

Intersection Control Evaluation Report

TH 23 at CSAH 5 / CSAH 15

Kandiyohi County, Minnesota

S.P. No. 3405-94
SEH No. KANDC 141923

September 18, 2017



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Intersection Control Evaluation
TH 23 at CSAH 5 / CSAH 15
Kandiyohi County, Minnesota

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SEH No. KANDC 141923

September 18, 2017

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
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Intersection Control Evaluation

TH 23 at CSAH 5 / CSAH 15

Prepared for the Kandiyohi County in cooperation with the Minnesota Department of Transportation (MnDOT) District 8.

1.0 Background and Description of Location

Kandiyohi County is interested in improvements at the intersections in the area of Minnesota Highway 23 (TH 23) and County State Aid Highway 5/15 (CSAH 5/15). The existing at-grade intersection had a significant number of crashes in recent years and became an intersection of concern. In 2014, MnDOT conducted a Highway Safety Improvement Project (HSIP) to reduce the number of vehicle conflict points in an effort to decrease the number of crashes at the intersection.

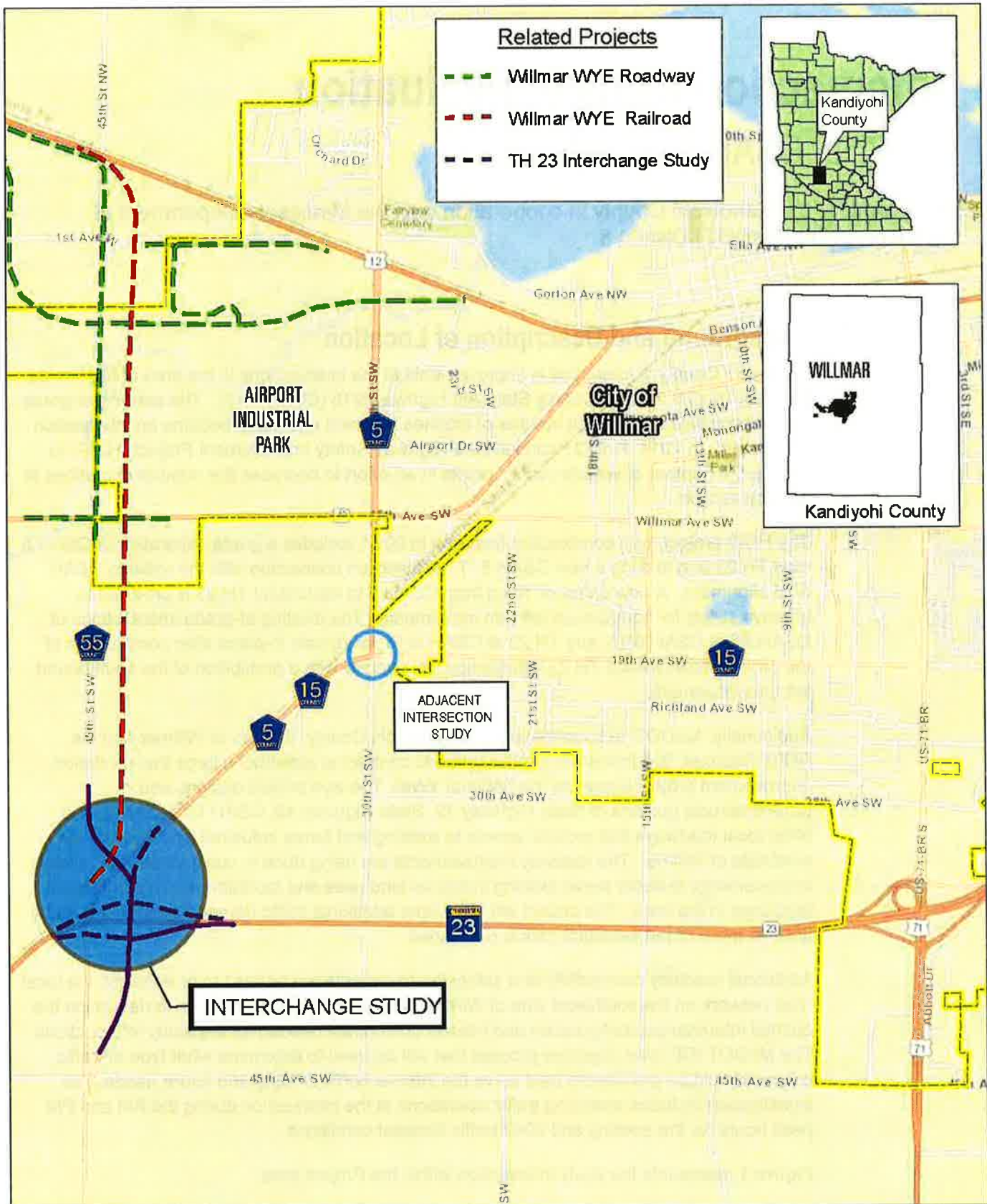
The HSIP project, with construction finalizing in 2017, includes a grade separation of CSAH 5 over TH 23 and making a new CSAH 5 "T" intersection connection with the existing CSAH 5/15 alignment. A new entrance ramp from CSAH 5 to eastbound TH 23 is provided to improve safety for southbound left turn movements. The existing at-grade intersections of CSAH 55 at CSAH 5/15, and TH 23 at CSAH 5/15 will remain in-place after construction of the project; however the TH 23 intersection will operate with a prohibition of the southbound left turn movement.

Additionally, MnDOT, in coordination with Kandiyohi County, the City of Willmar and the BNSF Railroad, is administering a design/build contract to construct a large transportation improvement project known as the "Willmar Wye". The wye project realigns and or/reconstructs portions of State Highway 12, State Highway 40, CSAH 55, CSAH 5, and other local roadways that provide access to existing and future industrial land uses on the west side of Willmar. The roadway improvements are being done in conjunction with railroad improvements to better serve existing industrial land uses and facilitate growth of industrial land uses in the area. The project will likely spur additional traffic demand through this study area as more of the industrial park is developed.

Additional roadway connectivity and safety improvements are needed to re-establish the local road network on the southwest side of Willmar. The purpose of this study is to determine the optimal interchange configuration and intersection control needed for the study intersections. The MnDOT ICE is an objective process that will be used to determine what type of traffic control should be provided to best serve the intersection's existing and future needs. The investigation includes analyzing traffic operations at the intersection during the AM and PM peak hours for the existing and 2040 traffic forecast conditions.

Figure 1 represents the study intersection within the Project area.

Figure 1 – Location Map



2.0 Existing Conditions

Currently, CSAH 5 is a north-south, Major Collector that extends through the west side of Willmar, Minnesota and spans all of Kandiyohi County. Through the project area, CSAH 5 has a single lane in each direction and a posted speed limit of 55 mph.

Trunk Highway 23 (TH 23) is a Principal Arterial that extends between Interstate 90 at the southwest end to Duluth at the northeast end, spanning a majority of the state. TH 23 through the project area runs east-west along the south side of Willmar with a single lane in each direction and a posted speed limit of 60 mph. Approximately 2 miles east of the project area TH 23 is expanded to a 4-lane divided freeway.

There are two existing intersections under consideration in the study area along CSAH 5.

- CSAH 5 at TH 23 (Prior to 2017 HSIP Project - see Note below)
 - Two-way stop control with TH 23 operating freely
 - Northbound approach had a single lane for all movements
 - Southbound approach has a shared through/left turn lane and a dedicated right turn lane
 - Westbound approach has a single through lane and dedicated right and left turn lanes
 - Eastbound approach has a single through lane and dedicated right and left turn lanes

Note: The 2017 HSIP project realigned CSAH 5 on a new bridge over TH 23, and rerouted southbound left turns, northbound left turns, westbound left turns and eastbound right turns.

- CSAH 5 at CSAH 55
 - Stop control on CSAH 55 with CSAH 5 operating freely
 - Northbound approach has a shared through/left turn lane and a left turn bypass lane
 - Southbound approach has a single through lane and a dedicated right turn lane
 - Eastbound approach has dedicated right and left turn lanes

Spacing between the two intersections is relatively close with approximately 475 feet of roadway between the intersections and 400 feet of useable storage.

2.1 Crash History

Crash data from January 1, 2011 through December 31, 2015 was obtained from MnDOT's crash mapping analysis software (MnCMAT). The type and severity of crashes were reviewed and the crash rate and critical rate was calculated for each study intersection. The crash information is summarized in **Table 1**. Crash diagrams can be found in **Appendix A**.

Crash rates are expressed as number of crashes per million entering vehicles (MEV) at the intersection. The critical crash rate is a statistical value that is unique to each intersection and is based on vehicular exposure and the statewide average crash rate for similar intersections. An intersection with a crash rate higher than the critical rate indicates a sustained crash problem at the intersection.

Crash severity is separated into five categories based on injuries sustained during the crash.

- Fatal – Crash that results in a death
- Severity A – Crash that results in an incapacitating injury
- Severity B – Crash that results in a non-incapacitating injury
- Severity C – Crash that results in possible injury
- Property Damage – Crash that results in property damage only, with no injuries

**Table 1
Crash History 2011-2015**

Intersection	Crash Severity					Crash Rates	
	Fatal and Severity A	Severity B	Severity C	Property Damage	Total	Intersection Rate	Critical Rate
CSAH 5 at TH 23	0	2	2	6	10	0.77	0.65
CSAH 5 at CSAH 55	0	0	0	4	4	0.55	0.80

The intersection of CSAH 5 at TH 23 has experienced 10 crashes during the 5-year analysis period and has a crash rate that is above the calculated critical rate, indicating a sustained crash problem at this intersection. Four of the 10 crashes were right angle crashes and an additional two crashes involved left turning vehicles. Three of the crashes involved southbound vehicles in rear-end type collisions.

The intersection of CSAH 5 at CSAH 55 has experienced 4 crashes during the 5-year analysis period and has a crash rate that is below the critical rate, indicating that the intersection does not have a crash problem.

2.2 Existing Traffic Demands

A 13-hour (6 a.m. to 7 p.m.) intersection turning movement count was performed in May of 2017 prior to the completion of the HSIP project. Passenger vehicles, heavy commercial vehicles (trucks), pedestrians, and bicyclists were counted.

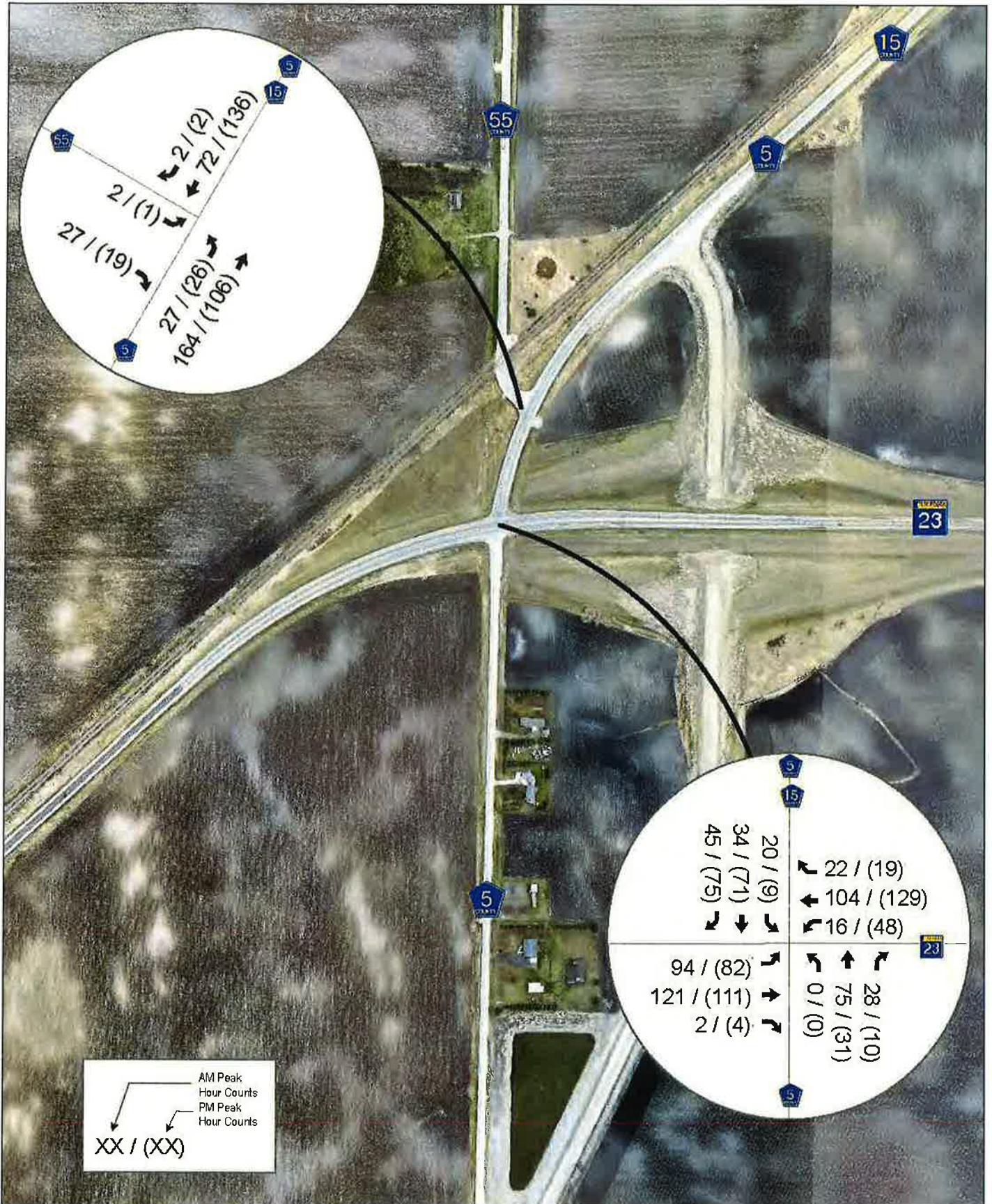
The 13-hour intersection volumes include approximately 15% trucks (15% a.m., 9% p.m.). The existing 2017 vehicular turning movements are shown in **Figure 2**.

