:00	0	0	0	0	**0**	0	0	2	0	**2**	0	5	0	0	**5**	0	6	0	0	**6**	**13**	
2020-09-23 01:15:00	1	0	0	0	**1**	0	0	0	0	**0**	0	4	1	0	**5**	0	6	0	0	**6**	**12**	
2020-09-23 01:30:00	0	0	0	0	**0**	0	0	0	0	**0**	0	5	0	0	**5**	1	1	0	0	**2**	**7**	
2020-09-23 01:45:00	0	0	0	0	**0**	0	0	0	0	**0**	0	4	0	0	**4**	0	5	0	0	**5**	**9**	
2020-09-23 02:00:00	4	0	0	0	**4**	1	0	0	0	**1**	0	3	0	0	**3**	1	2	0	0	**3**	**11**	
2020-09-23 02:15:00	1	0	0	0	**1**	0	0	0	0	**0**	0	1	0	0	**1**	0	2	0	0	**2**	**4**	
2020-09-23 02:30:00	2	0	0	0	**2**	0	0	1	0	**1**	0	0	1	0	**1**	0	0	0	0	**0**	**4**	
2020-09-23 02:45:00	1	0	2	0	**3**	0	0	0	0	**0**	0	2	0	0	**2**	1	5	0	0	**6**	**11**	
2020-09-23 03:00:00	0	0	1	0	**1**	0	0	1	0	**1**	1	1	0	0	**2**	0	0	0	0	**0**	**4**	
2020-09-23 03:15:00	1	0	0	0	**1**	0	0	0	0	**0**	0	0	0	0	**0**	0	1	0	0	**1**	**2**	
2020-09-23 03:30:00	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	1	2	0	0	**3**	**3**	
2020-09-23 03:45:00	1	0	0	0	**1**	0	0	0	0	**0**	0	3	1	0	**4**	0	0	0	0	**0**	**5**	
2020-09-23 04:00:00	0	0	0	0	**0**	0	0	1	0	**1**	0	2	0	0	**2**	0	1	0	0	**1**	**4**	
2020-09-23 04:15:00	0	0	0	0	**0**	0	0	0	0	**0**	0	1	0	0	**1**	0	2	0	0	**2**	**3**	
2020-09-23 04:30:00	0	0	0	0	**0**	0	0	1	0	**1**	0	2	0	0	**2**	0	1	0	0	**1**	**3**	
2020-09-23 04:45:00	0	0	0	0	**0**	0	0	0	0	**0**	0	1	0	0	**1**	0	2	0	0	**2**	**3**	
2020-09-23 05:00:00	1	0	0	0	**1**	1	0	0	0	**1**	0	3	0	0	**3**	0	4	0	0	**4**	**8**	
2020-09-23 05:15:00	1	0	0	0	**1**	1	0	3	0	**4**	1	6	1	0	**8**	0	6	0	0	**6**	**19**	
2020-09-23 05:30:00	2	0	0	0	**2**	1	3	3	0	**7**	1	6	0	0	**7**	2	5	0	0	**7**	**23**	
2020-09-23 05:45:00	3	0	0	0	**3**	0	0	5	0	**5**	2	13	0	0	**15**	0	10	4	0	**14**	**37**	
2020-09-23 06:00:00	0	0	2	0	**2**	2	0	1	0	**3**	4	17	0	0	**21**	1	7	14	0	**22**	**48**	
2020-09-23 06:15:00	1	0	3	0	**4**	1	1	3	0	**5**	16	25	0	0	**41**	0	24	16	0	**40**	**90**	
2020-09-23 06:30:00	6	0	3	0	**9**	3	2	2	0	**7**	7	16	0	0	**23**	1	21	8	0	**30**	**69**	
2020-09-23 06:45:00	3	0	3	0	**6**	4	0	8	0	**12**	8	26	0	0	**34**	0	16	2	0	**18**	**70**	
2020-09-23 07:00:00	0	0	5	0	**5**	1	0	2	0	**3**	6	18	0	0	**24**	2	28	2	0	**32**	**64**	
2020-09-23 07:15:00	4	1	0	0	**5**	7	3	2	0	**12**	6	27	1	0	**34**	0	22	5	0	**27**	**78**	
2020-09-23 07:30:00	4	0	2	0	**6**	9	1	4	0	**14**	7	46	2	0	**55**	1	29	9	1	**40**	**115**	
2020-09-23 07:45:00	2	0	5	0	**7**	10	3	7	0	**20**	9	48	3	0	**60**	1	56	6	0	**63**	**150**	
2020-09-23 08:00:00	7	2	2	0	**11**	10	2	5	0	**17**	13	61	1	0	**75**	1	60	7	0	**68**	**171**	
2020-09-23 08:15:00	3	1	3	0	**7**	3	6	12	0	**21**	12	74	2	0	**88**	2	51	15	0	**68**	**184**	
2020-09-23 08:30:00	4	2	2	0	**8**	4	2	9	0	**15**	3	50	4	0	**57**	5	42	7	0	**54**	**134**	
2020-09-23 08:45:00	1	0	2	0	**3**	6	0	3	0	**9**	14	31	1	0	**46**	1	21	6	0	**28**	**86**	
2020-09-23 09:00:00	6	1	7	0	**14**	10	0	4	0	**14**	7	44	5	0	**56**	1	33	5	0	**39**	**123**	
2020-09-23 09:15:00	5	0	7	0	**12**	5	0	5	0	**10**	3	45	4	0	**52**	3	60	8	0	**71**	**145**	
2020-09-23 09:30:00	7	0	2	0	**9**	4	1	2	0	**7**	3	34	2	0	**39**	3	24	2	0	**29**	**84**	
2020-09-23 09:45:00	8	2	2	0	**12**	4	1	8	0	**13**	6	40	2	0	**48**	2	43	2	0	**47**	**120**	
2020-09-23 10:00:00	7	1	3	0	**11**	5	3	6	0	**14**	7	47	2	0	**56**	2	38	2	0	**42**	**123**	
2020-09-23 10:15:00	9	2	5	0	**16**	4	0	4	0	**8**	11	76	4	0	**91**	5	45	6	0	**56**	**171**	
2020-09-23 10:30:00	7	1	2	0	**10**	5	3	4	0	**12**	4	43	5	0	**52**	3	49	2	0	**54**	**128**	
2020-09-23 10:45:00	9	3	2	0	**14**	6	2	8	0	**16**	3	52	3	0	**58**	10	37	4	0	**51**	**139**	
2020-09-23 11:00:00	8	0	1	0	**9**	8	1	6	0	**15**	5	46	6	0	**57**	4	34	6	0	**44**	**125**	
2020-09-23 11:15:00	5	1	4	0	**10**	2	1	4	0	**7**	10	52	5	0	**67**	5	43	5	0	**53**	**137**	
2020-09-23 11:30:00	13	1	12	0	**26**	5	0	5	0	**10**	1	59	5	0	**65**	3	52	5	0	**60**	**161**	
2020-09-23 11:45:00	5	2	5	0	**12**	6	1	8	0	**15**	4	57	7	0	**68**	4	58	11	0	**73**	**168**	
2020-09-23 12:00:00	10	3	3	0	**16**	4	0	8	0	**12**	6	81	7	0	**94**	7	74	4	0	**85**	**207**	
2020-09-23 12:15:00	15	0	5	0	**20**	5	0	5	0	**10**	5	67	1	0	**73**	8	74	5	0	**87**	**190**	
2020-09-23 12:30:00	12	0	10	0	**22**	4	0	3	0	**7**	6	69	3	0	**78**	13	70	4	0	**87**	**194**	
2020-09-23 12:45:00	9	0	7	0	**16**	4	3	4	0	**11**	5	69	4	0	**78**	5	68	8	0	**81**	**186**	
2020-09-23 13:00:00	9	3	4	0	**16**	11	4	6	0	**21**	7	57	5	0	**69**	10	70	7	0	**87**	**193**	
2020-09-23 13:15:00	12	0	4	0	**16**	3	0	10	0	**13**	6	72	5	0	**83**	4	72	6	0	**82**	**194**	
2020-09-23 13:30:00	6	2	6	0	**14**	3	3	3	0	**9**	6	55	1	0	**62**	2	62	2	0	**66**	**151**	
2020-09-23 13:45:00	3	2	2	0	**7**	1	0	5	0	**6**	4	63	4	0	**71**	8	56	6	0	**70**	**154**	
2020-09-23 14:00:00	4	2	2	0	**8**	5	2	3	0	**10**	10	61	0	0	**71**	7	62	7	0	**76**	**165**	
2020-09-23 14:15:00	7	0	9	0	**16**	4	0	8	0	**12**	15	59	3	0	**77**	3	74	4	0	**81**	**186**	
2020-09-23 14:30:00	15	1	11	0	**27**	3	1	4	0	**8**	10	78	7	0	**95**	7	53	5	0	**65**	**195**	
2020-09-23 14:45:00	7	0	5	0	**12**	5	2	5	0	**12**	4	76	6	0	**86**	2	68	5	0	**75**	**185**	
2020-09-23 15:00:00	27	2	6	0	**35**	1	1	7	0	**9**	6	60	6	0	**72**	6	68	4	0	**78**	**194**	
2020-09-23 15:15:00	7	3	8	0	**18**	1	4	7	0	**12**	10	63	10	0	**83**	8	71	7	0	**86**	**199**	
2020-09-23 15:30:00	11	1	4	0	**16**	6	1	6	0	**13**	4	75	3	0	**82**	8	66	1	0	**75**	**186**	
2020-09-23 15:45:00	2	4	7	0	**13**	5	3	10	0	**18**	1	65	5	0	**71**	11	67	5	0	**83**	**185**	
2020-09-23 16:00:00	13	4	6	0	**23**	4	1	5	0	**10**	6	80	7	0	**93**	9	76	2	0	**87**	**213**	
2020-09-23 16:15:00	8	1	2	0	**11**	6	0	9	0	**15**	8	98	8	0	**114**	9	80	5	0	**94**	**234**	
2020-09-23 16:30:00	12	1	9	0	**22**	12	3	9	0	**24**	4	89	3	0	**96**	12	64	4	0	**80**	**222**	
2020-09-23 16:45:00	12	1	8	0	**21**	10	0	5	0	**15**	12	106	7	0	**125**	8	76	1	0	**85**	**246**	
2020-09-23 17:00:00	8	2	8	0	**18**	7	1	6	0	**14**	4	86	9	0	**99**	9	75	4	0	**88**	**219**	
2020-09-23 17:15:00	14	2	7	0	**23**	9	1	10	0	**20**	8	106	10	0	**124**	11	90	9	0	**110**	**277**	
2020-09-23 17:30:00	18	0	9	0	**27**	4	2	5	0	**11**	8	103	9	0	**120**	18	102	6	0	**126**	**284**	
2020-09-23 17:45:00	10	1	3	0	**14**	4	5	9	0	**18**	4	111	16	0	**131**	11	82	2	0	**95**	**258**	
2020-09-23 18:00:00	9	2	8	0	**19**	6	0	6	0	**12**	5	81	10	0	**96**	7	75	2	0	**84**	**211**	
2020-09-23 18:15:00	8	0	4	0	**12**	7	1	7	0	**15**	2	63	6	0	**71**	8	82	2	0	**92**	**190**	
2020-09-23 18:30:00	9	0	3	0	**12**	5	2	4	0	**11**	5	71	6	0	**82**	1	67	1	0	**69**	**174**	
2020-09-23 18:45:00	6	2	3	0	**11**	4	1	4	0	**9**	4	66	5	0	**75**	3	77	0	0	**80**	**175**	
2020-09-23 19:00:00	4	0	1	0	**5**	7	1	9	0	**17**	0	58	4	0	**62**	6	55	1	0	**62**	**146**	
2020-09-23 19:15:00	4	1	4	0	**9**	5	4	6	0	**15**	4	71	6	0	**81**	10	60	1	0	**71**	**176**	
2020-09-23 19:30:00	0	0	6	0	**6**	2	1	6	0	**9**	3	64	6	0	**73**	8	69	0	0	**77**	**165**	
2020-09-23 19:45:00	3	2	0	0	**5**	2	3	2	0	**7**	4	45	4	0	**53**	3	47	2	0	**52**	**117**	
	4	1	4	0	**9**	2	1	3	0	**6**	1	52	2	0	**55**	5	47	4	0	**56**	**126**	
	2	1	4	0	**7**	1	0	4	0	**5**	2	52	2	0	**56**	4	33	1	0	**38**	**106**	