Average Annual Daily Traffic (AADT) from MnDOT traffic flow maps includes the most current AADT from 2014. The AADT for each approach for each intersection is shown in **Table 2**.

**Table 2
Existing Traffic Demands AADT**

Intersection	Intersection Leg	Roadway	AADT
CSAH 5 at TH 23	East	TH 23	3,900
	West	TH 23	5,700
	South	CSAH 5	1,200
	North	CSAH 5	3,400
CSAH 5 at CSAH 55	West	CSAH 55	940
	South	CSAH 5	3,400
	North	CSAH 5/CSAH 15	3,550

Figure 2 – 2017 Existing Peak Hour Turning Movement Volumes



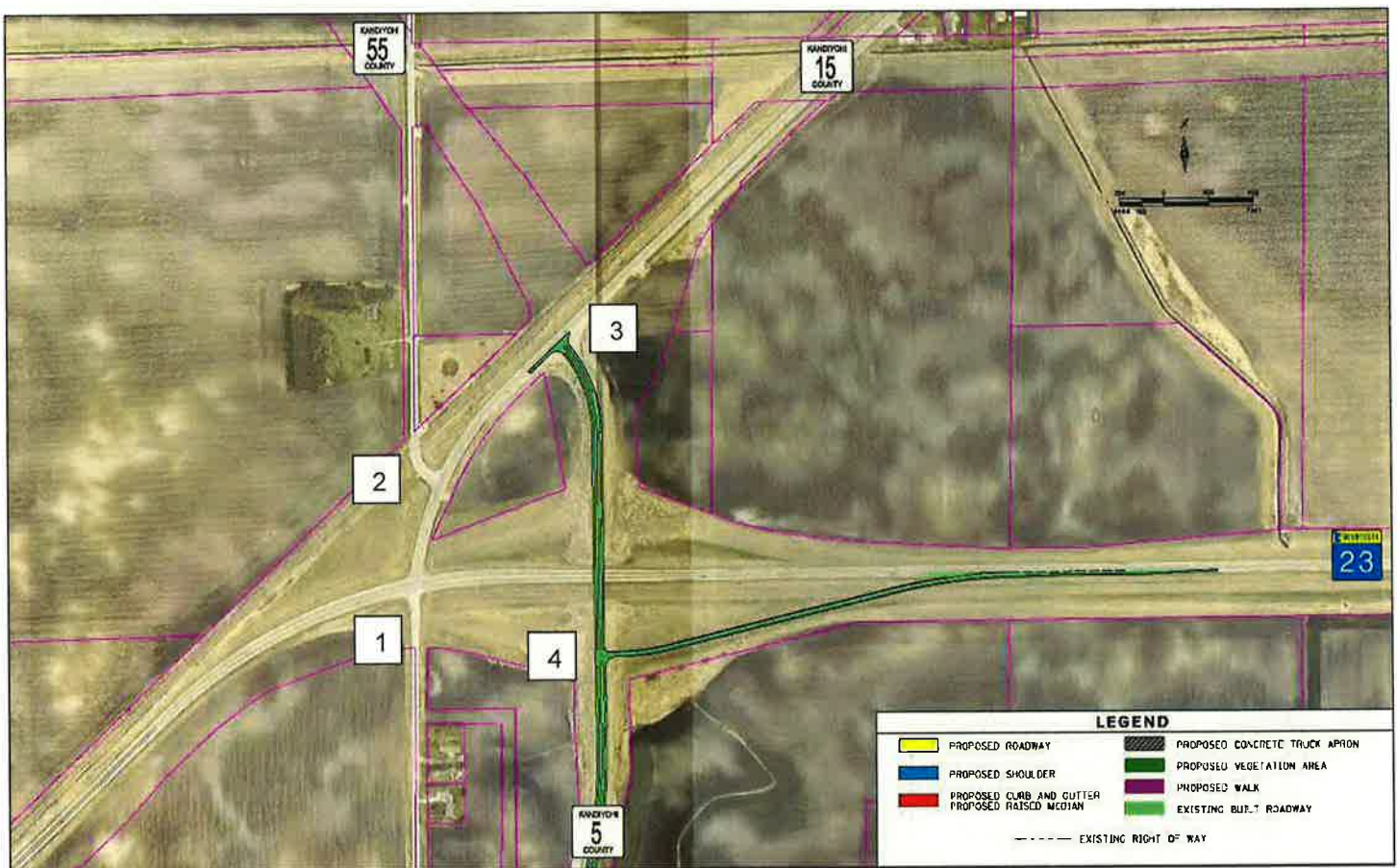
3.0 Future Conditions

A new CSAH 5 Bridge that passes over TH 23 was constructed and opened to traffic in 2017. The bridge project included an entrance ramp to eastbound TH 23 and removal of the south at grade leg which was rerouted over the bridge. In addition, the southbound left turn movement will be prohibited and replaced by the new entrance ramp.

For the purpose of this report, the newly constructed geometric configuration will be considered both the “2017 Build” and “2040 No Build” alternatives. For the purposes of warrant, safety, and operational analysis, the 2017 Build configuration is required to show the benefits from the HSIP project compared to the existing conditions. However, in the 2040 forecast year, the HSIP project is considered to be the No Build alternative as it would have been in place for over 20 years.

A layout of the newly constructed CSAH 5 Bridge is shown in **Figure 3**; a full layout can be found in **Figure 6** in **Appendix B**.

Figure 3 – 2017 HSIP Project: CSAH 5 Bridge Layout



The 2017 Build/2040 No Build configuration consists of two new intersections, the modification of one of the existing intersections, and one existing intersection along CSAH 5. The intersections are numbered in Figure 3 to correspond with the following descriptions.

- **1. CSAH 5 at TH 23 (Modified Existing Intersection)**
 - Southbound approach has a dedicated right turn lane
 - Westbound approach has a single through lane and a dedicated right turn lane
 - Eastbound approach has a single through lane and a dedicated left turn lane
- **2. CSAH 5 at CSAH 55 (Existing Intersection)**
 - Northbound approach has a shared through/left turn lane and a left turn bypass lane
 - Southbound approach has a single through lane and a dedicated right turn lane
 - Eastbound approach has dedicated right and left turn lanes
- **3. CSAH 5 at New CSAH 5 (New Intersection north of bridge)**
 - Northbound approach has a single through lane and a dedicated right turn lane
 - Southbound approach has a shared through/left turn lane and a left turn bypass lane
 - Westbound approach has dedicated left and right turn lanes
- **4. CSAH 5 at TH 23 Eastbound Entrance Ramp (New Intersection)**
 - Northbound approach has a single through lane and a dedicated right turn lane
 - Southbound approach has a shared through/left turn lane
 - The east leg is an on ramp to eastbound TH 23 so there are no lanes of approach

3.1 Traffic Forecasts

Traffic forecasts were developed based on historical trends in the roadway AADT, gathered from MnDOT traffic flow maps. **Table 3** represents the historical AADT demands within the project area between 1994 and 2014.

A regression analysis was done to provide information for the expected growth rate; the resultant growth rates ranged from 0% to 2% per year. These values were then compared to the “Willmar Wye” traffic forecasts prepared as part of that study.

Based on the comparison of the available data and agency input, an assumed growth rate of 1% per year was used for all roadways except CSAH 55, which had an assumed growth rate of 3.6% per year due to expected industrial park development growth spurred by the “Willmar Wye” project.

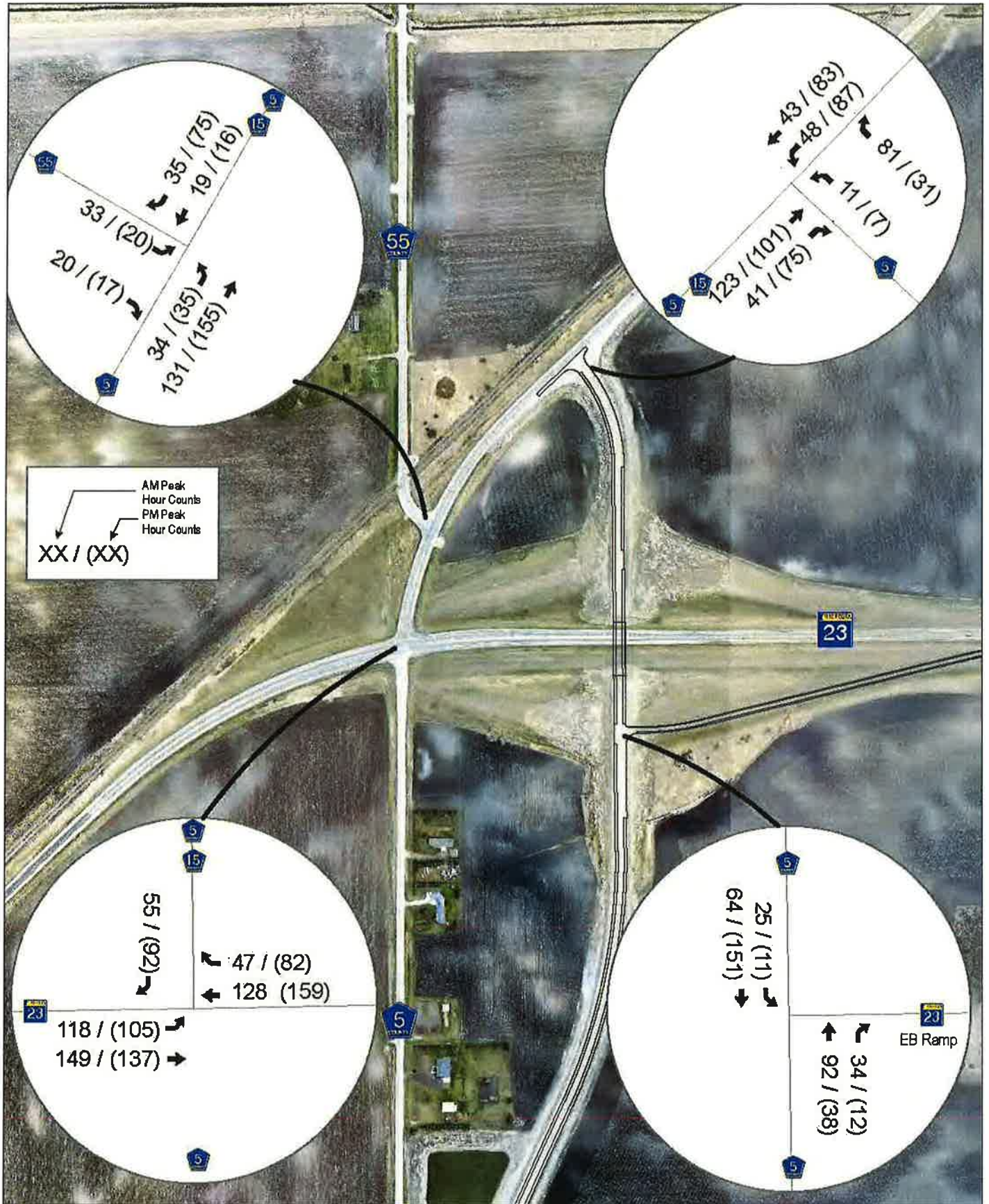
Table 3
Historical and Forecast Traffic Demands AADT

Route	Description	1994	1998	2002	2006	2010	2014	2040 Forecast
TH 23	West of CSAH 5	4,500	4,950	5,100	5,000	5,600	5,700	7,200
TH 23	East of CSAH 5	2,000	2,350	2,250	2,150	4,000	3,900	4,900
CSAH 5	South of TH 23	830	1,350	1,550	1,350	1,250	1,200	1,500
CSAH 5	TH 23 to CSAH 55	n/a	n/a	n/a	n/a	2,350	3,400	4,300
CSAH 55	North of CSAH 5	840	1,150	980	1,150	830	940	1,830
CSAH 5/CSAH 15	CSAH 55 to CSAH 5	3,500	4,100	3,750	3,500	3,800	3,550	4,450

Using the linear growth rates of 1% per year for all roadways, with the exception of CSAH 55 (3.6%), future turning movement volumes were estimated for the 2040 design year based on the 2017 Build configuration for the CSAH 5 HSIP project.

For the other CSAH 5 interchange alternatives, trips were rerouted based on the alternative intersection designs and then growth rates were applied to estimate 2040 traffic demands. The future turning movement volumes for the 2040 No Build configuration can be found in **Figure 4**.

Figure 4 – 2040 Peak Hour Turning Movement Volumes (2017 Build Configuration)



4.0 Analysis of Alternatives

In addition to the 2040 No Build alternative, five other CSAH 5 Interchange configurations were analyzed as part of this project.

The 2017 HSIP construction project will leave a high speed, at-grade intersection in place along TH 23 and provide only a partial interchange. This design may be confusing for non-local traffic, especially heavy vehicle traffic destined to the many industrial land uses to the north.

The intent of the additional interchange alternative designs, set forth by the county, is to address the following objectives:

- Provide an effective westerly bypass
- Provide good access to the industrial land uses
- Clarity of use for driving public
- Cost effective solutions

4.1 CSAH 5 Interchange Alternatives

This section will describe the five build alternatives considered in this study. Alternatives 1, 2, and 3 are considered to be a 2-phase projects for the long term vision of the project area; while Alternatives 4 and 5 would need to be completed in a single phase.

Kandiyohi County has a long term plan to grade separate CSAH 55 over the BNSF railroad to enhance its effectiveness as a westerly bypass route. The railroad grade separation is considered Phase 2 for Alternatives 1 through 3; however it would be considered part of the initial project for both Alternatives 4 and 5 because it is integral to the connectivity of ramps to and from TH 23.

Full layouts of each of the CSAH 5 Interchange alternatives can be found in **Appendix B**. In Alternatives 1, 2, and 3, each layout includes the future Phase 2 configuration.