2020-09-23 20:00:00	4	1	4	0	**9**	2	0	1	0	**3**	2	37	1	0	**40**	3	44	0	0	**47**	**99**
2020-09-23 20:15:00	0	0	0	0	**0**	0	0	2	0	**2**	1	25	4	0	**30**	3	35	1	0	**39**	**71**
2020-09-23 20:30:00	2	0	2	0	**4**	1	0	1	0	**2**	0	29	2	0	**31**	2	40	0	1	**43**	**80**
2020-09-23 20:45:00	0	0	4	0	**4**	0	0	5	0	**5**	2	26	1	0	**29**	0	34	1	0	**35**	**73**
2020-09-23 21:00:00	1	0	1	0	**2**	1	0	3	0	**4**	0	23	1	0	**24**	4	23	2	0	**29**	**59**
2020-09-23 21:15:00	0	1	1	0	**2**	0	0	3	0	**3**	0	19	2	0	**21**	2	24	2	0	**28**	**54**
2020-09-23 21:30:00	2	0	0	0	**2**	1	0	1	0	**2**	3	7	0	0	**10**	1	15	3	0	**19**	**33**
2020-09-23 21:45:00	2	0	3	0	**5**	1	0	0	0	**1**	4	13	1	0	**18**	0	8	3	0	**11**	**35**
2020-09-23 22:00:00	7	0	6	0	**13**	1	0	2	0	**3**	2	12	2	0	**16**	3	25	0	0	**28**	**60**
2020-09-23 22:15:00	2	0	1	0	**3**	1	1	1	0	**3**	0	10	0	0	**10**	1	16	0	0	**17**	**33**
2020-09-23 22:30:00	1	0	0	0	**1**	0	0	0	0	**0**	0	5	0	0	**5**	2	6	0	0	**8**	**14**
2020-09-23 22:45:00	1	0	1	0	**2**	0	1	0	0	**1**	0	11	0	0	**11**	1	7	0	0	**8**	**22**
2020-09-23 23:00:00	1	0	0	0	**1**	0	0	1	0	**1**	2	3	3	0	**8**	0	4	0	0	**4**	**14**
2020-09-23 23:15:00	0	0	1	0	**1**	0	0	0	0	**0**	0	6	0	0	**6**	1	6	0	0	**7**	**14**
2020-09-23 23:30:00	0	0	0	0	**0**	0	0	0	0	**0**	0	6	0	0	**6**	1	7	0	0	**8**	**14**
2020-09-23 23:45:00	0	0	1	0	**1**	0	0	0	0	**0**	1	6	0	0	**7**	1	4	0	0	**5**	**13**
2020-09-24 00:00:00	0	0	0	0	**0**	0	0	0	0	**0**	0	3	0	0	**3**	2	7	0	0	**9**	**12**
2020-09-24 00:15:00	0	0	0	0	**0**	0	0	0	0	**0**	0	4	0	0	**4**	1	3	0	0	**4**	**8**
2020-09-24 00:30:00	0	0	1	0	**1**	0	0	0	0	**0**	0	3	0	0	**3**	1	5	0	0	**6**	**10**
2020-09-24 00:45:00	1	0	0	0	**1**	1	0	0	0	**1**	0	4	0	0	**4**	1	3	0	0	**4**	**10**
2020-09-24 01:00:00	3	0	0	0	**3**	1	0	0	0	**1**	0	0	0	0	**0**	2	4	0	0	**6**	**10**
2020-09-24 01:15:00	1	0	0	0	**1**	0	0	1	0	**1**	0	2	0	0	**2**	0	1	0	0	**1**	**5**
2020-09-24 01:30:00	1	0	1	0	**2**	0	0	0	0	**0**	0	0	0	0	**0**	0	1	0	0	**1**	**3**
2020-09-24 01:45:00	0	0	1	0	**1**	0	0	0	0	**0**	0	1	0	0	**1**	0	1	0	0	**1**	**3**
2020-09-24 02:00:00	2	0	0	0	**2**	0	0	0	0	**0**	1	2	0	0	**3**	0	0	0	0	**0**	**5**
2020-09-24 02:15:00	2	0	0	0	**2**	0	1	1	0	**2**	0	3	0	0	**3**	1	1	0	0	**2**	**9**
2020-09-24 02:30:00	1	0	0	0	**1**	0	0	0	0	**0**	0	3	0	0	**3**	1	4	0	0	**5**	**9**
2020-09-24 02:45:00	0	0	0	0	**0**	0	0	0	0	**0**	0	2	1	0	**3**	0	1	0	0	**1**	**4**
2020-09-24 03:00:00	0	0	0	0	**0**	0	1	0	0	**1**	0	1	0	0	**1**	0	2	0	0	**2**	**4**
2020-09-24 03:15:00	1	0	0	0	**1**	0	0	0	0	**0**	0	4	0	0	**4**	0	1	0	0	**1**	**6**
2020-09-24 03:30:00	0	0	0	0	**0**	0	0	1	0	**1**	0	0	0	0	**0**	0	0	1	0	**1**	**2**
2020-09-24 03:45:00	0	0	0	0	**0**	0	0	0	0	**0**	0	1	0	0	**1**	0	4	0	0	**4**	**5**
2020-09-24 04:00:00	0	0	0	0	**0**	0	0	1	0	**1**	0	1	0	0	**1**	0	1	0	0	**1**	**3**
2020-09-24 04:15:00	0	0	0	0	**0**	0	0	0	0	**0**	0	4	0	0	**4**	0	0	4	0	**4**	**8**
2020-09-24 04:30:00	0	0	0	0	**0**	1	0	0	0	**1**	2	4	0	0	**6**	0	2	1	0	**3**	**10**
2020-09-24 04:45:00	1	0	0	0	**1**	0	0	1	0	**1**	1	4	0	0	**5**	0	3	7	0	**10**	**17**
2020-09-24 05:00:00	7	0	1	0	**8**	0	0	2	0	**2**	1	6	0	0	**7**	0	7	3	0	**10**	**27**
2020-09-24 05:15:00	1	0	0	0	**1**	0	0	3	0	**3**	3	11	0	0	**14**	0	11	7	0	**18**	**36**
2020-09-24 05:30:00	0	0	1	0	**1**	2	1	2	0	**5**	4	16	0	0	**20**	0	15	10	0	**25**	**51**
2020-09-24 05:45:00	3	1	4	0	**8**	2	4	2	0	**8**	11	22	0	0	**33**	0	16	14	0	**30**	**79**
2020-09-24 06:00:00	5	1	3	0	**9**	3	0	3	0	**6**	9	20	0	0	**29**	1	21	8	0	**30**	**74**
2020-09-24 06:15:00	1	0	1	0	**2**	1	1	4	0	**6**	5	29	0	0	**34**	0	19	2	0	**21**	**63**
2020-09-24 06:30:00	2	0	2	0	**4**	0	0	5	0	**5**	7	25	0	0	**32**	0	22	3	0	**25**	**66**
2020-09-24 06:45:00	3	1	4	0	**8**	6	4	3	0	**13**	8	33	0	0	**41**	1	30	6	0	**37**	**99**
2020-09-24 07:00:00	1	1	2	0	**4**	11	4	1	0	**16**	6	31	3	0	**40**	0	29	6	0	**35**	**95**
2020-09-24 07:15:00	5	0	3	0	**8**	10	2	7	0	**19**	11	48	1	0	**60**	0	50	4	0	**54**	**141**
2020-09-24 07:30:00	3	2	3	0	**8**	17	3	20	0	**40**	15	50	5	0	**70**	4	72	4	0	**80**	**198**
2020-09-24 07:45:00	7	4	6	0	**17**	11	3	11	0	**25**	11	73	9	0	**93**	1	70	17	0	**88**	**223**
2020-09-24 08:00:00	3	2	6	0	**11**	3	0	6	0	**9**	13	89	3	0	**105**	5	46	4	0	**55**	**180**
2020-09-24 08:15:00	4	1	7	0	**12**	8	1	6	0	**15**	6	62	1	0	**69**	7	63	8	0	**78**	**174**
2020-09-24 08:30:00	4	0	7	0	**11**	3	1	6	0	**10**	5	41	2	0	**48**	7	55	7	0	**69**	**138**
2020-09-24 08:45:00	6	0	3	0	**9**	4	0	8	0	**12**	2	36	3	0	**41**	0	39	2	0	**41**	**103**
2020-09-24 09:00:00	4	0	2	0	**6**	1	0	5	0	**6**	3	39	4	0	**46**	4	34	2	0	**40**	**98**
2020-09-24 09:15:00	2	0	5	0	**7**	3	0	3	0	**6**	5	51	2	0	**58**	3	35	5	0	**43**	**114**
2020-09-24 09:30:00	4	0	8	0	**12**	3	1	3	0	**7**	7	33	2	0	**42**	4	44	6	0	**54**	**115**
2020-09-24 09:45:00	3	0	9	0	**12**	3	1	0	0	**4**	6	36	4	0	**46**	1	44	4	0	**49**	**111**
2020-09-24 10:00:00	8	0	8	0	**16**	2	4	3	0	**9**	7	46	2	0	**55**	5	36	7	0	**48**	**128**
2020-09-24 10:15:00	11	1	3	0	**15**	2	1	6	0	**9**	7	46	0	0	**53**	4	40	7	0	**51**	**128**
2020-09-24 10:30:00	5	0	3	0	**8**	1	2	6	0	**9**	5	54	4	0	**63**	2	37	4	0	**43**	**123**
2020-09-24 10:45:00	10	0	5	0	**15**	1	0	7	0	**8**	5	45	6	0	**56**	4	47	5	0	**56**	**135**
2020-09-24 11:00:00	12	1	8	0	**21**	5	0	7	0	**12**	6	48	2	0	**56**	4	51	3	0	**58**	**147**
2020-09-24 11:15:00	10	2	7	0	**19**	4	4	4	0	**12**	6	46	4	0	**56**	5	51	7	0	**63**	**150**
2020-09-24 11:30:00	11	0	8	0	**19**	6	1	6	0	**13**	7	56	1	0	**64**	9	56	8	0	**73**	**169**
2020-09-24 11:45:00	8	2	9	0	**19**	6	1	5	0	**12**	9	69	2	0	**80**	6	64	7	0	**77**	**188**
2020-09-24 12:00:00	19	0	11	0	**30**	5	3	9	0	**17**	6	73	4	0	**83**	9	57	8	0	**74**	**204**
2020-09-24 12:15:00	9	0	9	0	**18**	4	2	5	0	**11**	2	93	4	0	**99**	5	70	8	0	**83**	**211**
2020-09-24 12:30:00	9	0	5	0	**14**	2	1	10	0	**13**	5	70	3	0	**78**	11	56	5	0	**72**	**177**
2020-09-24 12:45:00	11	1	6	0	**18**	6	0	7	0	**13**	13	72	8	0	**93**	3	69	13	0	**85**	**209**