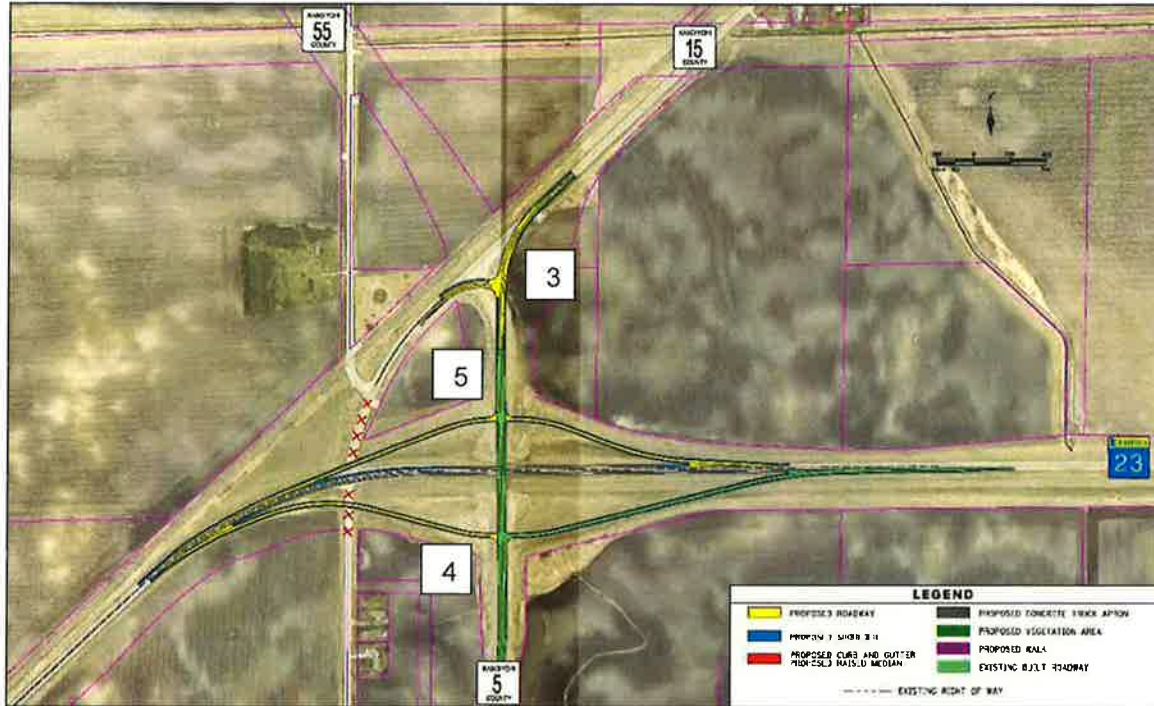
4.1.1 Alternative 1 - Standard Diamond Interchange

Alternative 1 is configured as a standard diamond interchange with ramps to and from eastbound and westbound TH 23. In alternative 1, CSAH 55 follows part of the existing CSAH 5/CSAH 15 before connecting to the new CSAH 5 alignment.

The three new proposed ramp connections to TH 23 utilize right of way and rough grading that is already established. As depicted in the Appendix B drawing, the estimated Phase 1 cost for this alternative is approximately \$3.5 million (2019 dollars, including engineering and CA). Phase 2 costs would be approximately \$7.1M.

This design allows for free flow of traffic moving through the study area along CSAH 5, which is the predominant movement. The Alternative 1- Standard Diamond Interchange layout is depicted in **Figure 5**.

Figure 5 – Alternative 1 - Standard Diamond Interchange Layout



Alternative 1 consists of three modified or new intersections to achieve the standard diamond interchange configuration. The intersections are numbered in Figure 5 to correspond with the following descriptions.

- **3. CSAH 5 at CSAH 55 (New Intersection)**
 - Northbound approach has a shared through/left turn lane and a left turn bypass lane
 - Southbound approach has a single through lane and a dedicated right turn lane
 - Eastbound approach has dedicated right and left turn lanes
- **4. CSAH 5 at TH 23 Eastbound Ramps (Modified Intersection)**
 - Northbound approach has a single through lane and a dedicated right turn lane
 - Southbound approach has a shared through/left turn lane
 - Westbound approach is an on ramp to eastbound TH 23 so there are no lanes of approach
 - Eastbound approach has a shared through/left turn lane and a dedicated right turn lane (EB TH 23 Exit Ramp)
- **5. CSAH 5 at TH 23 Westbound Ramps (New Intersection)**
 - Northbound approach has a shared through/left turn lane
 - Southbound approach has a single through lane and a dedicated right turn lane
 - Westbound approach has a shared through/left turn lane and a dedicated right turn lane (WB TH 23 Exit Ramp)
 - Eastbound approach is an on ramp to westbound TH 23 so there are no lanes of approach

4.1.2 Alternative 2 - Folded Diamond Interchange A

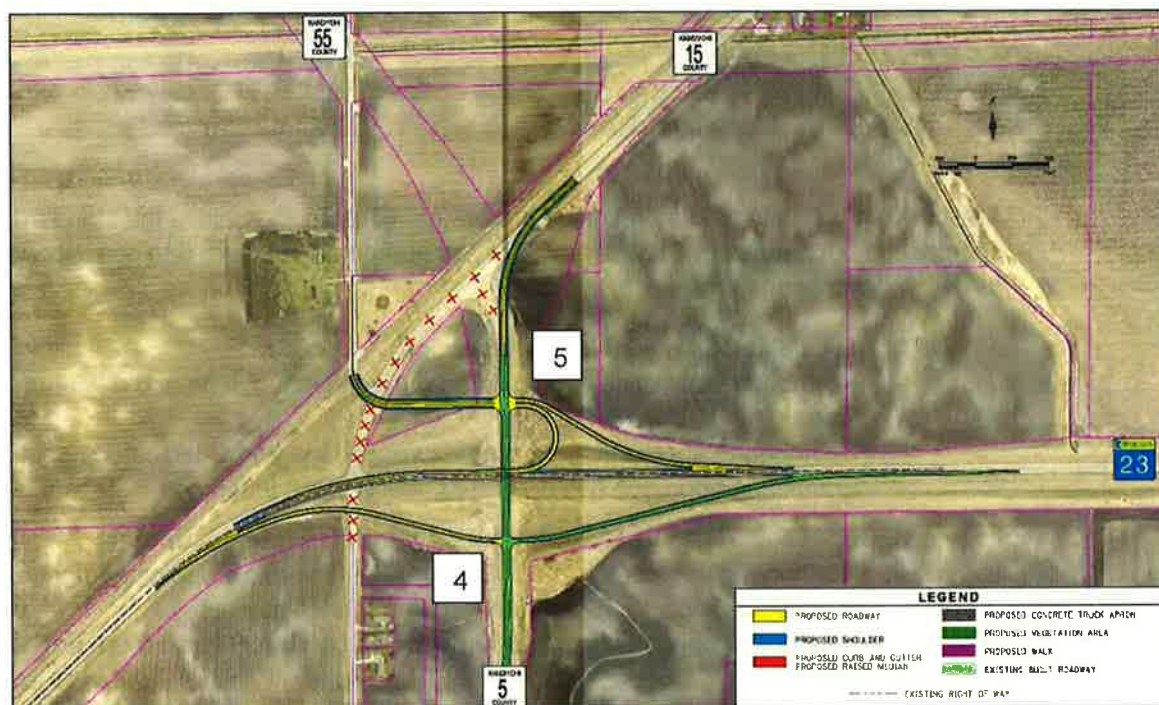
Alternative 2 utilizes a partially folded diamond interchange where the ramps to and from westbound TH 23 are both on the east side of CSAH 5. The ramps to and from eastbound TH 23 have the same configuration as the standard diamond alternative.

The majority of the new proposed ramp connections to TH 23 already have the right of way space and grading on the alignments; however modifications to accommodate the loop configuration will require additional right of way. As depicted in the Appendix B drawing, the estimated Phase 1 cost for this alternative is approximately \$3.8 million (2019 dollars, including engineering and CA). Phase 2 costs are approximately \$7.1M.

In Alternative 2, CSAH 55 is extended so that it connects directly to the CSAH 5 north ramp intersection. Alternative 2 allows for free flow of traffic moving through the study area along CSAH 5, while also reducing the total number of intersections within the network.

The Alternative 2- Folded Diamond Interchange A layout can be found in **Figure 6** below.

Figure 6 – Alternative 2 - Folded Diamond Interchange A Layout



Alternative 2 consists of one completely new intersection and the modification of one of the existing intersections from the 2017 Build configuration along CSAH 5. The intersections are numbered in Figure 6 to correspond with the following descriptions.

- **4. CSAH 5 at TH 23 Eastbound Ramps (Modified Intersection)**
 - Northbound approach has a single through lane and a dedicated right turn lane
 - Southbound approach has a shared through/left turn lane
 - Westbound approach is an on ramp to eastbound TH 23 so there are no lanes of approach
 - Eastbound approach has a shared through/left turn lane and a dedicated right turn lane (EB TH 23 Exit Ramp)

- **5. CSAH 5 at TH 23 Westbound Ramps (New Intersection)**
 - Northbound approach has a single lane for all movements
 - Southbound approach has a shared through/left turn lane and a dedicated right turn lane
 - Westbound approach has a shared through/left turn lane and a dedicated right turn lane (WB TH 23 Exit Ramp)
 - Eastbound approach has a shared through/left turn lane and a dedicated right turn lane (CSAH 55 Approach)

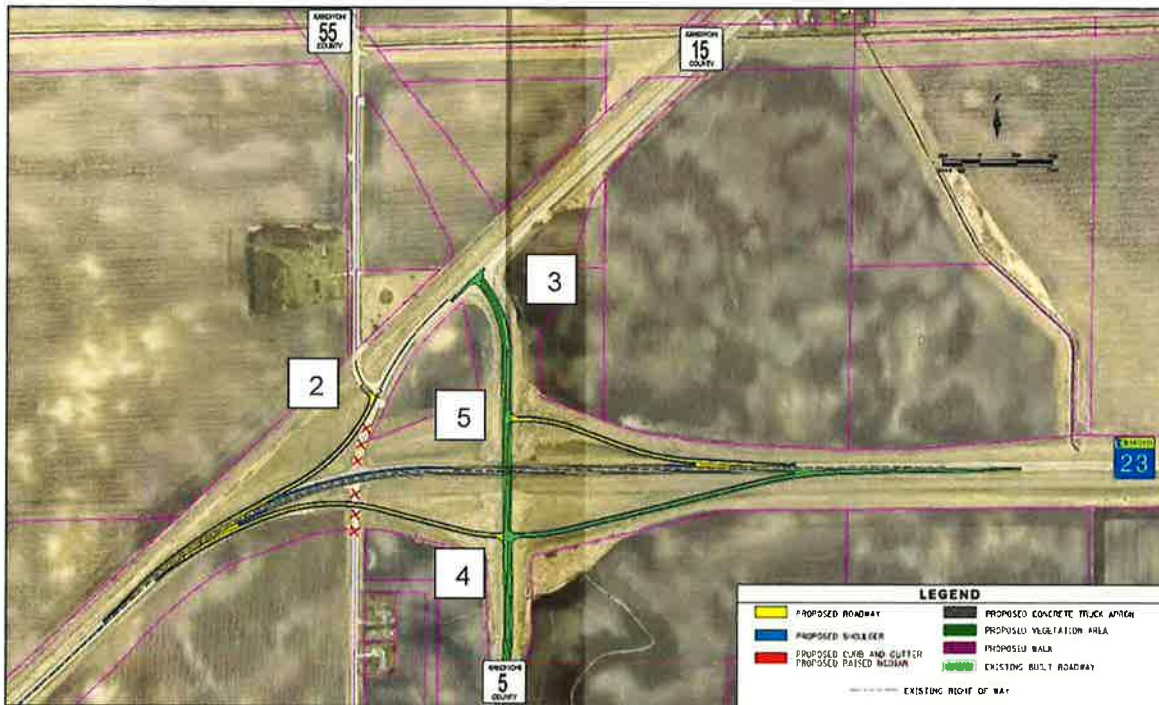
4.1.3 Alternative 3 - Modified Diamond Interchange

Alternative 3 is a modified diamond interchange where the entrance ramp to westbound TH 23 starts at the existing intersection of CSAH 5 at CSAH 55. The off ramp from westbound TH 23 and both the on and off ramps to and from eastbound TH 23 have the same standard diamond configuration as Alternative 1.

The three new proposed ramp connections to TH 23 already have the right of way space and grading on the majority of the alignments. This alternative would not provide modifications to allow CSAH 5 to be a continuous roadway and could leave the T-intersection in place as shown or realign the T to make the CSAH 5 the predominant roadway. As depicted in the Appendix B drawings the estimated Phase 1 cost for this alternative is approximately \$3.4 million (2019 dollars, including engineering and CA). Phase 2 costs are approximately \$7.8 million.

The Alternative 3 - Modified Diamond Interchange layout is shown in **Figure 7** below.

Figure 7 – Alternative 3 - Modified Diamond Interchange Layout



Alternative 3 consists of one completely new intersection, the modification of two of the existing intersections from the 2017 Build configuration, and one existing intersection from the 2017 Build configuration along CSAH 5. The intersections are numbered in Figure 7 to correspond with the following descriptions.

- **2. CSAH 5 at CSAH 55/TH 23 Westbound Entrance Ramp (Modified Intersection)**
 - Northbound approach is an on ramp to westbound TH 23 so there are no lanes of approach
 - Southbound approach has a single through turn lane and a dedicated right turn lane
 - Eastbound approach has dedicated left and right turn lanes
- **3. CSAH 5/15 at New CSAH 5 (Existing Intersection north of bridge)**
 - Northbound approach has a shared through/left turn lane and a left turn bypass lane
 - Southbound approach has a single through lane and a dedicated right turn lane
 - Westbound approach has dedicated left and right turn lanes
- **4. CSAH 5 at TH 23 Eastbound Ramps (Modified Intersection)**
 - Northbound approach has a single through lane and a dedicated right turn lane
 - Southbound approach has a shared through/left turn lane
 - Westbound approach is an on ramp to eastbound TH 23 so there are no lanes of approach
 - Eastbound approach has a shared through/left turn lane and a dedicated right turn lane
- **5. CSAH 5 at TH 23 Westbound Ramps (New Intersection)**
 - Northbound approach has a shared through/right turn lane
 - Southbound approach has a shared through/left turn lane
 - Westbound approach has dedicated left and right turn lanes

4.1.4 Alternative 4 - Folded Diamond Interchange B

Alternative 4 utilizes a partially folded diamond interchange where the ramps to and from eastbound TH 23 are on the east side of CSAH 5. The off ramp from westbound TH 23 is the same as in the standard diamond interchange configuration, however, the on ramp to westbound TH 23 follows the existing CSAH 5 alignment. The recently constructed southern TH 23 ramp terminal intersection would also need to be relocated in order to accommodate the folded diamond design.

Alternative 4 includes a new CSAH 55 alignment that has a bridge over the westbound TH 23 on ramp; this alternative would require the CSAH 55 rail grade separation project to be completed concurrently. The required combination of project phases increases the initial project cost by a significant amount. The estimated cost of Alternative 4 is \$13.2 million.

The Alternative 4 - Folded Diamond Interchange B layout can be found in **Figure 8** below.

Figure 8 – Alternative 4 - Folded Diamond Interchange B Layout



Alternative 4 requires that the CSAH 55 railroad grade separation project be constructed at the same time as the interchange project and also requires removal of recent infrastructure investments; therefore, this alternative was not considered reasonable and was dismissed and not analyzed further in this ICE study.

4.1.5 Alternative 5 - Folded Diamond Interchange C

Alternative 5 is a folded diamond interchange where the ramps to and from eastbound TH 23 are on the east side of CSAH 5 and the ramps to and from westbound TH 23 are on the west side of CSAH 5. The westbound TH 23 ramps follow the existing CSAH 5 alignment. The recently constructed southern TH 23 ramp terminal intersection would also need to be relocated in order to accommodate the folded diamond design.

Alternative 5 includes a new CSAH 55 alignment that has a bridge over the westbound TH 23 ramps; this alternative would require the CSAH 55 rail grade separation project to be completed concurrently. The required combination of project phases increases the initial project cost by a significant amount. The estimated cost of Alternative 5 is \$12.7 million.

The Alternative 5- Folded Diamond Interchange C layout is shown in **Figure 9** below.

Figure 9 – Alternative 5 - Folded Diamond Interchange C Layout



Alternative 5 requires that the CSAH 55 railroad grade separation project be constructed at the same time as the interchange project and also requires removal of recent infrastructure investments; therefore, this alternative was not considered reasonable and was dismissed and not analyzed further in this ICE study.

4.2 Warrant Analysis

The Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD) provides guidance on when it may be appropriate to use all-way stop or signal control at an intersection. This guidance is provided in the form of “warrants”, or criteria, and an engineering analysis of the intersection’s design factors to determine when all-way stop or signal control may be justified. Though all-way stop or signal control should not be installed at an intersection unless a MnMUTCD warrant is met, meeting a warrant at an intersection does not in itself require the installation of that particular control type. The particular control type also needs an engineering analysis of the intersection’s design in order for it to be justified. Under the MnDOT ICE process, roundabouts are considered to be warranted if traffic volumes meet the criteria for either all-way stops or traffic signals.

For traffic signal installation, MnDOT typically relies on Warrant 1, which requires 8 hours of combined major approach volumes and the maximum minor approach volume to meet MnMUTCD thresholds based on the number of approach lanes; however, other warrants can be used as indicators of need to consider traffic control change. An engineering study that considers factors, including warrants, should be performed to determine the “optimum” type of control at an intersection.

MnDOT guidelines suggest that for the purpose of warrant analysis, 100% of right turning traffic from the minor leg should be removed because right turners are typically able to enter the traffic stream with minimal delay or conflict; the right turning traffic would not require a traffic signal to reduce delay or improve safety. In certain circumstances (i.e. high right turn volume, minimum mainline gaps, etc.), MnDOT procedures allow for the inclusion of 50% of the minor street right turning traffic in the analysis. The MnDOT guidance states “if right turning volume exceeds 70% of its potential capacity for any hour for each approach, 50% of the right turning volume for all hours should be added back in.”

Based upon MnDOT guidance, the analysis for all intersections in this study include the removal of 100% of the right turning traffic on the minor approaches.

When the speed limit on any of the approaches is greater than 40 mph, MnMUTCD guidelines allow using 70 percent of the signal warrant thresholds that would otherwise be required. The speed limit on all of the approaches in the study area are above 40, which allows a 70 percent reduction in signal warrant requirements.

Based on the existing 2017 traffic data and the future 2040 forecast traffic demands:

- None of the study intersections in any of the alternatives meet the all-way stop warrant volume thresholds from the MnMUTCD.
- None of the intersections in any of the alternatives meet the 8-hour, 4-hour, or peak hour traffic signal warrant volume thresholds from the MnMUTCD for any demand scenario.

No all-way stop or signal warrants were met for any of the intersections in any of the alternatives. **Table 4** and **Table 5** provide the number of hours met for the all-way stop and 8-hour traffic signal warrants the 2017 existing and 2040 traffic volume demand scenarios for each of the configuration alternatives. The complete all-way stop and traffic signal warrant analyses can be found in **Appendix C**.

**Table 4
All-way Stop Warrant Analysis Results**

Intersection	Number of Hours Met (2017 / 2040)			
	No Build**	Alternative 1	Alternative 2	Alternative 3
CSAH 5 at TH 23	0 / 0	n/a	n/a	n/a
CSAH 5 at CSAH 55	0 / 0	0 / 0	n/a	0 / 0
CSAH 5 at TH 23 WB Ramps	n/a	0 / 0	0 / 0	0 / 0
CSAH 5 at TH 23 EB Ramps	N/A*	0 / 0	0 / 0	0 / 0
CSAH 5 at CSAH 5 Bridge	0 / 0	n/a	n/a	0 / 0

*There are no minor road turning movements. Therefore, no warrants can be met.
 **The No Build alternative is the 2017 Build/2040 No Build alternative discussed in Section 3

**Table 5
8-Hour Traffic Signal Warrant Analysis Results**

Intersection	Number of Hours Met (2017 / 2040)			
	No Build**	Alternative 1	Alternative 2	Alternative 3
CSAH 5 at TH 23	N/A***	n/a	n/a	n/a
CSAH 5 at CSAH 55	0 / 0	0 / 0	n/a	0 / 0
CSAH 5 at TH 23 WB Ramps	n/a	0 / 0	0 / 0	0 / 0
CSAH 5 at TH 23 EB Ramps	N/A*	0 / 0	0 / 0	0 / 0
CSAH 5at CSAH 5 Bridge	0 / 0	n/a	n/a	0 / 0

*There are no minor road turning movements. Therefore, no warrants can be met.
 **The No Build alternative is the 2017 Build/2040 No Build alternative discussed in Section 3
 ***All minor road turning movements are right turns. Therefore, after right turn reductions there are no minor road turning movements and no warrants can be met.

4.3 Safety Analysis

Future vehicular crash estimates were determined by applying crash rates, typical for various intersection types, to entering traffic for the study intersection. The "Existing" estimates are based on the existing crash rates described in Section 2 and are only included to show the safety benefits of the 2017 Build configuration.

The "2017 Build/2040 No Build" estimates are based on the existing crash rates described in Section 2 with crashes removed based on improvements made with the HSIP project. This includes removing crashes involving southbound left turning vehicles, eastbound right turning vehicles, westbound left turning vehicles, and all northbound vehicles for the intersection of CSAH 5 at TH 23. Removing these crashes represents the expected crashes based on existing data for the 2017 build configuration.

The following crash rates were utilized in this analysis:

- Existing (2016 and prior configuration) estimates are based on the existing crash rates described in Section 2. The existing crash rate at the intersection of CSAH 5 and TH 23 is 0.77, and 0.55 at the intersection of CSAH 5 and CSAH 55.
- No Build (2017 HSIP Project) estimates are based on the existing crash rates described above. The existing crash rate at the intersection of TH 23 and CSAH 5 is reduced to 0.23, and 0.55 at the intersection of CSAH 5 and CSAH 55.
- The MnDOT statewide average crash rate for a rural two-way stop controlled intersections is 0.25 crashes per million vehicles entering the intersection.

Table 6 shows the projected number of total crashes for each intersection in each alternative under two-way stop control analyzed for the existing and forecast 2040 traffic conditions. Other forms of traffic control were not evaluated because no all-way stop or traffic signal warrants are met for any intersection in any alternative.

**Table 6
2017 and 2040 Annual Crash Estimates**

Intersection	Total Crashes (2017 / 2040)				
	Existing	No Build	Alternative 1	Alternative 2	Alternative 3
CSAH 5 at TH 23	1.9 / 2.3	0.4 / 0.5			
CSAH 5 at CSAH 55	0.6 / 0.8	0.5 / 0.7	0.3 / 0.4		0.1 / 0.1
CSAH 5 at TH 23 WB Ramps			0.3 / 0.4	0.3 / 0.4	0.3 / 0.4
CSAH 5 at TH 23 EB Ramps		0.2 / 0.2	0.3 / 0.4	0.3 / 0.4	0.3 / 0.4
CSAH 5/CSAH 15 at CSAH 5 Bridge		0.3 / 0.4			0.3 / 0.4
Yearly Crash Totals	2.5 / 3.1	1.4 / 1.8	0.9 / 1.2	0.6 / 0.8	1.0 / 1.3
Total Conflict Points	41	31	35	45	36

Notes:

Existing crash rate at TH 23/CSAH 5 is 0.77

Estimated crash rate under "No Build" conditions at TH 23/CSAH 5 is 0.23 based on removal of conflict reductions

Existing crash rate at CSAH 5/CSAH 55 is 0.55

All new intersection estimated crashes are based on MnDOT Average Rate of 0.25 for Two-way Stop Conditions

4.4 Operational Analysis

Traffic operations analyses were conducted to determine the level of service (LOS), delay, and queueing information for the AM and PM peak hour conditions for each alternative.

LOS is a qualitative rating system used to describe the efficiency of traffic operations at an intersection. Six LOS values are defined, designated by letters A through F. LOS A represents the best operating conditions (no congestion), and LOS F represents the worst operating conditions (longest delays). For the study intersection it was assumed that LOS D or better represents acceptable operating conditions.

LOS for intersections is determined by the average control delay per vehicle. The range of control delay for each LOS is different for signalized and unsignalized intersections. The expectation is that a signalized intersection is designed to carry higher traffic volumes and will experience greater delays than an unsignalized intersection; driver tolerance for delay is greater at a signal than a stop sign. Therefore, LOS thresholds for each LOS category are lower for unsignalized intersections than for signalized intersections.

The traffic operations analyses were performed using Synchro/SimTraffic (version 9) software; using an average of 5 simulation runs for each modeling result. LOS for intersections is determined by the average control delay per vehicle.

All intersections, for every alternative, were analyzed under two-way stop control as all-way stop and traffic signal warrants are not met by any intersections in any alternative.

Appendix D includes all relevant operational tables for the existing and future 2040 alternatives that follow.

4.4.1 Existing (2017) Operating Conditions

The intersection currently, prior to the HSIP project, operates at LOS A. **Table 7** represents the existing traffic operations under two-way stop control with TH 23 under free flow conditions and CSAH 5 being required to stop.

Table 7
Existing (2017) Operating Conditions

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		Eastbound	Westbound	Northbound	Southbound	
AM Peak	CSAH 5 at TH 23	1.3 / A	2 / A	10 / B	5.6 / A	4.1 / A
	CSAH 5 at CSAH 55	1.7 / A		3.2 / A	0.3 / A	2.3 / A
PM Peak	CSAH 5 at TH 23	1.3 / A	2.4 / A	8 / A	6.2 / A	3.4 / A
	CSAH 5 at CSAH 55	1.3 / A		1.8 / A	0.4 / A	1.1 / A

4.4.2 Traffic Control Alternatives

Based on the warrant analysis, all-way stop and traffic signal warrants are not currently met for any intersection in any of the interchange alternatives. Therefore, the analysis will include only two-way stop controlled intersections in all interchange alternatives.

4.4.2.1 2040 No Build (HSIP Build)

The future no build alternative is the 2017 HSIP Project configuration that is currently under construction as described in Section 3.

All of the study intersections would perform at LOS A through the design year 2040. **Table 8** presents the 2040 traffic operations results for the No Build (HSIP Build) alternative.

**Table 8
2040 No Build (HSIP Build) Operations**

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		Eastbound	Westbound	Northbound	Southbound	
AM Peak	CSAH 5 at TH 23	1.5 / A	2.5 / A		2.2 / A	1.9 / A
	CSAH 5 at CSAH 55	2.6 / A		0.9 / A	0.2 / A	1.1 / A
	CSAH 5 at CSAH 5 Bridge	0.7 / A	0.6 / A	1.9 / A		1 / A
	CSAH 5 at TH 23 EB Ramp			0.3 / A	0.5 / A	0.4 / A
PM Peak	CSAH 5 at TH 23	1.1 / A	2.7 / A		2.3 / A	2 / A
	CSAH 5 at CSAH 55	2.7 / A		0.8 / A	0.4 / A	0.9 / A
	CSAH 5 at CSAH 5 Bridge	0.7 / A	0.9 / A	1.6 / A		0.9 / A
	CSAH 5 at TH 23 EB Ramp			0.1 / A	0.3 / A	0.3 / A

4.4.2.2 2040 Alternative 1 (Diamond Interchange)

A diamond interchange was considered for the study area. The turning movement volumes for the diamond interchange were rerouted from the existing configuration and the same growth rates discussed in Section 3 were applied to the rerouted volumes.