Detailed Crash Reports (2015-2019)

Crash Detail Report - Short Form

Report Version 1.0
February 2020

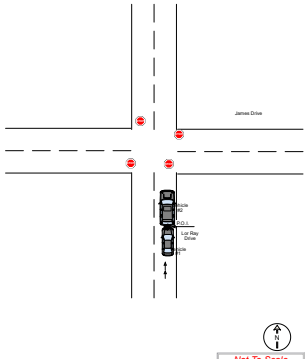
INCIDENT ID	ROUTE SYS	ROUTE NUM	MEASURE	ROUTE NAME	ROUTE ID	COUNTY	CITY
00652397	05-MSAS	0117	0.211	LORRAY DR	0500023952570117-I	52-Nicollet	North Mankato

INTERSECT WITH	# VEH	# KILL	DATE	TIME	DAY	LAT	LONG	UTM X	UTM Y	WORK ZONE TYPE
	2	0	10/16/18	17:12	Tue	44.1765	-94.0334	417394.1	4891991.6	NOT APPLICABLE

BASIC TYPE	CRASH SEVERITY	FIRST HARMFUL	LIGHT CONDITION	WEATHER PRIMARY
Rear End	N - Prop Damage Only	Motor Vehicle In Transport	Sunset	Clear

	Unit 1	Unit 2	Unit 3	Unit 4
Unit Type	Motor Vehicle in Transport	Motor Vehicle in Transport		
Vehicle Type	Passenger Car	Sport Utility Vehicle		
Direction of Travel	Northbound	Northbound		
Veh Manuever	Moving Forward	Slowing		
Age/Sex	20 F	37 F		
Physical Cond	Apparently Normal	Apparently Normal		
Contributing Factor 1	Following Too Closely	No Clear Contributing Action		

OFFICER SKETCH



NARRATIVE

VEHICLE #1 REAR ENDED VEHICLE #2 IN THE NORTHBOUND LANE OF LOR RAY DRIVE APPROACHING THE STOP SIGN AT THE INTERSECTION WITH JAMES DRIVE IN THE CITY OF NORTH MANKATO. NO REPORTED INJURIES. VEHICLE #1 WAS TOWED FROM THE SCENE. VEHICLE #2 WAS DRIVEN FROM THE SCENE. REFER TO NARRATIVE REPORT. - END. #705 MCGUIRE

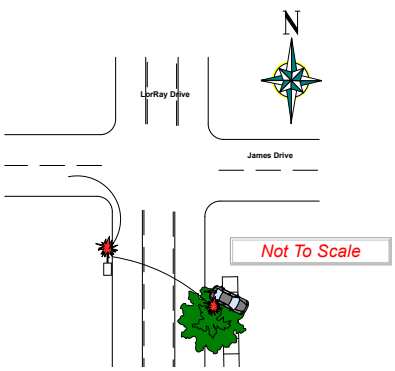
INCIDENT ID	ROUTE SYS	ROUTE NUM	MEASURE	ROUTE NAME	ROUTE ID	COUNTY	CITY
00493798	05-MSAS	0117	0.234	LORRAY DR	0500023952570117-I	52-Nicollet	North Mankato

INTERSECT WITH	# VEH	# KILL	DATE	TIME	DAY	LAT	LONG	UTM X	UTM Y	WORK ZONE TYPE
	1	0	08/13/17	18:25	Sun	44.1768	-94.0334	417394.1	4892027.8	NOT APPLICABLE

BASIC TYPE	CRASH SEVERITY	FIRST HARMFUL	LIGHT CONDITION	WEATHER PRIMARY
Single Vehicle Run Off Road	N - Prop Damage Only	Jackknife	Daylight	Cloudy

	Unit 1	Unit 2	Unit 3	Unit 4
Unit Type	Motor Vehicle in Transport			
Vehicle Type	Passenger Car			
Direction of Travel	Southbound			
Veh Manuever	Moving Forward			
Age/Sex	43 M			
Physical Cond	Apparently Normal			
Contributing Factor 1	Over Correcting / Over Steeri			

OFFICER SKETCH



NARRATIVE

ON AUGUST 13, 2017 AT APPROXIMATELY 1826 HOURS, I, OFFICER MIKEAL TORDSEN #717 WAS DISPATCHED TO LORRAY DRIVE FOR A ONE VEHICLE CRASH. AT THE TIME OF THE CALL, INJURIES WERE NOT KNOWN AND GOLD CROSS WAS DISPATCHED AS A PRECAUTION. WHEN I ARRIVED, I LOCATED THE VEHICLE IN THE YARD OF 1674 LORRAY DRIVE. BOTH PARTIES HAD EXITED THE VEHICLE. I ASSED BOTH PARTIES FOR INJURIES AND DETERMINED THERE WERE NONE. I DID NOT OBSERVE ANY SIGNS OF IMPAIRMENT FROM THE DRIVER. AT THAT TIME I CANCELLED GOLD CROSS DUE TO NO INJURIES. I SPOKE WITH TWO WITNESSES WHO STATED THE VEHICLE HAD MADE A RIGHT TURN ONTO LORRAY DRIVE FROM JAMES DRIVE. WITNESSES STATED ONCE THE VEHICLE COMPLETED THE TURN, IT WENT ONTO THE BOULEVARD AND STRUCK A SIGN AND THEN PROCEEDED TO THE OTHER SIDE OF THE STREET WHERE THE VEHICLE STRUCK A MAILBOX AND A TREE. I ATTEMPTED TO SPEAK TO THE DRIVER, BUT

Crash Detail Report - Short Form

Report Version 1.0
February 2020

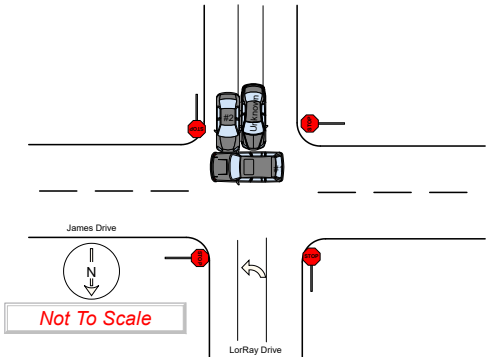
INCIDENT ID	ROUTE SYS	ROUTE NUM	MEASURE	ROUTE NAME	ROUTE ID	COUNTY	CITY
00393447	05-MSAS	0117	0.237	LORRAY DR	0500023952570117-I	52-Nicollet	North Mankato

INTERSECT WITH	# VEH	# KILL	DATE	TIME	DAY	LAT	LONG	UTM X	UTM Y	WORK ZONE TYPE
	2	0	11/09/16	17:09	Wed	44.1768	-94.0335	417383.5	4892033.7	NOT APPLICABLE

BASIC TYPE	CRASH SEVERITY	FIRST HARMFUL	LIGHT CONDITION	WEATHER PRIMARY
Angle	N - Prop Damage Only	Motor Vehicle In Transport	Dark (Str Lights On)	Clear

	Unit 1	Unit 2	Unit 3	Unit 4
Unit Type	Motor Vehicle in Transport	Motor Vehicle in Transport		
Vehicle Type	Sport Utility Vehicle	Passenger Car		
Direction of Travel	Eastbound	Northbound		
Veh Manuever	Moving Forward	Moving Forward		
Age/Sex	49 M	76 M		
Physical Cond	Apparently Normal	Apparently Normal		
Contributing Factor 1	Other Contributing Action	Other Contributing Action		

OFFICER SKETCH



NARRATIVE

VEHICLE #1 AND VEHICLE #2 WERE STOPPED AT FOUR WAY STOP SIGN. VEHICLE #1 ENTERED INTO INTERSECTION AS VEHICLE #2 ENTERED INTERSECTION STRIKING VEHICLE #1 IN DRIVERS SIDE AT RIGHT ANGLE. HEAVY CONGESTION OF TRAFFIC AT TIME OF OCCURRENCE. DRIVER'S STATED THAT A TURNING VEHICLE BLOCKED THERE VIEW WHEN ENTERING INTERSECTION. UNKNOWN TURNING VEHICLE HAD LEFT THE SCENE. MODERATE DAMAGE TO BOTH VEHICLES. PHOTO'S TAKEN AT SCENE AND NO TOWS WERE REQUIRED. NO INJURIES RESULTED AND NO CITATIONS ISSUED. VEHICLES WERE MOVED FROM CRASH LOCATION PRIOR TO OFFICER ARRIVAL.

INCIDENT ID	ROUTE SYS	ROUTE NUM	MEASURE	ROUTE NAME	ROUTE ID	COUNTY	CITY
00755612	05-MSAS	0117	0.248	LOR RAY DR	0500023952570117-I	52-Nicollet	North Mankato

INTERSECT WITH	# VEH	# KILL	DATE	TIME	DAY	LAT	LONG	UTM X	UTM Y	WORK ZONE TYPE
JAMES DR			10/19/19	11:49	Sat	44.1770	-94.0335	417389.3	4892050.8	NOT APPLICABLE

BASIC TYPE	CRASH SEVERITY	FIRST HARMFUL	LIGHT CONDITION	WEATHER PRIMARY
Other	N - Prop Damage Only	Motor Vehicle In Transport	Daylight	Clear

	Unit 1	Unit 2	Unit 3	Unit 4
Unit Type	Motor Vehicle in Transport	Motor Vehicle in Transport		
Vehicle Type	Pickup	Sport Utility Vehicle		
Direction of Travel	Southbound	Southbound		
Veh Manuever	Vehicle Stopped or Stalled in	Moving Forward		
Age/Sex	65 F	84 M		
Physical Cond	Apparently Normal	Apparently Normal		
Contributing Factor 1	No Clear Contributing Action	Following Too Closely		

OFFICER SKETCH

NARRATIVE

VEHICLE #1 WAS STOPPED IN THE LANE WAITING FOR TRAFFIC TO CLEAR SO SHE COULD TURN INTO HER DRIVEWAY. DRIVER OF VEHICLE #2 SAID HE DIDN'T SEE VEHICLE #1 STOPPED IN THE ROADWAY. DRIVER #2 STATED HE HAD A LOT ON HIS MIND AND WAS NOT PAYING ATTENTION. BOTH VEHICLES DROVE AWAY FROM THE SCENE. NO INJURIES. MINIMUM DAMAGE EXCEEDED. OFFICER J. KRAL NORTH MANKATO POLICE DEPT.

Crash Detail Report - Short Form

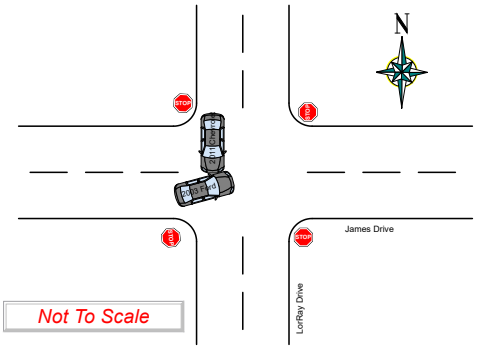
INCIDENT ID	ROUTE SYS	ROUTE NUM	MEASURE	ROUTE NAME	ROUTE ID	COUNTY	CITY
00675922	05-MSAS	0117	0.249	LORRAY DR	0500023952570117-I	52-Nicollet	North Mankato

INTERSECT WITH	# VEH	# KILL	DATE	TIME	DAY	LAT	LONG	UTM X	UTM Y	WORK ZONE TYPE
	2	0	01/14/19	12:15	Mon	44.1770	-94.0335	417389.9	4892053.0	NOT APPLICABLE

BASIC TYPE	CRASH SEVERITY	FIRST HARMFUL	LIGHT CONDITION	WEATHER PRIMARY
Angle	N - Prop Damage Only	Motor Vehicle In Transport	Daylight	Cloudy

	Unit 1	Unit 2	Unit 3	Unit 4
Unit Type	Motor Vehicle in Transport	Motor Vehicle in Transport		
Vehicle Type	Passenger Car	Passenger Car		
Direction of Travel	Eastbound	Southbound		
Veh Manuever	Turning Left	Moving Forward		
Age/Sex	51 M	19 F		
Physical Cond	Apparently Normal	Apparently Normal		
Contributing Factor 1	No Clear Contributing Action	Ran Stop Sign		

OFFICER SKETCH



NARRATIVE

VEHICLE 1 WAS EASTBOUND ON JAMEES DRIVE MAKING A LEFT TURN ONTO LORRAY DRIVE TO GO NORTH. VEHICLE 2 WAS SOUTHBOUND ON LORRAY DRIVE APPROACHING JAMES DRIVE. VEHICLE 2 RAN THROUGH THE STOP SIGN AND COLLIDED WITH VEHICLE 1. DRIVER OF VEHICLE 2 ADMITTED ON SCENE SHE WAS NOT PAYING ATTENTION AND RAN THE STOP SIGN AT JAMES DRIVE COLLIDING INTO VEHICLE 1. DRIVER OF VEHICLE 2 WAS CITED FOR STOP SIGN VIOLATION VEHICLE 1 WAS DISABLED IN THE ACCIDENT AND HAD TO BE TOWED BY AFFORDABLE TOWING. VEHICLE 2 HAD MINOR FRONT END DAMAGE AND WAS ABLE TO DRIVE AWAY FROM THE SCENE. NO PICTURES WERE TAKEN AT THE SCENE.

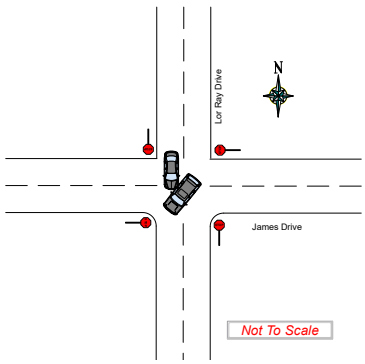
INCIDENT ID	ROUTE SYS	ROUTE NUM	MEASURE	ROUTE NAME	ROUTE ID	COUNTY	CITY
00771054	05-MSAS	0117	0.250	LOR RAY DR	0500023952570117-I	52-Nicollet	North Mankato

INTERSECT WITH	# VEH	# KILL	DATE	TIME	DAY	LAT	LONG	UTM X	UTM Y	WORK ZONE TYPE
			12/13/19	11:25	Fri	44.1770	-94.0334	417391.4	4892055.1	NOT APPLICABLE

BASIC TYPE	CRASH SEVERITY	FIRST HARMFUL	LIGHT CONDITION	WEATHER PRIMARY
Other	N - Prop Damage Only	Motor Vehicle In Transport	Daylight	Cloudy

	Unit 1	Unit 2	Unit 3	Unit 4
Unit Type	Motor Vehicle in Transport	Motor Vehicle in Transport		
Vehicle Type	Sport Utility Vehicle	Passenger Car		
Direction of Travel	Southbound	Southbound		
Veh Manuever	Turning Left	Moving Forward		
Age/Sex	32 F	92 F		
Physical Cond	Apparently Normal	Apparently Normal		
Contributing Factor 1	No Clear Contributing Action	Disregard Other Traffic Signs		

OFFICER SKETCH



NARRATIVE

VEHICLE 1 WAS WEST ON JAMES DRIVE APPROACHING LOR RAY DRIVE. VEHICLE 1 STOPPED AT STOP SIGN AND BEGAN TO TURN LEFT TO GO SOUTH ON LOR RAY DRIVE. VEHICLE 2 WAS SOUTHBOUND ON LOR RAY DRIVE APPROACHING JAMES DRIVE. DRIVER OF VEHICLE 2 FAILED TO SEE STOP SIGN AT JAMES DRIVE. VEHICLE 2 STRUCK VEHICLE 1. VEHICLE 1 SUSTAINED MODERATE DAMAGE TO RIGHT SIDE AND VEHICLE 2 HAD MINOR DAMAGE TO LEFT FRONT CORNER BUMPER AREA. I PHOTOGRAPHED DAMAGE TO BOTH VEHICLES.

Crash Detail Report - Short Form

Report Version 1.0
February 2020

INCIDENT ID	ROUTE SYS	ROUTE NUM	MEASURE	ROUTE NAME	ROUTE ID	COUNTY	CITY
11068081	05-MSAS	0117	0.251	LorRay Dr	0500023952570117-I	52-Nicollet	North Mankato

INTERSECT WITH	# VEH	# KILL	DATE	TIME	DAY	LAT	LONG	UTM X	UTM Y	WORK ZONE TYPE
	2	0	09/21/15	08:30	Mon	44.1770	-94.0334	417391.0	4892056.0	NOT APPLICABLE

BASIC TYPE	CRASH SEVERITY	FIRST HARMFUL	LIGHT CONDITION	WEATHER PRIMARY
Angle	N - Prop Damage Only	Motor Vehicle In Transport	Daylight	Clear

	Unit 1	Unit 2	Unit 3	Unit 4
Unit Type	Motor Vehicle in Transport	Motor Vehicle in Transport		
Vehicle Type	Passenger Car	Passenger Car		
Direction of Travel	Southbound	Eastbound		
Veh Manuever	Moving Forward	Moving Forward		
Age/Sex	33 F	26 F		
Physical Cond	Apparently Normal	Apparently Normal		
Contributing Factor 1	Inattentive/Distraction (Talkin	No Clear Contributing Action		

OFFICER SKETCH

NO OFFICER SKETCH WAS FOUND.

NARRATIVE

VEHICLE # 1 (FIELDS) WAS TRAVELING SOUTH ON LORRAY AND CAME TO A STOP FOR A POSTED STOP SIGN AT THE LORRAY AND JAMES INTERSECTION. FIELDS STATED SHE STOPPED, ENTERED THE INTERSECTION AND COLLIDED WITH VEHICLE #2 (BIREN) BIREN WAS TRAVELING EAST ON JAMES AND ALSO STOPPED AT A POSTED STOP SIGN ON JAMES AT LORRAY. FIELDS STATED THAT SHE MAY HAVE BEEN DISTRACTED AND ENTERED THE INTERSECTION EARLY, COLLIDING WITH BIREN. NO INJURIES WERE REPORTED AND BOTH VEHICLES WERE DRIVEN FROM THE SCENE. NO CITATIONS WERE ISSUED. NO DIAGRAM WAS DRAWN DUE TO BOTH VEHICLES BEING MOVED PRIOR TO MY ARRIVAL. PHOTOGRAPHS WERE TAKEN OF THE VEHICLE DAMAGE.