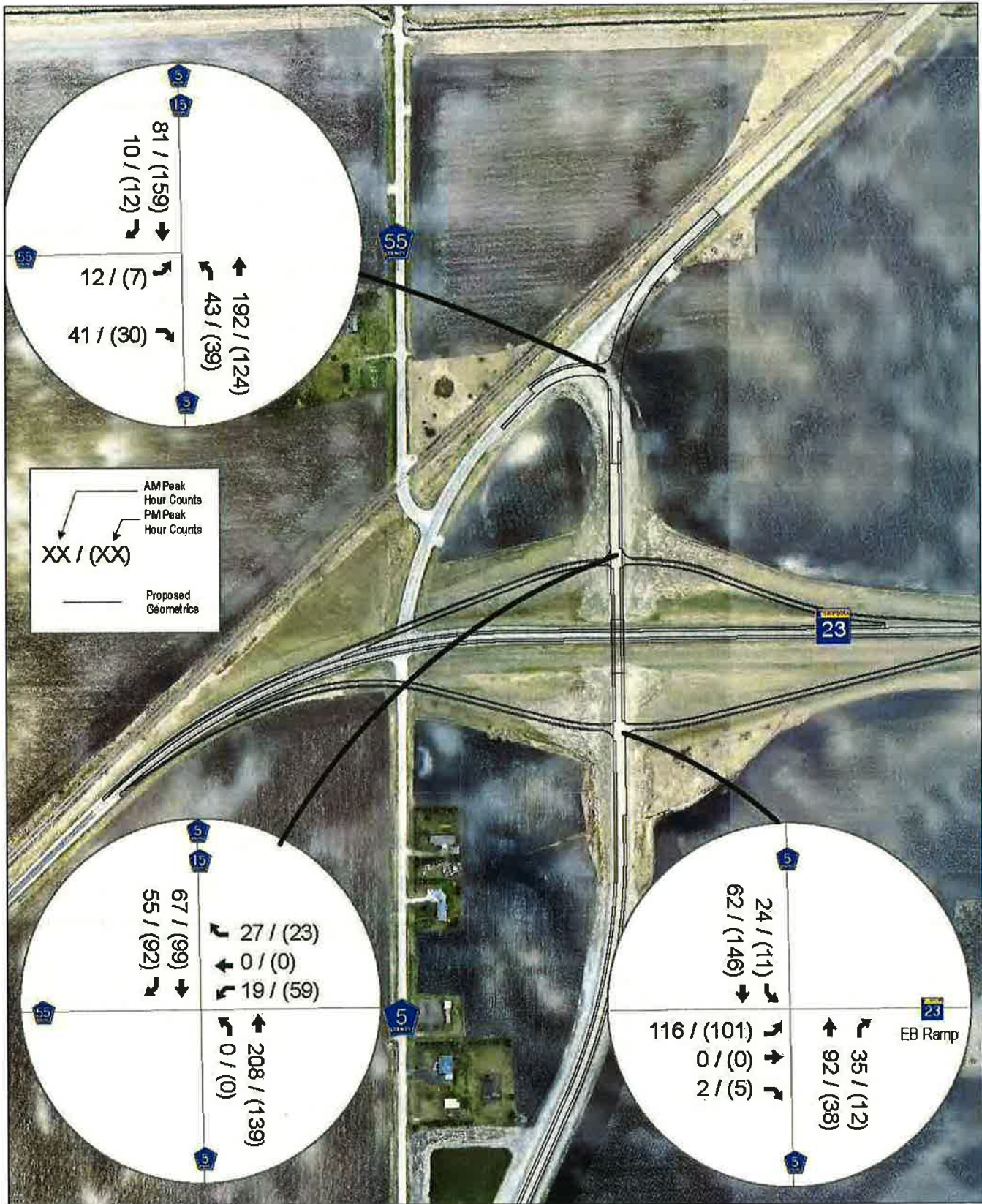
The 2040 turning movement volumes for Alternative 1 are in **Figure 10**.

The diamond interchange would perform at LOS A through the design year 2040. **Table 9** presents the 2040 traffic operations results for Alternative 1 (Diamond Interchange).

**Table 9
2040 Alternative 1 (Diamond Interchange) Operations**

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		Eastbound	Westbound	Northbound	Southbound	
AM Peak	CSAH 5 at CSAH 55	1.6 / A		0.6 / A	0.3 / A	0.7 / A
	CSAH 5 at TH 23 WB Ramps		2.7 / A	0.9 / A	0.2 / A	0.9 / A
	CSAH 5 at TH 23 EB Ramps	4.3 / A		0.7 / A	0.9 / A	1.9 / A
PM Peak	CSAH 5 at CSAH 55	1.9 / A		0.8 / A	0.3 / A	0.7 / A
	CSAH 5 at TH 23 WB Ramps		3.3 / A	0.8 / A	0.2 / A	1 / A
	CSAH 5 at TH 23 EB Ramps	4.1 / A		0.4 / A	0.7 / A	1.9 / A

Figure 10 – 2040 Peak Hour Turning Movement Volumes (Alternative 1)



4.4.2.3 Alternative 2 (Folded Diamond Interchange)

A folded diamond interchange was considered for the study area. The turning movement volumes for the folded diamond interchange were rerouted from the existing configuration and the same growth rates discussed in Section 3 were applied to the rerouted volumes.

The 2040 turning movement volumes for Alternative 2 are in **Figure 11**.

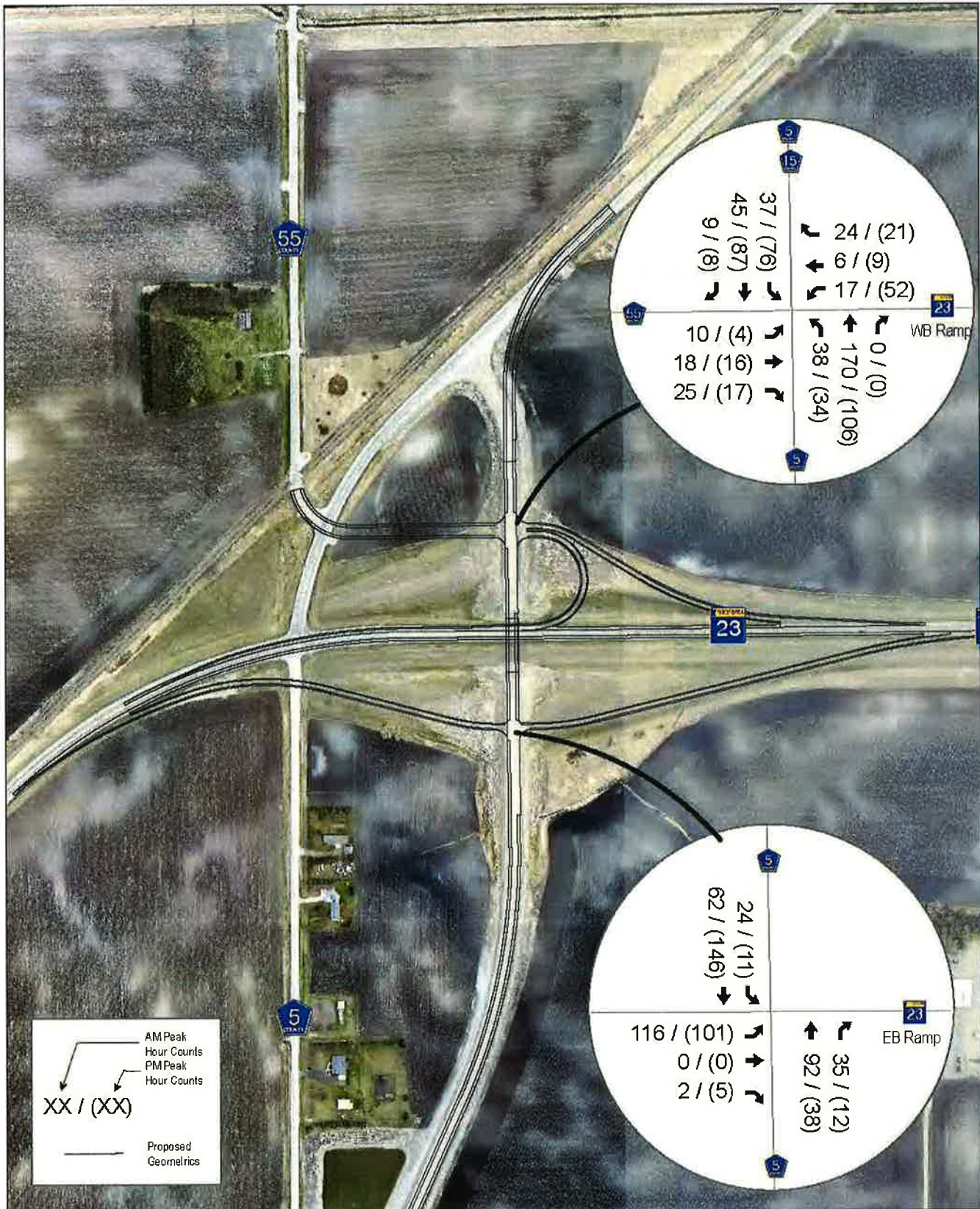
The folded diamond interchange would perform at LOS A through the design year 2040.

Table 10 presents the 2040 traffic operations results for Alternative 2 (Folded Diamond Interchange).

**Table 10
Alternative 2 (Folded Diamond Interchange) Operations**

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		Eastbound	Westbound	Northbound	Southbound	
AM Peak	CSAH 5 at TH 23 WB Ramps	4.7 / A	3 / A	1.2 / A	0.8 / A	1.8 / A
	CSAH 5 at TH 23 EB Ramps	3.7 / A		0.6 / A	1.2 / A	1.8 / A
PM Peak	CSAH 5 at TH 23 WB Ramps	4.9 / A	4.2 / A	1.4 / A	1.2 / A	2.2 / A
	CSAH 5 at TH 23 EB Ramps	3.9 / A		0.5 / A	1.2 / A	2 / A

Figure 11 – 2040 Peak Hour Turning Movement Volumes (Alternative 2)



4.4.2.4 Alternative 3 (Modified Diamond Interchange)

A modified diamond interchange was considered for the study area. The turning movement volumes for the modified diamond interchange were rerouted from the existing configuration and the same growth rates discussed in Section 3 were applied to the rerouted volumes.

The 2040 turning movement volumes for Alternative 3 are in **Figure 12**.

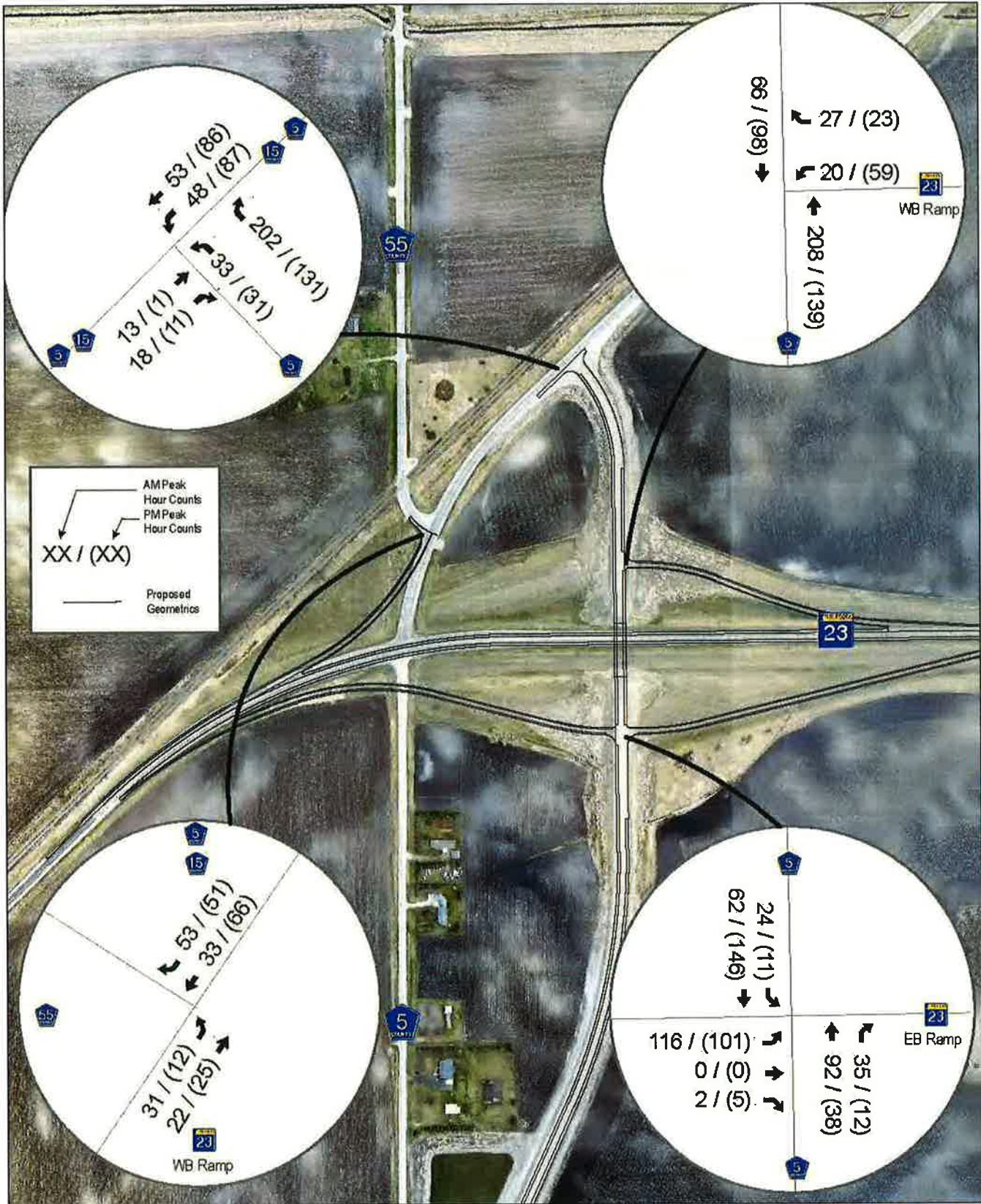
The folded diamond interchange would perform at LOS A through the design year 2040.

Table 11 presents the 2040 traffic operations results for Alternative 3 (Modified Diamond Interchange).