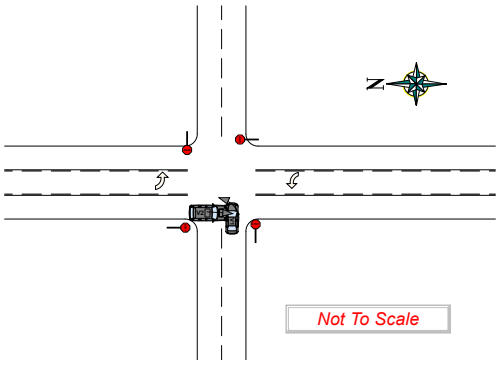
INCIDENT ID	ROUTE SYS	ROUTE NUM	MEASURE	ROUTE NAME	ROUTE ID	COUNTY	CITY
00394456	05-MSAS	0117	0.251	LORRAY DR	0500023952570117-I	52-Nicollet	North Mankato

INTERSECT WITH	# VEH	# KILL	DATE	TIME	DAY	LAT	LONG	UTM X	UTM Y	WORK ZONE TYPE
	2	0	11/14/16	12:35	Mon	44.1770	-94.0334	417390.9	4892056.0	NOT APPLICABLE

BASIC TYPE	CRASH SEVERITY	FIRST HARMFUL	LIGHT CONDITION	WEATHER PRIMARY
Angle	N - Prop Damage Only	Motor Vehicle In Transport	Daylight	Cloudy

	Unit 1	Unit 2	Unit 3	Unit 4
Unit Type	Motor Vehicle in Transport	Motor Vehicle in Transport		
Vehicle Type	Passenger Car	Passenger Car		
Direction of Travel	Eastbound	Southbound		
Veh Manuever	Moving Forward	Moving Forward		
Age/Sex	31 M	59 F		
Physical Cond	Apparently Normal	Apparently Normal		
Contributing Factor 1	No Clear Contributing Action	Failure to Yield Right-of-Way		

OFFICER SKETCH



NARRATIVE

ON NOVEMBER 14, 2016 AT APPROXIMATELY 1234 HOURS, I, OFFICER MIKEAL TORDSEN WAS DISPATCHED TO LORRAY DRIVE AND JAMES DRIVE FOR A TWO VEHICLE CRASH. WHEN I ARRIVED, BOTH VEHICLES HAD MOVED INTO THE SHELL GAS STATION PARKING LOT. BOTH PARTIES WERE IN CONVERSATION WHICH APPEARED TO BE CIVIL. I FIRST SPOKE WITH DRIVER 1. DRIVER ONE STATED HE WAS EASTBOUND ON JAMES DRIVE AT THE INTERSECTION WAITING HIS TURN TO PROCEED THROUGH. IT SHOULD BE NOTED THIS INTERSECTION IS A FOUR WAY STOP WITH CLEARLY VISIBLE STOP SIGNS. DRIVER 1 STATED HE THEN PROCEEDED INTO THE INTERSECTION WHEN VEHICLE 2 HAD ALSO ENTERED THE INTERSECTION STRIKING VEHICLE 1 IN THE FRONT LEFT WHEEL. DRIVER 2 WAS STANDING NEXT TO MYSELF AND DRIVER 2 WHILE HE WAS EXPLAINING WHAT HAD HAPPENED. I ASKED DRIVER 2 IF HIS EXPLANATION SOUNDED CORRECT. DRIVER 2 REPLIED,"YES, THAT IS

Crash Detail Report - Short Form

Report Version 1.0
February 2020

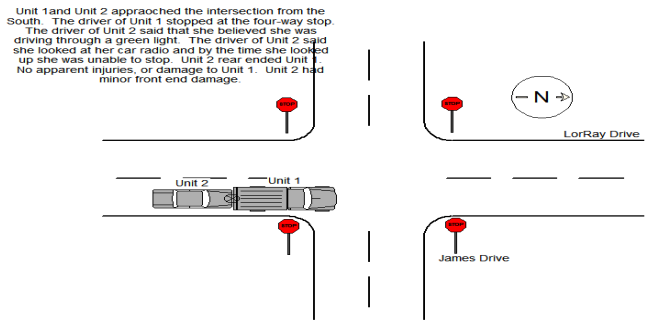
INCIDENT ID	ROUTE SYS	ROUTE NUM	MEASURE	ROUTE NAME	ROUTE ID	COUNTY	CITY
11056156	10-MUN	0078	0.827	LorRay Dr	1000023952570078-I	52-Nicollet	North Mankato

INTERSECT WITH	# VEH	# KILL	DATE	TIME	DAY	LAT	LONG	UTM X	UTM Y	WORK ZONE TYPE
	2	0	05/06/15	15:20	Wed	44.1770	-94.0334	417391.0	4892056.0	NOT APPLICABLE

BASIC TYPE	CRASH SEVERITY	FIRST HARMFUL	LIGHT CONDITION	WEATHER PRIMARY
Rear End	N - Prop Damage Only	Motor Vehicle In Transport	Daylight	Cloudy

	Unit 1	Unit 2	Unit 3	Unit 4
Unit Type	Motor Vehicle in Transport	Motor Vehicle in Transport		
Vehicle Type	Pickup	Passenger Car		
Direction of Travel	Northbound	Northbound		
Veh Manuever	Moving Forward	Moving Forward		
Age/Sex	42 M	21 F		
Physical Cond	Apparently Normal	Apparently Normal		
Contributing Factor 1	No Clear Contributing Action	Failure to Obey Traffic Signs,		

OFFICER SKETCH



NARRATIVE

UNIT 1 AND UNIT 2 WERE TRAVELLING NORTH ON LORRAY DR. UNIT 1 STOPPED AT THE FOUR-WAY STOP. THE DRIVER OF UNIT 2 SAID SHE BELIEVED SHE WAS GOING THROUGH A GREEN LIGHT AND LOOKED DOWN AT HER RADIO. THE DRIVER OF UNIT 2 SAID SHE LOOKED UP, AND IT WAS TOO LATE TO STOP FOR THE VEHICHLE IN FRONT OF HER. UNIT 2 THEN REAR ENDED UNIT 1. NO APPARENT INJURIES. NO APPARENT DAMAGE TO UNIT 1. MINOR FRONT END DAMAGE TO UNIT 2.

Selection Filter:

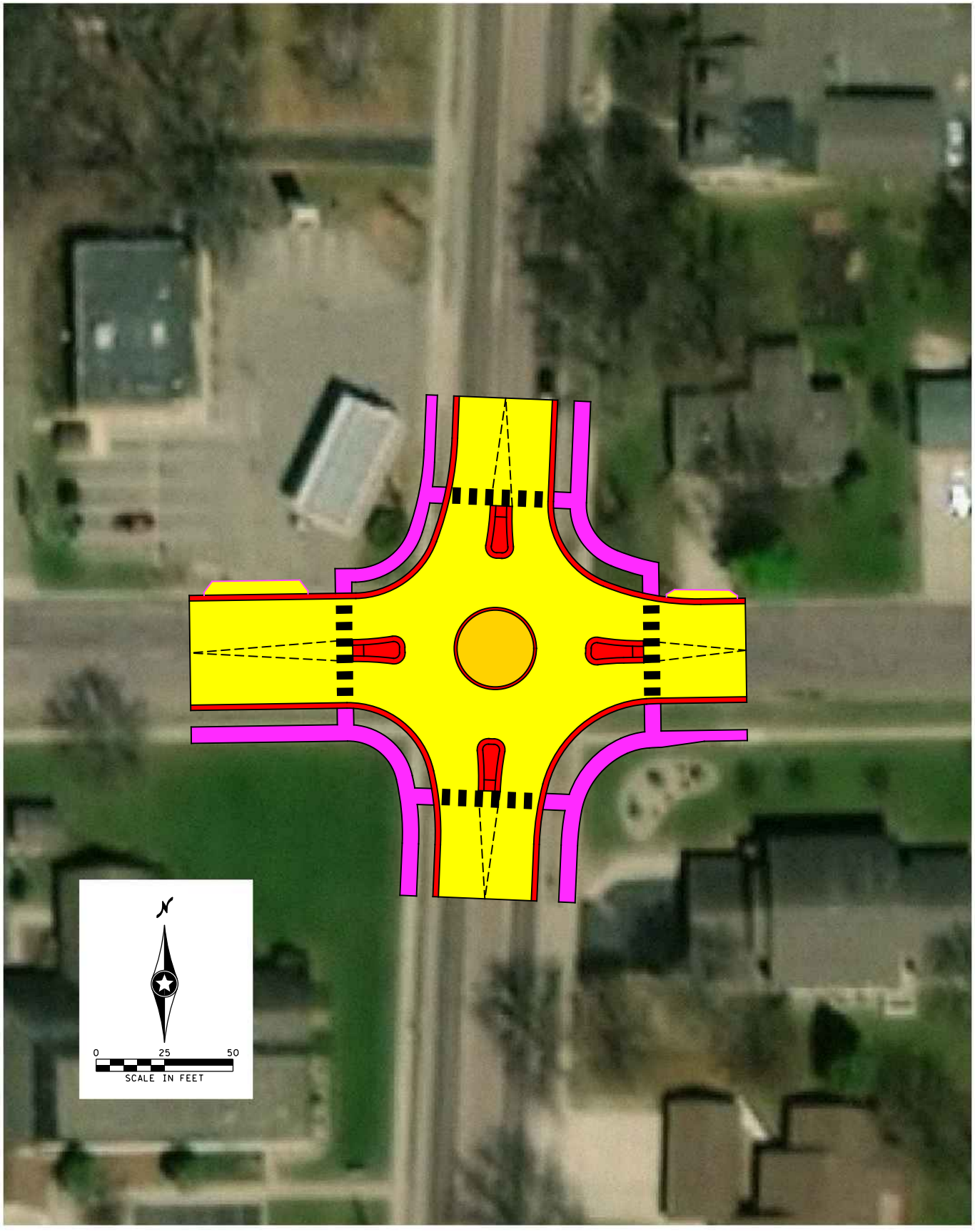
WORK AREA: County('659497') - FILTER: Year('2015','2016','2017','2018','2019') - SPATIAL FILTER APPLIED

Analyst:

Kevin Olm

Notes:

Mini-Roundabout Concept Layout



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SRF

020 13559
December 2020

Mini-Roundabout Concept

Intersection Control Evaluation
Lor Ray Drive at James Drive
North Mankato, Minnesota

Existing Warrants Analysis

WARRANTS ANALYSIS

Existing Year 2020

Lor Ray Drive and James Drive
North Mankato ICE Report
North Mankato, Nicollet County

Background Information

		Speed (mph)	Lanes	Approach	
Location :	North Mankato, Nicollet County	30	2 or more	Major Approach 1:	Northbound Lor Ray Drive
Date:	12/2/2020	30	2 or more	Major Approach 3:	Southbound Lor Ray Drive
Analysis Prepared By:	Natnael Dametaw	30	2 or more	Minor Approach 2:	Eastbound James Drive
Population Less than 10,000:	No	30	2 or more	Minor Approach 4:	Westbound James Drive
Seventy Percent Factor Used:	No	30	2 or more		

Warrants Analysis: Warrants 1A, 1B and 1C

Hour	Major Approach 1	Major Approach 3	Total 1 + 3	Warrant Met 600	Warrant Met 900	Minor Approach 2	Minor Approach 4	Largest Minor App.	Warrant Met 200	Warrant Met 100	Met Same Hours Condition A	Met Same Hours Condition B	Combination A	Combination B	MWSA (C) 300	MWSA (C) 200
6 - 7 AM	134	118	252			26	36	36								
7 - 8 AM	289	265	554			37	95	95							X	
8 - 9 AM	254	231	485			43	51	51							X	
9 - 10 AM	226	191	417			45	37	45							X	
10 - 11 AM	246	213	459			53	47	53							X	
11 - 12 AM	296	305	601	X		83	50	83							X	
12 - 1 PM	351	347	698	X		83	58	83							X	
1 - 2 PM	321	322	643	X		56	48	56							X	
2 - 3 PM	338	322	660	X		97	45	97							X	
3 - 4 PM	426	411	837	X		78	60	78							X	
4 - 5 PM	452	387	839	X		88	71	88						X	X	
5 - 6 PM	439	411	850	X		77	59	77							X	
6 - 7 PM	332	288	620	X		37	49	49							X	
7 - 8 PM	245	244	489			29	30	30							X	
8 - 9 PM	126	166	292			16	18	18								
9 - 10 PM	83	115	198			12	12	12								
10 - 11 PM	44	65	109			24	10	24								
											0	0	0	1	0	

Warrant Summary

Warrant and Description		Hours Met	Hours Required	Met/Not Met
MWSA (C):	Multiway Stop Applications Condition C	0	8	Not Met
Warrant 1A:	Minimum Vehicular Volume	0	8	Not Met
Warrant 1B:	Interruption of Continuous Traffic	0	8	Not Met
Warrant 1C:	Combination of Warrants	0	8	Not Met
Warrant 2:	Four-Hour Vehicular Volume	0	4	Not Met
Warrant 3B:	Peak Hour	0	1	Not Met

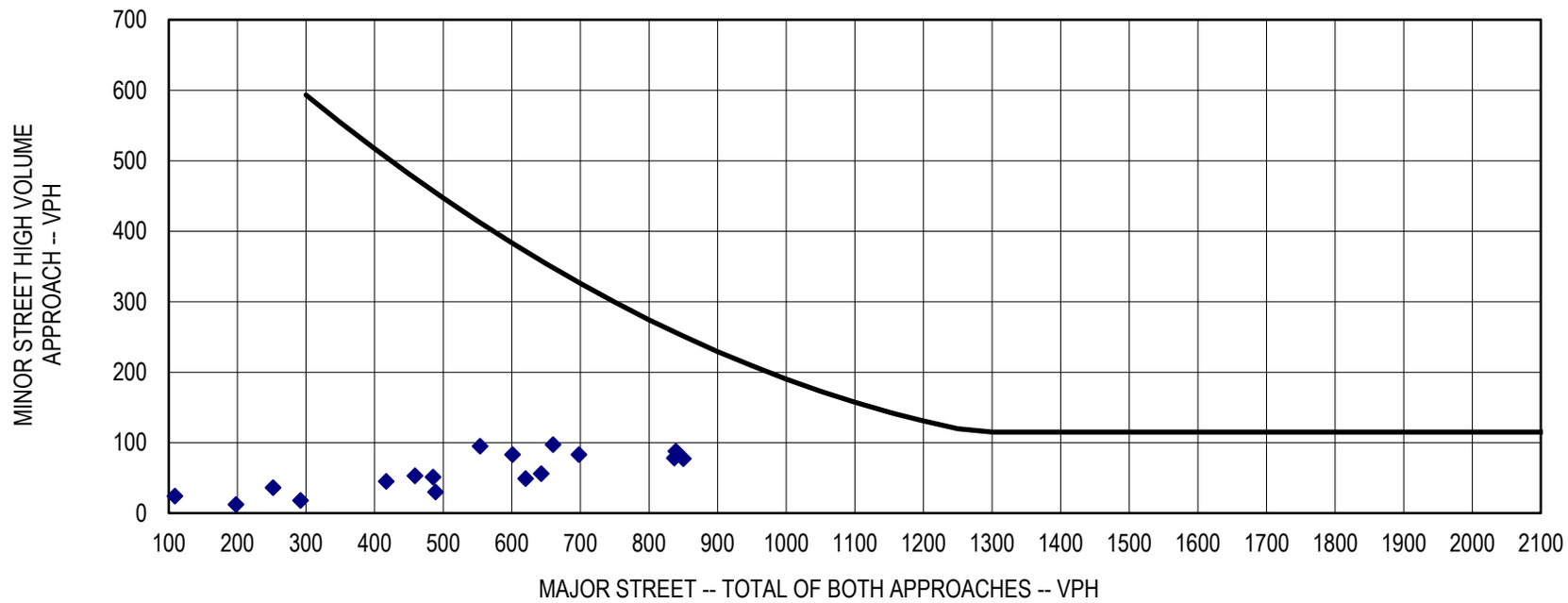
WARRANTS ANALYSIS

Existing Year 2020

Lor Ray Drive and James Drive
North Mankato ICE Report
North Mankato, Nicollet County

Warrants Analysis: Warrant 2

WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME



Number of Hours Satisfying Requirements:	0

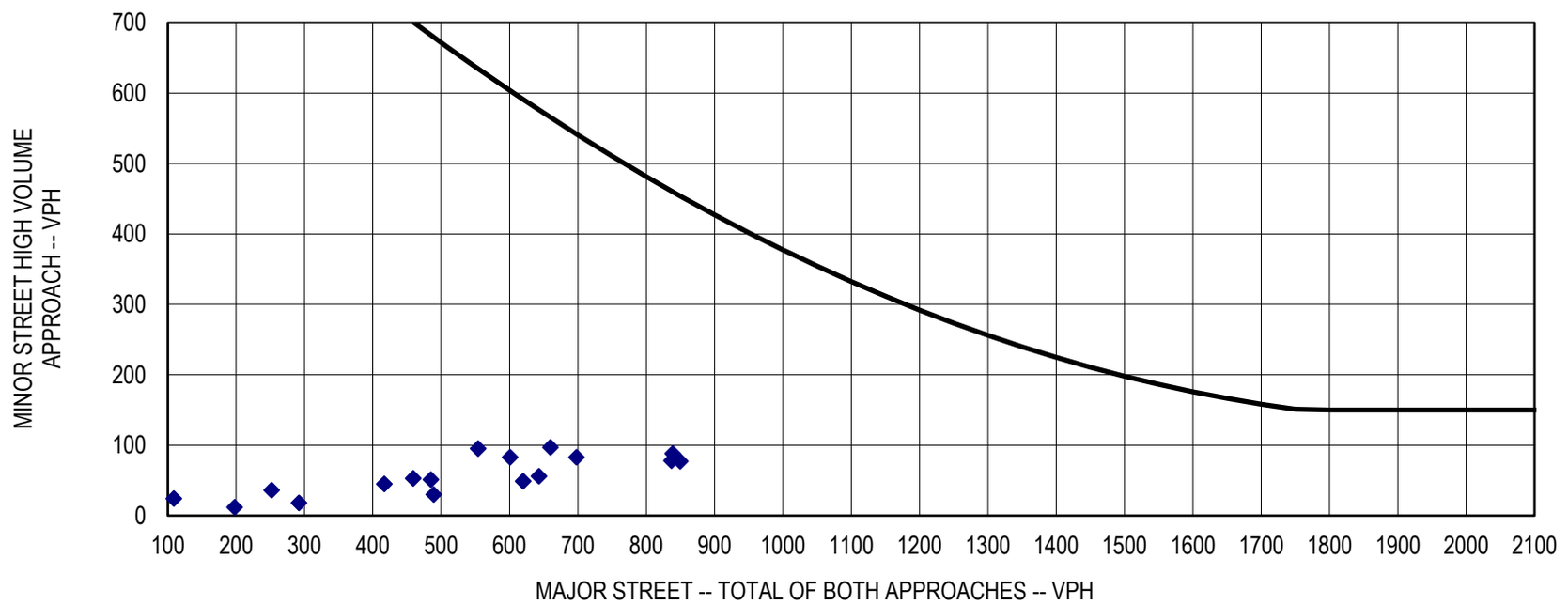
Notes: 1. 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

WARRANTS ANALYSIS

Existing Year 2020

Lor Ray Drive and James Drive
North Mankato ICE Report
North Mankato, Nicollet County

Warrants Analysis: Warrant 3



Number of Hours Satisfying Requirements:	0

Notes: 1. 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

2040 Warrants Analysis

WARRANTS ANALYSIS

Forecasted Year 2040

Lor Ray Drive and James Drive
North Mankato ICE Report
North Mankato, Nicollet County

Background Information

		Speed (mph)	Lanes	Approach	
Location :	North Mankato, Nicollet County	30	2 or more	Major Approach 1:	Northbound Lor Ray Drive
Date:	12/2/2020	30	2 or more	Major Approach 3:	Southbound Lor Ray Drive
Analysis Prepared By:	Natnael Dametaw	30	2 or more	Minor Approach 2:	Eastbound James Drive
Population Less than 10,000:	No	30	2 or more	Minor Approach 4:	Westbound James Drive
Seventy Percent Factor Used:	No	30	2 or more		