Table 11
Alternative 3 (Modified Diamond Interchange) Operations

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		Eastbound	Westbound	Northbound	Southbound	
AM Peak	CSAH 5 at CSAH 55/TH 23 WB Entrance Ramp	2.4 / A			0.2 / A	1.1 / A
	CSAH 5 at CSAH 5 Bridge		2.4 / A	0.8 / A	0.7 / A	1.8 / A
	CSAH 5 at TH 23 WB Exit Ramp		2.5 / A	0.9 / A	1.6 / A	1.3 / A
	CSAH 5 at TH 23 EB Ramps	4.1 / A		0.7 / A	0.9 / A	1.9 / A
PM Peak	CSAH 5 at CSAH 55/TH 23 WB Entrance Ramp	1.5 / A			0.3 / A	0.6 / A
	CSAH 5 at CSAH 5 Bridge		2.2 / A	1 / A	0.8 / A	1.5 / A
	CSAH 5 at TH 23 WB Exit Ramp		3.2 / A	0.9 / A	0.9 / A	1.5 / A
	CSAH 5 at TH 23 EB Ramps	3.9 / A		0.5 / A	0.7 / A	1.8 / A

Figure 12 – 2040 Peak Hour Turning Movement Volumes (Alternative 3)



4.5 Alternative Comparison

All interchange configurations evaluated have both acceptable traffic safety and traffic operations at all of the study intersections. However, not all of the alternatives fully meet the overall project goals as set forth by the agency coordination team. The intent of the interchange alternative designs is to address the following objectives:

- Provide an effective westerly bypass
- Provide good access to the industrial land uses
- Clarity of use for driving public
- Cost effective solutions

The following matrix, **Table 12**, was developed in cooperation with project partners as a method to distinguish the alternatives based on the current project as well as the long term vision of the area.

Kandiyohi County has a long term plan to grade separate CSAH 55 over the railroad and connect to CSAH 5. This would complete the westerly Willmar bypass route. Short Term solutions that are consistent with the long term plan are likely the most cost effective.

4.6 Public Involvement

On July 10, 2017, a presentation was made the Kandiyohi County Road and Bridge Committee. Interchange alternatives were presented to the committee for discussion. The committee concurred that the standard diamond should be presented to the public as the preferred concept.

On July 27th, 2017, a Public Information Meeting was held at the Kandiyohi County Health and Human Services building. The meeting was in regards to the two projects Kandiyohi County was studying along CSAH 5. In total, 27 people signed in as attending the open house meeting, however there were additional people in attendance who did not sign in.

The meeting provided opportunity for the public to review information boards for both projects. Safety and connectivity issues at the TH 23 and CSAH 5/15 intersection were highlighted in the exhibits. The interchange alternatives were displayed to inform the public on all options considered as part of the study, as well as informational boards regarding the project goals and comparisons of all alternatives.

Based on public input gathered at the meeting as well as from the comment cards that were turned in, the general consensus was that the standard diamond interchange would be an acceptable solution to the safety problem in the project area.

Table 12
Alternative Comparison Matrix

Comparison of Interchange Types (Long Term)						
Goals & Objectives	No-Build	Standard Diamond	Modified Diamond	Folded Diamonds		
				A	B	C
Provide an effective westerly bypass						
Improve connection between CSAH 5 & TH 23	0	+	+	+	+	+
Improve intersection performance	-	+	+	+	+	+
Improve safety	-	+	+	+	+	+
Eliminates at-grade railroad crossing	0	+	+	+	+	+
Provide good access to the industrial park						
Improve route via CSAH 55	0	+	+	+	+	+
Improve route via CSAH 5/15	0	+	+	+	+	+
Attracts trucks from other routes	0	+	+	+	+	+
Clarity of use for drivers (not confusing)						
Minimize turns	0	+	+	+	0	0
Intuitive to navigate	0	+	+	+	-	-
Satisfies public expectations	0	+	+	+	-	-
Cost effective solution						
Leverage previous investments (reduce "throw-aways")	0	+	-	-	-	-
Minimizes need for additional R/W	0	+	+	-	-	-
Estimated Cost - \$Millions (Total: Phases 1 & 2)	none	\$10.6	\$11.2	\$10.9	\$13.2	\$12.7

5.0 Summary of Findings

Based on this evaluation, two-way stop control intersections will perform at acceptable levels, LOS A, within any of the CSAH 5 Interchange alternatives through the design year 2040. The intersection control warrant analysis supports these results.

Because all of the interchange alternatives have been shown to have comparable safety and intersection performance, a recommendation will be based on the ability to satisfy the previously identified project goals and objectives.

- Provide an effective westerly bypass
- Provide good access to the industrial land uses
- Clarity of use for driving public
- Cost effective solutions

While all of the alternatives would provide an improved westerly bypass and improved accessibility between TH 23 and industrial land uses, the diamond interchange most fully achieves all of the project goals. The diamond interchange configuration is the most familiar to the general public and therefore best achieves the goal of satisfying driver expectations. In addition, the standard diamond is most cost effective because it leverages the highest level of previously constructed infrastructure and has the lowest overall project cost.

Based on the analysis documented in this report, input from the Agency Coordination Team, as well as input obtained at the public open house, it is recommended that Alternative 1, the standard diamond interchange, best addresses the projects objectives and therefore should be constructed at TH 23 and CSAH 5/15.

Appendix A

Crash History and Diagrams

Table A1
CSAH 5 ICE Reports
2011 to 2015 Crash Data; 5-years
MnDOT Crash Mapping Software Information

From	Crash Severity					Intersection Rates	MnDOT* Average Rates	Calculated Critical Rates
	Fatal	A	B	C	Property			
CSAH 5 at TH 23	0	0	2	2	6	0.77	0.25	0.65
CSAH 5 at CSAH 55	0	0	0	0	4	0.55	0.25	0.80
CSAH 5 at CSAH 15	0	0	3	7	15	1.82	0.25	0.64
TOTAL	0	0	5	9	25	XX		
0%					0%	13%	23%	64%
					Above Avg or Critical Rate		Avg Rate Exceeded	Critical Rate Exceeded

**Signalized Intersections

NOTES:

Exceeding the Calculated Critical Rates indicated a sustained crash problem.

MnDOT Statewide Average Rates (2015 Data; 5-Year)*	
Intersection Type	Crash Rate
6 Rural Thru/Stop	0.25

Table A2
CSAH 5 ICE Reports
2011 to 2015 Crash Data; 5-years
MnDOT Crash Mapping Software Information

From	Diagram - Crash Type										Intersection Rates				
	Rear End	Left Turn	Right Angle	Side Swipe	Head On	Ran Off Road	Other	Total	Crash Rate						
CSAH 5 at TH 23	1	2	4	0	1	0	2	10	0.77						
CSAH 5 at CSAH 55	1	1	1	0	0	1	0	4	0.55						
CSAH 5 at CSAH 15	8	2	7	1	1	0	6	25	1.82						
TOTAL	10	5	12	1	2	1	8	39							
26%										13%	31%	3%	5%	3%	21%
										Above Avg or Critical Rate		Avg Rate Exceeded	Critical Rate Exceeded		

**Signalized Intersections

NOTES:

Crash diagram types are based on codes in MnCMAT database; however, the crash diagram figure is a better representation of each collision.

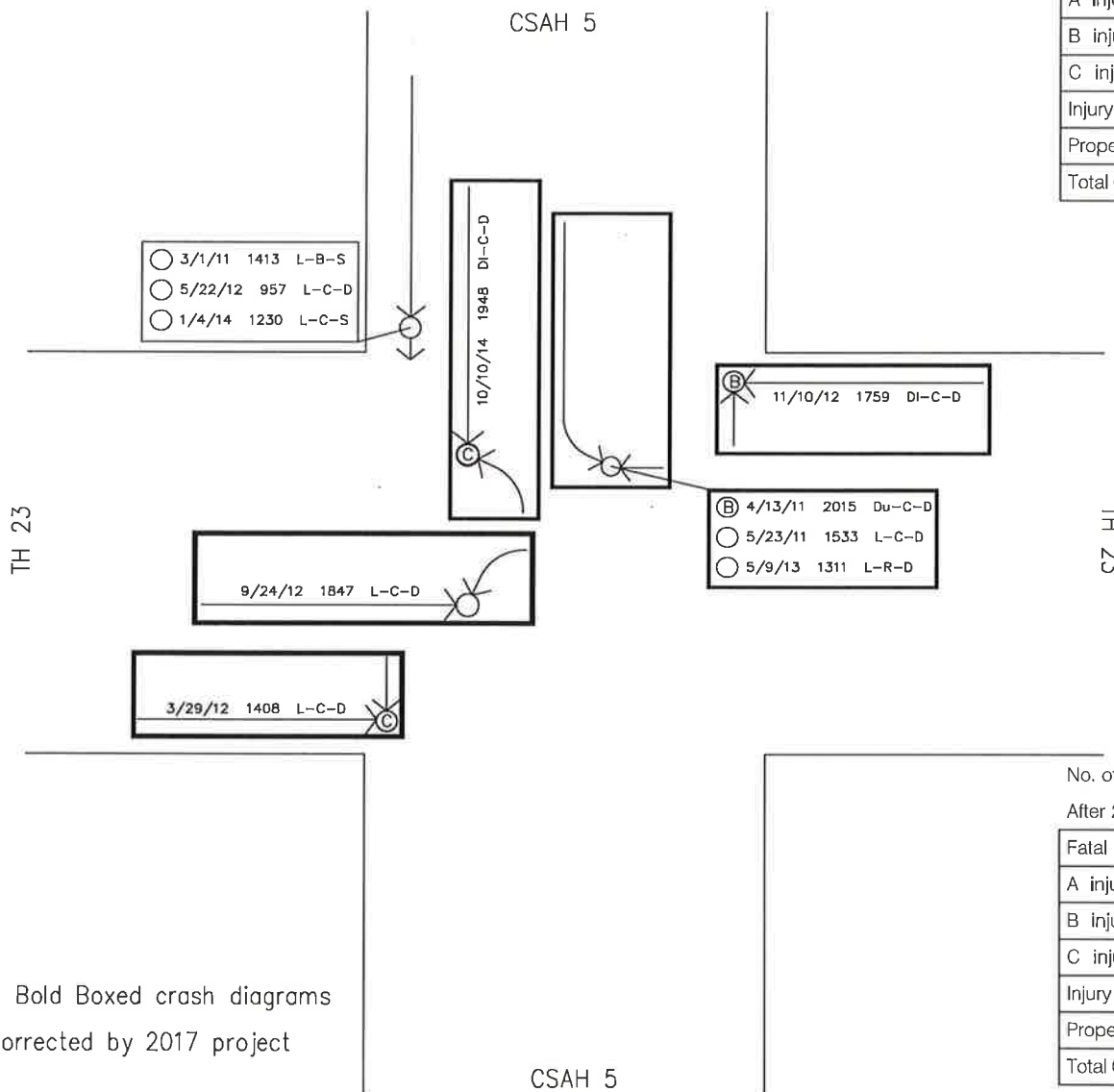
Collision Diagram

Minnesota Department of Transportation

Location: CSAH 5 at TH 23
 Time Period: 01/01/2011 - 12/31/2015 Date: June 29th, 2017
 Prepared By: JDA

No. of Crashes
Before 2017 Project

Fatal =	0
A injury =	0
B injury =	2
C injury =	2
Injury Total =	4
Property Damage =	6
Total Crashes =	10



No. of Crashes
After 2017 Project

Fatal =	0
A injury =	0
B injury =	0
C injury =	0
Injury Total =	0
Property Damage =	3
Total Crashes =	3

Note: Bold Boxed crash diagrams are corrected by 2017 project

KEY	NOTES						
<ul style="list-style-type: none"> ←→ Motor Vehicle Backing Up → Motor Vehicle Out of Control → Motor Vehicle Ahead → Motor Vehicle Slideswipe -T→ Truck □ Fixed Object ● Fatal Acc. (A) A Injury Acc. (B) B Injury Acc. (C) C Injury Acc. ○ Property Damage Acc. * Details Unclear Deer Parked Vehicle Pedestrian Bicycle/Moped Motorcycle Rear End Property Damage Right Angle B Injury 	<p>[1] _____</p> <p>[2] _____</p> <p>[3] _____</p> <table border="1" style="width: 100%;"> <tr> <th>Light:</th> <th>Weather:</th> <th>Surface:</th> </tr> <tr> <td> L= Daylight (1) DN= Dawn (2) Du= Dusk (3) DI= Dark, Lighted (4) Da= Dark, Lights Off (5) D= Dark, Unlighted (6) X= Unknown (99) </td> <td> C= Clear or Cloudy (1 or 2) R= Rain (3) S= Snow/Sleet/Hail/Freezing Rain (4 or 5) F= Fog, Smog, Smoke (6) B= Blowing Sand/Dust/Snow (7) W= Severe Cross Winds (8) X= Other or Unknown (99) </td> <td> D= Dry (1) W= Wet or Water (2 or 6) S= Snow, Slush or Ice (3, 4 or 5) M= Muddy (7) Db= Debris (8) O= Oily (9) X= Other or Unknown (99) </td> </tr> </table> <p>(X) = Number of Vehicles In Crash</p> <p>Other Vehicle</p> <p style="text-align: center;">(X) → Injury Type ← DATE TIME(HR) LIGHT-WEATHER-SURFACE</p>	Light:	Weather:	Surface:	L= Daylight (1) DN= Dawn (2) Du= Dusk (3) DI= Dark, Lighted (4) Da= Dark, Lights Off (5) D= Dark, Unlighted (6) X= Unknown (99)	C= Clear or Cloudy (1 or 2) R= Rain (3) S= Snow/Sleet/Hail/Freezing Rain (4 or 5) F= Fog, Smog, Smoke (6) B= Blowing Sand/Dust/Snow (7) W= Severe Cross Winds (8) X= Other or Unknown (99)	D= Dry (1) W= Wet or Water (2 or 6) S= Snow, Slush or Ice (3, 4 or 5) M= Muddy (7) Db= Debris (8) O= Oily (9) X= Other or Unknown (99)
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PHONE: (651)490-2000
 3535 VADNAIS CENTER DR.
 ST. PAUL, MN 55110