Warrants Analysis: Warrants 1A, 1B, and 1C

Hour	Major Approach 1	Major Approach 3	Total 1 + 3	Warrant Met 600	Warrant Met 900	Minor Approach 2	Minor Approach 4	Largest Minor App.	Warrant Met 200	Warrant Met 100	Met Same Hours Condition A	Met Same Hours Condition B	Combination A	Combination B	MWSA (C) 300	MWSA (C) 200
6 - 7 AM	163	144	307			32	44	44							X	
7 - 8 AM	355	320	675	X		50	100	100		X					X	
8 - 9 AM	310	282	592			53	62	62							X	
9 - 10 AM	275	233	508			55	45	55							X	
10 - 11 AM	300	260	560			65	57	65							X	
11 - 12 AM	361	372	733	X		102	61	102		X				X	X	
12 - 1 PM	428	424	852	X		102	71	102		X				X	X	
1 - 2 PM	391	393	784	X		69	59	69							X	
2 - 3 PM	412	393	805	X		119	55	119		X				X	X	
3 - 4 PM	519	502	1021	X	X	95	73	95						X	X	
4 - 5 PM	530	470	1000	X	X	95	70	95						X	X	
5 - 6 PM	535	502	1037	X	X	94	72	94						X	X	
6 - 7 PM	405	352	757	X		45	60	60							X	
7 - 8 PM	299	298	597			35	37	37							X	
8 - 9 PM	154	203	357			20	22	22							X	
9 - 10 PM	101	140	241			15	15	15								
10 - 11 PM	54	79	133			29	12	29								
											0	0	0	6	0	

Warrant Summary

Warrant and Description		Hours Met	Hours Required	Met/Not Met
MWSA (C):	Multiway Stop Applications Condition C	0	8	Not Met
Warrant 1A:	Minimum Vehicular Volume	0	8	Not Met
Warrant 1B:	Interruption of Continuous Traffic	0	8	Not Met
Warrant 1C:	Combination of Warrants	0	8	Not Met
Warrant 2:	Four-Hour Vehicular Volume	0	4	Not Met
Warrant 3B:	Peak Hour	0	1	Not Met

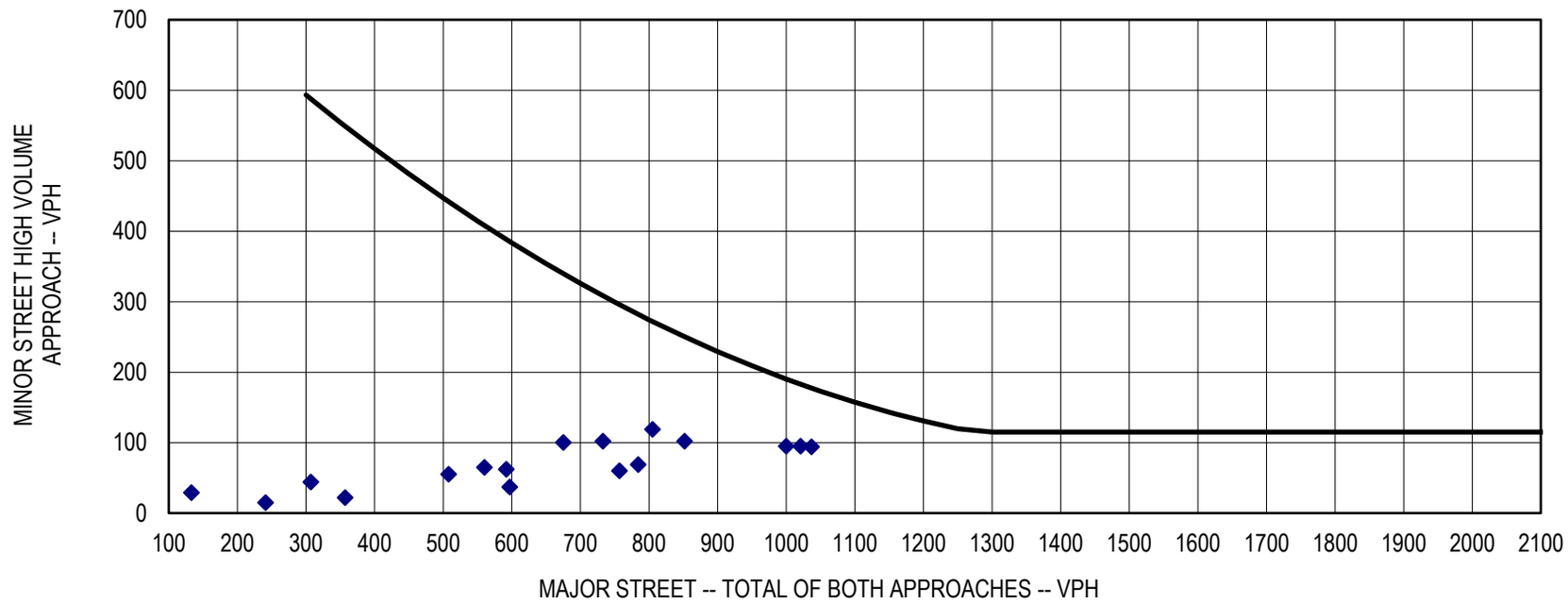
WARRANTS ANALYSIS

Forecasted Year 2040

Lor Ray Drive and James Drive
North Mankato ICE Report
North Mankato, Nicollet County

Warrants Analysis: Warrant 2

WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME



Number of Hours Satisfying Requirements:	0

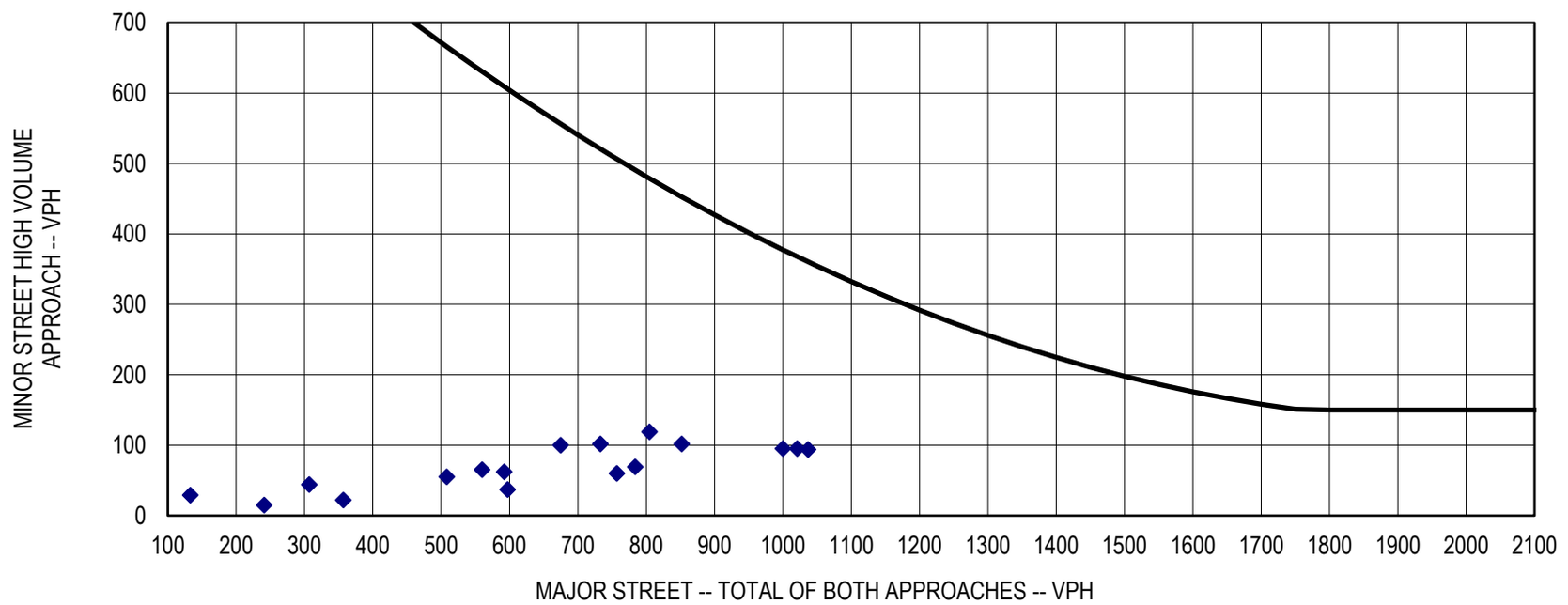
Notes: 1. 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

WARRANTS ANALYSIS

Forecasted Year 2040

Lor Ray Drive and James Drive
North Mankato ICE Report
North Mankato, Nicollet County

Warrants Analysis: Warrant 3



Number of Hours Satisfying Requirements:	0

Notes: 1. 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Detailed Operations Analysis Memo

Table 1. VISSIM Operations Analysis AM Peak Results

Scenario		Overall	NB	SB	EB	WB
2020 Existing	Delay	10.5	11.2	11.0	7.8	7.8
	LOS	B	B	B	A	A
2020 TWSC	Delay	3.8	1.1	0.8	17.7	17.9
	LOS	A	A	A	C	C
2020 Mini RAB	Delay	2.0	2.0	2.1	1.3	2.3
	LOS	A	A	A	A	A
2040 No Build	Delay	12.8	13.7	14.0	8.1	8.3
	LOS	B	B	B	A	A
2040 Build TWSC	Delay	6.5	1.3	1.0	27.3	32.5
	LOS	A	A	A	D	D
2040 Build Mini RAB	Delay	2.8	2.8	3.0	1.6	2.7
	LOS	A	A	A	A	A

Table 2. VISSIM Operations Analysis MD Peak Results

Scenario		Overall	NB	SB	EB	WB
2020 Existing	Delay	12.3	13.7	12.6	8.1	7.6
	LOS	B	B	B	A	A
2020 TWSC	Delay	4.8	1.0	1.0	28.3	17.6
	LOS	A	A	A	D	C
2020 Mini RAB	Delay	2.4	2.5	2.3	1.9	2.2
	LOS	A	A	A	A	A
2040 No Build	Delay	17.7	19.8	19.4	8.9	8.0
	LOS	C	C	C	A	A
2040 Build TWSC	Delay	10.6	1.3	1.2	71.8	30.4
	LOS	B	A	A	F	D
2040 Build Mini RAB	Delay	3.2	3.5	3.2	2.3	3.1
	LOS	A	A	A	A	A

Table 3. VISSIM Operations Analysis PM Peak Results

Scenario		Overall	NB	SB	EB	WB
2020 Existing	Delay	22.2	30.2	18.2	8.6	7.7
	LOS	C	D	C	A	A
2020 TWSC	Delay	7.5	1.4	1.2	56.7	30.1
	LOS	A	A	A	F	D
2020 Mini RAB	Delay	3.6	3.9	3.4	2.5	3.1
	LOS	A	A	A	A	A
2040 No Build	Delay	88.5	164.7	39.3	9.1	8.4
	LOS	F	F	E	A	A
2040 Build TWSC	Delay	34.2	1.7	1.6	421.4	59.2
	LOS	D	A	A	F	F
2040 Build Mini RAB	Delay	5.2	5.8	5.0	3.4	5.2
	LOS	A	A	A	A	A

Table 4. VISSIM Operations Analysis AM Peak Maximum Queuing

Scenario	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
2020 Existing	40	116	131	30	117	134	47	45	59	68	67	75
2020 TWSC	24	0	0	7	0	0	56	54	68	82	81	89
2020 Mini RAB	56	56	56	61	60	61	20	19	20	41	41	42
2040 No Build	47	157	172	27	159	174	51	50	63	76	76	83
2040 Build TWSC	27	0	0	13	0	0	67	66	80	116	114	122
2040 Build Mini RAB	81	81	80	76	77	77	24	24	24	47	47	47

Table 5. VISSIM Operations Analysis MD Peak Maximum Queuing

Scenario	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
2020 Existing	33	154	168	35	144	159	61	60	73	54	51	60
2020 TWSC	16	0	0	18	0	0	93	91	104	60	57	66
2020 Mini RAB	73	73	74	69	69	69	33	33	33	28	29	29
2040 No Build	34	226	240	42	234	249	73	71	85	60	58	66
2040 Build TWSC	28	0	0	24	0	0	165	164	175	80	80	86
2040 Build Mini RAB	102	102	103	86	86	86	37	39	37	40	40	40

Table 6. VISSIM Operations Analysis PM Peak Maximum Queuing

Scenario	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
2020 Existing	30	323	337	43	216	231	62	59	74	58	56	64
2020 TWSC	19	0	0	26	0	0	119	116	130	80	79	84
2020 Mini RAB	132	131	130	106	106	106	35	37	37	38	37	38
2040 No Build	35	1,042	1,058	56	415	430	71	69	83	64	62	70
2040 Build TWSC	25	0	0	35	0	0	458	477	481	116	116	124
2040 Build Mini RAB	186	186	186	147	147	146	40	41	40	52	52	52

SSAM Results Memo

The Surrogate Safety Model (SSAM) is a software used to quantify near-miss traffic conflicts. The program uses the vehicle trajectory output provided by VISSIM to identify the conflict type. As part of the operations analysis, SSAM was used to evaluate the existing intersection conditions and compare them to future conditions. While the analysis often overestimates the number of conflicts, the percentage difference between alternatives is helpful in assessing the safety of the intersection. **Table 1** summarizes the conflicts under existing, no build, and build conditions by conflict type and peak hour. **Table 2** adds the AM, Midday, and PM conflicts together to understand how the total identified conflicts change between the existing, no build, and build conditions.

Table 1. SSAM Total Predicted Crashes by Conflict Type for 10 Simulation Runs

Scenario	Peak Hour	Conflict Type			
		Crossing	Rear End	Lane Change	Total
2020 Existing	AM	76	732	33	841
	MD	104	1,214	32	1,350
	PM	167	4,892	49	5,108
2020 TWSC	AM	12	47	0	59
	MD	11	63	1	75
	PM	22	105	1	128
2020 Mini RAB	AM	10	59	9	78
	MD	8	95	12	115
	PM	8	240	3	251
2040 No Build	AM	128	1,403	47	1,578
	MD	192	3,258	69	3,519
	PM	237	27,996	72	28,305
2040 Build TWSC	AM	16	92	1	109
	MD	25	213	2	240
	PM	33	828	3	864
2040 Build Mini RAB	AM	6	134	6	146
	MD	4	193	7	204
	PM	9	478	6	493

Table 2. SSAM Total Predicted AM and PM Crashes by Conflict Type for 10 Simulation Runs

Scenario	Conflict Type			
	Crossing	Rear End	Lane Change	Total
2020 Existing	347	6,838	114	7,299
2020 TWSC	45	215	2	262
2020 Mini RAB	26	394	24	444
2040 No Build	557	32,657	188	33,402
2040 Build TWSC	74	1,133	6	1,213
2040 Build Mini RAB	19	805	19	843

The current control type at the intersection is an all-way stop. Due to this control type the analysis anticipated a high number of rear-end conflicts. The results show in **Tables 2 and 3** support this assumption with a majority of the conflicts being rear-end. The results summarized in **Table 3** show the percent change in conflicts by type and total between each alternative. As anticipated under no build conditions, the increase in volume and delay has led to an increase in each conflict type. As delay increases the primary increase in conflict type was rear end conflicts. This is consistent with what was anticipated.

Table 3. Percent Difference

Scenario	Conflict Type			
	Crossing	Rear End	Lane Change	Total
2020 Existing	-	-	-	-
2020 TWSC	-87%	-97%	-98%	-96%
2020 Mini RAB	-93%	-94%	-79%	-94%
2040 No Build	61%	378%	65%	358%
2040 Build TWSC	-79%	-83%	-95%	-83%
2040 Build Mini RAB	-95%	-88%	-83%	-89%

The results between the 2020 and the 2040 two-way stop-controlled and mini roundabout alternatives are very similar. As anticipated, there are less rear end crashes for the two-way stop-controlled and mini roundabout alternatives under both 2020 and 2040 volumes conditions than in the 2040 no build all-way stop-controlled because of the reduction in conflicts. This reduction in conflicts under the two-way stop-controlled alternative is attributed to most of the volume at the

intersection no longer needing to stop. By removing the stop control on the northbound and southbound approaches, a large amount of the traffic does not have to stop, which leads to the large decrease in rear-end conflicts. Additionally, the mini roundabout is expected to have less crossing conflicts than the all-way stop-controlled alternative because a roundabout removes the traditional crossing movements. In addition to the removal of traditional crossing conflicts, the mini roundabout alternative showed a significant reduction in rear-end conflicts. This reduction in rear-end conflicts is attributed to the decrease in delay on the northbound and southbound approaches as well as the side-street approaches.

The key takeaways from the SSAM analysis indicate that the two-way stop-control and mini roundabout alternatives are anticipated to have significant reductions in total conflicts. In general, a reduction in total conflicts suggests a reduction in anticipated crashes. With this assumption, both build alternatives (two-way stop-control and mini roundabout) are anticipated to reduce conflicts at the study intersection, which is anticipated to lead to a reduction in overall anticipated crashes at the intersection.

Mini-Roundabout Detailed Cost Estimate

Lor Ray Drive - James Drive Roundabout

Concept Cost Estimate (based upon 2019 bid price information)
Prepared By: SRF Consulting Group, Inc., 12/7/2020

	ITEM DESCRIPTION		UNIT	UNIT PRICE	TOTAL EST. QUANTITY	TOTAL EST. AMOUNT
PAVING AND GRADING COSTS						
GrP 1a	2106 Excavation - common & subgrade		cu. yd.	$11.00	1,500	$16,500
GrP 2a	2106 Common Embankment (CV)		cu. yd.	$5.00	700	$3,500
GrP 2d	2106 Granular Subgrade (CV)		cu. yd.	$17.50	800	$14,000
GrP 3a	Mainline Pavement	(1)	sq. yd.	$35.00	1,386	$48,510
GrP 3b	Truck Apron Pavement - Concrete	(1)	sq. yd.	$70.00	69	$4,830
GrP 3i	Driveway Pavement - Concrete	(1)	sq. yd.	$70.00	28	$1,960
GrP 4a	Concrete Walk / Trail / Median	(2)	sq. yd.	$50.00	313	$15,650
GrP 4c	ADA Pedestrian Curb Ramp		each	$1750.00	8	$14,000
GrP 5	Concrete Curb and Gutter		lin. ft.	$21.00	811	$17,031
GrP 8a	Removals - Pavement		sq. yd.	$7.50	1,757	$13,178
	SUBTOTAL PAVING AND GRADING COSTS:					**$149,159**
DRAINAGE, UTILITIES AND EROSION CONTROL						
Dr 5	Drainage - urban		20%			$30,000
Dr 7	Turf Establishment & Erosion Control		5%			$8,000
Dr 8	Landscaping		2%			$3,000
	SUBTOTAL DRAINAGE, UTILITIES AND EROSION CONTROL					**$41,000**
SIGNAL AND LIGHTING COSTS						
SGL 3	At Grade Intersection Lighting (permanent - non signalized)		each	$25,000	1	$25,000
	SUBTOTAL SIGNAL AND LIGHTING COSTS:					**$25,000**
SIGNING & STRIPING COSTS						
SGN 1	Mainline Signing (C&D)		mile	$35,000	0.1	$3,500
SGN 2	Mainline Striping		mile	$5,000	0.1	$500
	SUBTOTAL SIGNING & STRIPING COSTS:					**$4,000**
	SUBTOTAL CONSTRUCTION COSTS:					**$219,159**
MISCELLANEOUS COSTS						
M 1	Mobilization		5%			$11,000
M 2	Non Quantified Minor Items		20%			$44,000
M 8	Traffic Control		5%			$11,000
	SUBTOTAL MISCELLANEOUS COSTS:					**$66,000**
ESTIMATED TOTAL CONSTRUCTION COSTS without Contingency:						**$285,159**
1	Contingency or "risk"		25%			$72,000
ESTIMATED TOTAL CONSTRUCTION COSTS PLUS CONTINGENCY:						**$357,159**
	TOTAL PROJECT COST (OPENING YEAR DOLLARS)					**$357,159**

NOTE: (1) Includes aggregate base class 5 and PASB or OGAB, as appropriate
(2) Includes aggregate base class 5.

MAJOR ITEMS NOT INCLUDED:
- Local utilities (sanitary sewer or watermain)
- Water quality ponds or other BMPs
- R/W acquisitions
- Engineering design fees
- Inflation