KANDC 141923

DATE:
6/29/2017

CSAH 5 at TH 23
Willmar, MN

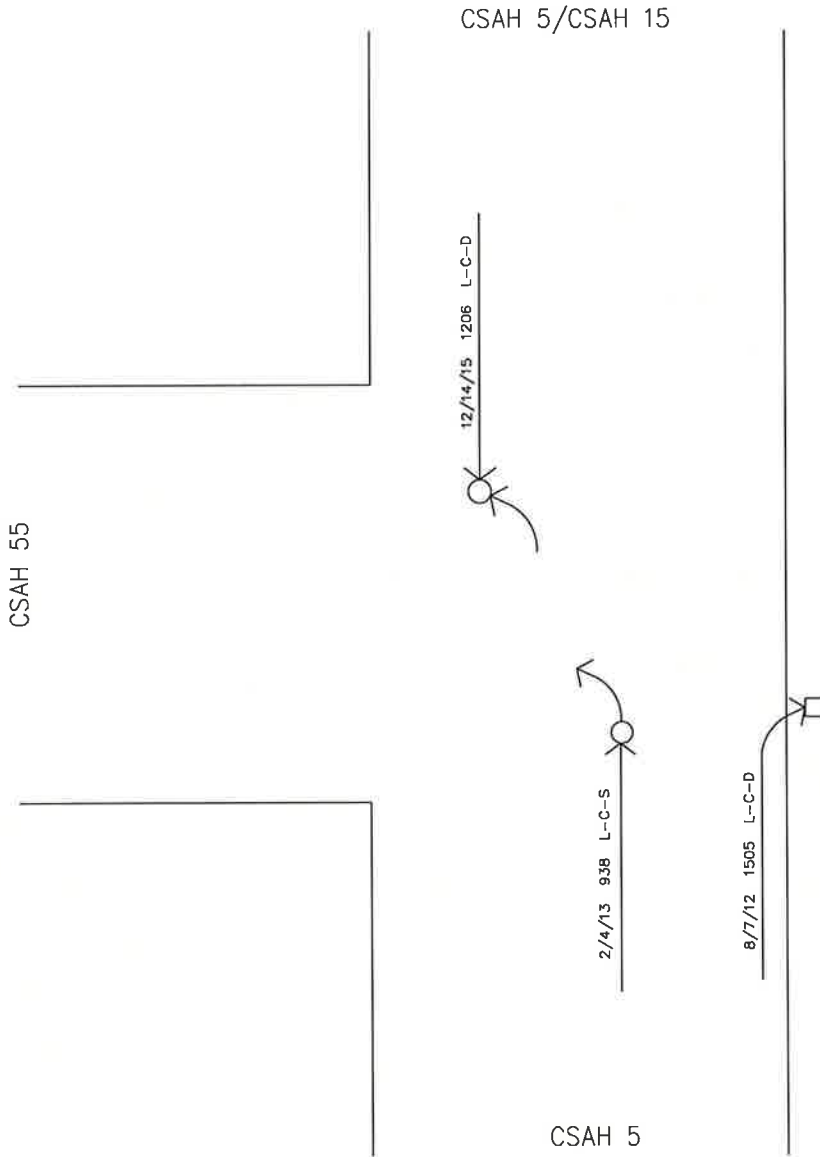
FIGURE
No. A1

Collision Diagram

Minnesota Department of Transportation

Location: CSAH 5 at CSAH 55
 Time Period: 01/01/2011 - 12/31/2015 Date: June 29th, 2017
 Prepared By: JDA

No. of Crashes	
Fatal =	0
A injury =	0
B injury =	0
C injury =	0
Injury Total =	0
Property Damage =	4
Total Crashes =	4



Crashes without diagrams:

○ 2/11/15 1959 D-C-S

KEY	NOTES			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <ul style="list-style-type: none"> ← Motor Vehicle Backing Up ⊖ Motor Vehicle Out of Control → Motor Vehicle Ahead ↪ Motor Vehicle Slideswipe -T → Truck □ Fixed Object ● Fatal Acc. Ⓐ A Injury Acc. Ⓑ B Injury Acc. Ⓒ C Injury Acc. ○ Property Damage Acc. </div> <div style="width: 45%;"> <ul style="list-style-type: none"> * Details Unclear 🦌 Deer ⊠ Parked Vehicle 🚶 Pedestrian 🚲 Bicycle/Moped 🏍 Motorcycle ⊗ Rear End Property Damage ⊕ Right Angle B Injury </div> </div>	<div style="margin-bottom: 10px;"> <p>[1] _____</p> <p>[2] _____</p> <p>[3] _____</p> </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;"> Light: I= Daylight (1) DN= Dawn (2) Du= Dusk (3) DI= Dark, Lighted (4) Do= Dark, Lights Off (5) D= Dark, Unlighted (6) X= Unknown (99) </td> <td style="width: 33%;"> Weather: C= Clear or Cloudy (1 or 2) R= Rain (3) S= Snow/Steel/Hail/Freezing Rain (4 or 5) F= Fog, Smog, Smoke (6) B= Blowing Sand/Dust/Snow (7) W= Severe Cross Winds (8) X= Other or Unknown (99) </td> <td style="width: 33%;"> Surface: D= Dry (1) W= Wet or Water (2 or 6) S= Snow, Slush or Ice (3, 4 or 5) M= Muddy (7) Db= Debris (8) O= Oily (9) X= Other or Unknown (99) </td> </tr> </table> <div style="margin-top: 10px;"> <p>(X) = Number of Vehicles In Crash</p> <p>Other Vehicle</p> <p>Injury Type</p> <p>DATE TIME(HR) LIGHT-WEATHER-SURFACE</p> </div>	Light: I= Daylight (1) DN= Dawn (2) Du= Dusk (3) DI= Dark, Lighted (4) Do= Dark, Lights Off (5) D= Dark, Unlighted (6) X= Unknown (99)	Weather: C= Clear or Cloudy (1 or 2) R= Rain (3) S= Snow/Steel/Hail/Freezing Rain (4 or 5) F= Fog, Smog, Smoke (6) B= Blowing Sand/Dust/Snow (7) W= Severe Cross Winds (8) X= Other or Unknown (99)	Surface: D= Dry (1) W= Wet or Water (2 or 6) S= Snow, Slush or Ice (3, 4 or 5) M= Muddy (7) Db= Debris (8) O= Oily (9) X= Other or Unknown (99)
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Appendix B

Alternative Layouts

3:37:20 PM

6/28/2017

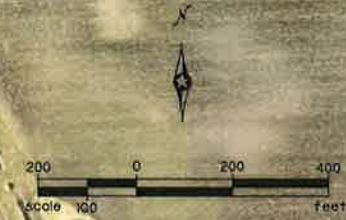
shotchkIn

S:\XON\Kando\141923\4-prelim-dsgn-rpts\43-prelim-dsgn\CPI141923_fig.d6figure 6 - No Build

KANDIYOHI
55
COUNTY

KANDIYOHI
15
COUNTY

KANDIYOHI
5
COUNTY



LEGEND	
	PROPOSED ROADWAY
	PROPOSED SHOULDER
	PROPOSED CURB AND GUTTER PROPOSED RAISED MEDIAN
	PROPOSED CONCRETE TRUCK APRON
	PROPOSED VEGETATION AREA
	PROPOSED WALK
	EXISTING BUILT ROADWAY
	EXISTING RIGHT OF WAY

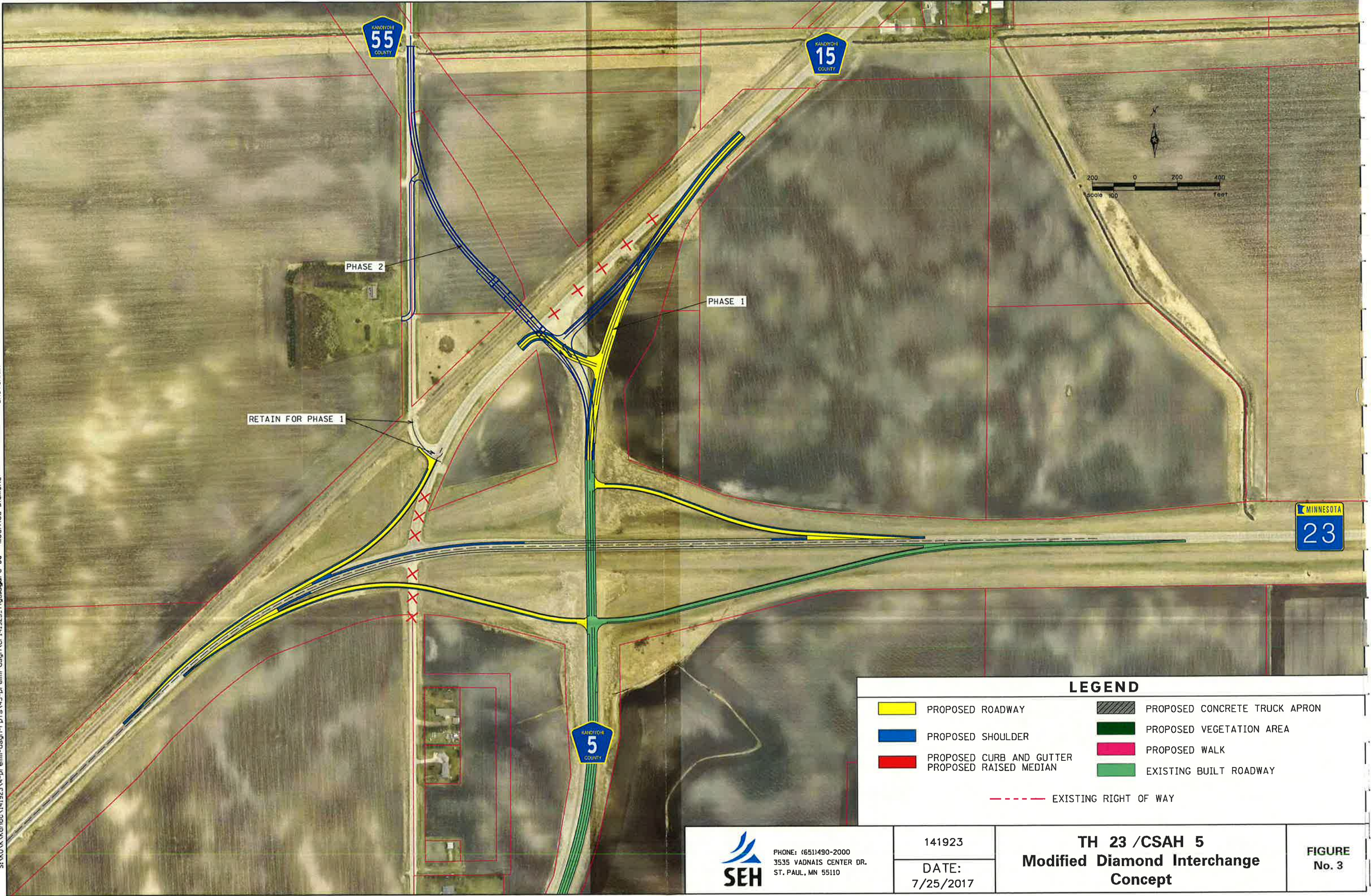









PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110


141923
DATE:
6/28/2017

TH 23 /CSAH 5
2017 Build /2040 No Build

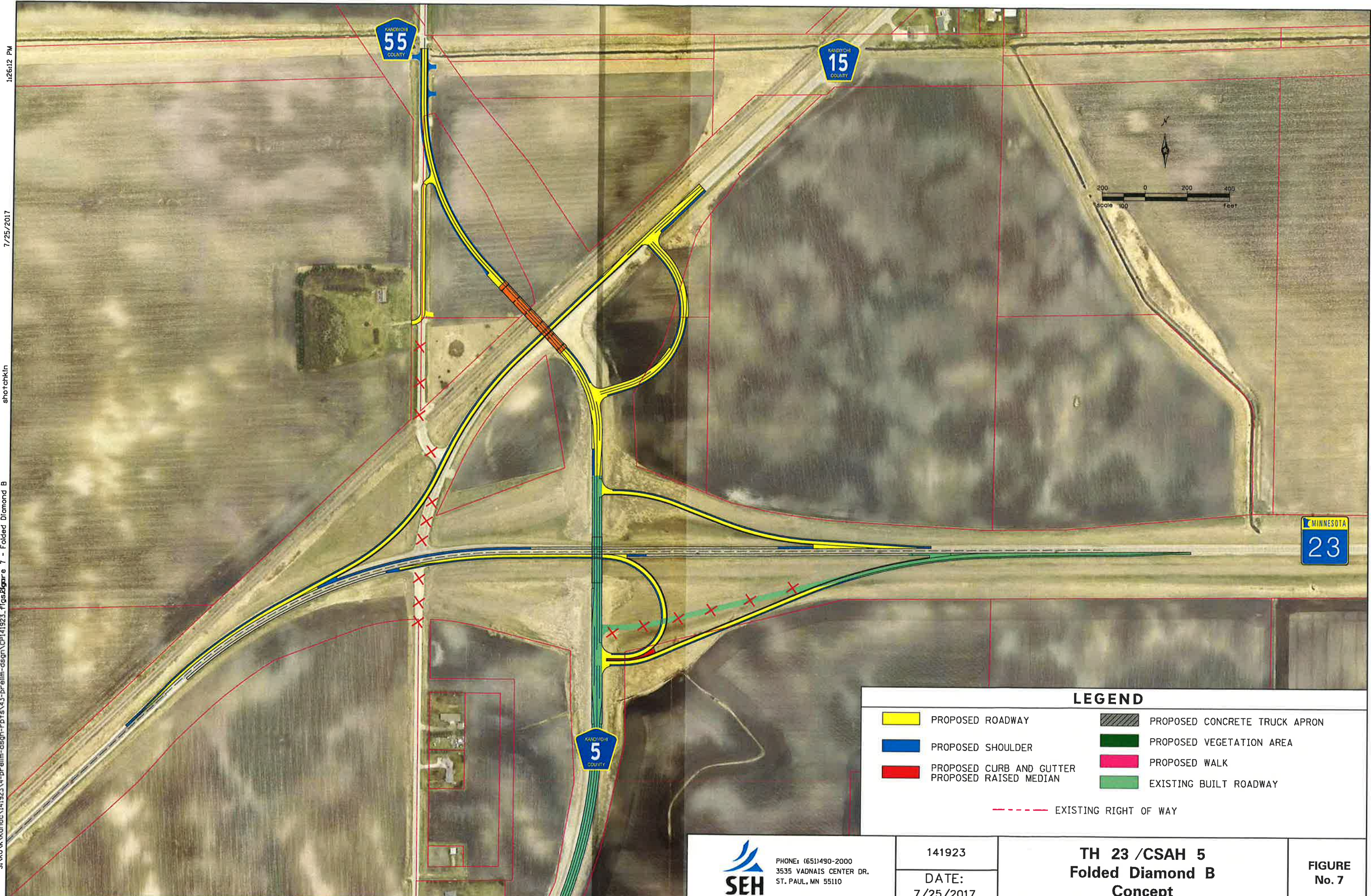
FIGURE
No. 6












LEGEND			
	PROPOSED ROADWAY		PROPOSED CONCRETE TRUCK APRON
	PROPOSED SHOULDER		PROPOSED VEGETATION AREA
	PROPOSED CURB AND GUTTER PROPOSED RAISED MEDIAN		PROPOSED WALK
			EXISTING BUILT ROADWAY
			EXISTING RIGHT OF WAY

 PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	141923	TH 23 / CSAH 5 Modified Diamond Interchange Concept	FIGURE No. 3
	DATE: 7/25/2017		

1:26:12 PM
7/25/2017
shotchktn
S:\NOVA\Kandc\141923\4-prelim-dsgn-rpt\43-prelim-dsgn\CPI141923_fig5Figure 7 - Folded Diamond B



LEGEND	
	PROPOSED ROADWAY
	PROPOSED SHOULDER
	PROPOSED CURB AND GUTTER PROPOSED RAISED MEDIAN
	PROPOSED CONCRETE TRUCK APRON
	PROPOSED VEGETATION AREA
	PROPOSED WALK
	EXISTING BUILT ROADWAY
	EXISTING RIGHT OF WAY

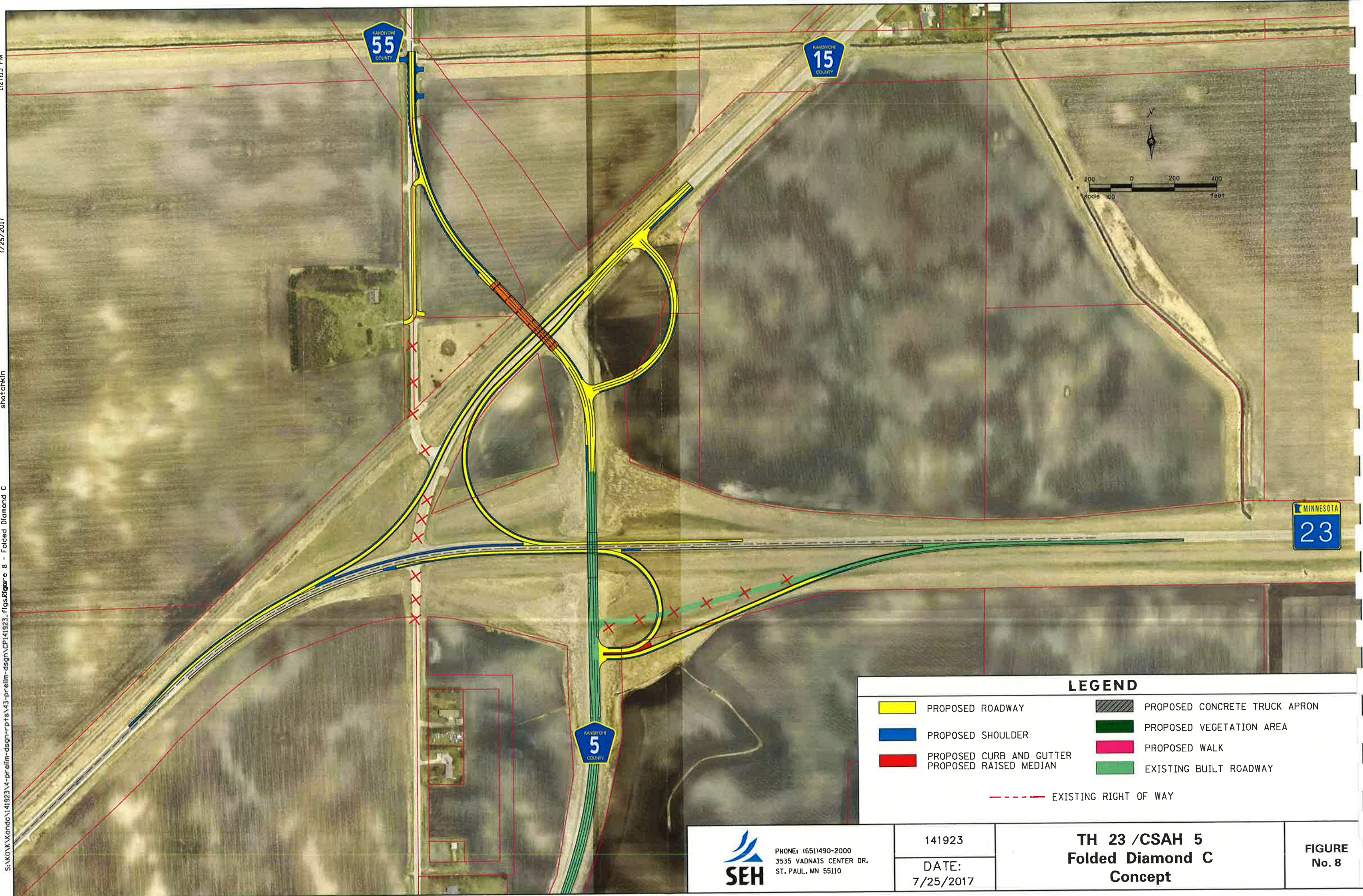
 PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	141923	TH 23 /CSAH 5 Folded Diamond B Concept	FIGURE No. 7
	DATE: 7/25/2017		

1:27:13 PM

7/25/2017

shatcklin

S:\X0\K\Kande\141923\4-prelim-dsgn-rpts\43-prelim-dsgn\CPI\41923_fig8\Figure 8 - Folded Diamond C



LEGEND	
	PROPOSED ROADWAY
	PROPOSED SHOULDER
	PROPOSED CURB AND GUTTER PROPOSED RAISED MEDIAN
	PROPOSED CONCRETE TRUCK APRON
	PROPOSED VEGETATION AREA
	PROPOSED WALK
	EXISTING BUILT ROADWAY
	EXISTING RIGHT OF WAY


 PHONE: (651)490-2000
 3535 VADNAIS CENTER DR.
 ST. PAUL, MN 55110

141923
 DATE:
 7/25/2017

TH 23 /CSAH 5
Folded Diamond C
Concept

FIGURE
No. 8

Appendix C

All-way Stop and Traffic Signal Warrant



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C1a

**2017 Build - CSAH 5 at TH 23
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 at TH 23

COUNTY: Kandiyohi

REF. POINT: 0

DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
60	Major App1: TH 23 WB	3	1842
60	Major App3: TH 23 EB	3	2062
55	Minor App2: CSAH 5 SB	2	559
55	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	119	128	35	0	247	35	YES / NO
7:00 - 8:00	144	159	40	0	303	40	YES / NO
8:00 - 9:00	131	188	37	0	319	37	YES / NO
9:00 - 10:00	116	162	25	0	278	25	YES / NO
10:00 - 11:00	106	139	35	0	245	35	YES / NO
11:00 - 12:00	110	125	31	0	235	31	YES / NO
12:00 - 13:00	132	143	27	0	275	27	YES / NO
13:00 - 14:00	137	127	42	0	264	42	YES / NO
14:00 - 15:00	148	181	54	0	329	54	YES / NO
15:00 - 16:00	177	172	65	0	349	65	YES / NO
16:00 - 17:00	199	193	71	0	392	71	YES / NO
17:00 - 18:00	197	198	63	0	395	63	YES / NO
18:00 - 19:00	126	147	34	0	273	34	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1842	2062	559	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C1b

2017 Build - CSAH 5 at TH 23 SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 at TH 23
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach
60	Major App1: TH 23 WB	3	1842
60	Major App3: TH 23 EB	3	2062
55	Minor App2: CSAH 5 SB	1	0
55	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	119	128	0	0	247	0	NO / NO	NO / NO	NO / NO
7:00 - 8:00	144	159	0	0	303	0	NO / NO	NO / NO	NO / NO
8:00 - 9:00	131	188	0	0	319	0	NO / NO	NO / NO	NO / NO
9:00 - 10:00	116	162	0	0	278	0	NO / NO	NO / NO	NO / NO
10:00 - 11:00	106	139	0	0	245	0	NO / NO	NO / NO	NO / NO
11:00 - 12:00	110	125	0	0	235	0	NO / NO	NO / NO	NO / NO
12:00 - 13:00	132	143	0	0	275	0	NO / NO	NO / NO	NO / NO
13:00 - 14:00	137	127	0	0	264	0	NO / NO	NO / NO	NO / NO
14:00 - 15:00	148	181	0	0	329	0	NO / NO	NO / NO	NO / NO
15:00 - 16:00	177	172	0	0	349	0	NO / NO	NO / NO	NO / NO
16:00 - 17:00	199	193	0	0	392	0	NO / NO	NO / NO	NO / NO
17:00 - 18:00	197	198	0	0	395	0	NO / NO	NO / NO	NO / NO
18:00 - 19:00	126	147	0	0	273	0	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1842	2062	0	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C1c

2040 No Build - CSAH 5 at TH 23 ALL WAY STOP WARRANT ANALYSIS

LOCATION: CSAH 5 at TH 23
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
60	Major App1: TH 23 WB	3	2268
60	Major App3: TH 23 EB	3	2541
55	Minor App2: CSAH 5 SB	2	692
55	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
210 **140**

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	146	157	44	0	303	44	YES / NO
7:00 - 8:00	178	195	49	0	373	49	YES / NO
8:00 - 9:00	161	232	46	0	393	46	YES / NO
9:00 - 10:00	142	199	31	0	341	31	YES / NO
10:00 - 11:00	131	172	44	0	303	44	YES / NO
11:00 - 12:00	136	154	38	0	290	38	YES / NO
12:00 - 13:00	163	177	33	0	340	33	YES / NO
13:00 - 14:00	168	157	53	0	325	53	YES / NO
14:00 - 15:00	182	223	67	0	405	67	YES / NO
15:00 - 16:00	219	212	81	0	431	81	YES / NO
16:00 - 17:00	244	238	87	0	482	87	YES / NO
17:00 - 18:00	243	244	77	0	487	77	YES / NO
18:00 - 19:00	155	181	42	0	336	42	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	2268	2541	692	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant:

Not satisfied

REMARKS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C1d

**2040 No Build - CSAH 5 at TH 23
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 at TH 23
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
60	Major App1: TH 23 WB	3	2268
60	Major App3: TH 23 EB	3	2541
55	Minor App2: CSAH 5 SB	1	133
55	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES
 CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	146	157	9	0	303	9	NO / NO	NO / NO	NO / NO
7:00 - 8:00	178	195	9	0	373	9	NO / NO	NO / NO	NO / NO
8:00 - 9:00	161	232	9	0	393	9	NO / NO	NO / NO	NO / NO
9:00 - 10:00	142	199	6	0	341	6	NO / NO	NO / NO	NO / NO
10:00 - 11:00	131	172	9	0	303	9	NO / NO	NO / NO	NO / NO
11:00 - 12:00	136	154	7	0	290	7	NO / NO	NO / NO	NO / NO
12:00 - 13:00	163	177	6	0	340	6	NO / NO	NO / NO	NO / NO
13:00 - 14:00	168	157	11	0	325	11	NO / NO	NO / NO	NO / NO
14:00 - 15:00	182	223	13	0	405	13	NO / NO	NO / NO	NO / NO
15:00 - 16:00	219	212	16	0	431	16	YES / NO	NO / NO	NO / NO
16:00 - 17:00	244	238	16	0	482	16	YES / NO	NO / NO	NO / NO
17:00 - 18:00	243	244	14	0	487	14	YES / NO	NO / NO	NO / NO
18:00 - 19:00	155	181	8	0	336	8	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	2268	2541	133	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C2a

**2017 Build - CSAH 5 at CSAH 55
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 at CSAH 55

COUNTY: Kandiyohi

REF. POINT: 0

DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	1366
55	Major App3: CSAH 5/CSAH 15 SB	2	569
55	Minor App2: CSAH 55 EB	2	232
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP. 1 + APP. 3)	Σ (APP. 2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	94	32	18	0	126	18	NO / NO
7:00 - 8:00	105	46	25	0	151	25	NO / NO
8:00 - 9:00	123	39	21	0	162	21	NO / NO
9:00 - 10:00	112	27	20	0	139	20	NO / NO
10:00 - 11:00	74	37	20	0	111	20	NO / NO
11:00 - 12:00	77	33	17	0	110	17	NO / NO
12:00 - 13:00	69	32	14	0	101	14	NO / NO
13:00 - 14:00	90	38	23	0	128	23	NO / NO
14:00 - 15:00	124	50	13	0	174	13	NO / NO
15:00 - 16:00	126	70	12	0	196	12	NO / NO
16:00 - 17:00	155	71	22	0	226	22	YES / NO
17:00 - 18:00	140	61	20	0	201	20	NO / NO
18:00 - 19:00	77	33	7	0	110	7	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1366	569	232	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit C2b

2017 Build - CSAH 5 at CSAH 55 SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 at CSAH 55
COUNTY: Kandiyohi
REF. POINT: 0
DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1366
55	Major App3: CSAH 5/CSAH 15 SB	2	569
55	Minor App2: CSAH 55 EB	1	135
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
POPULATION < 10,000? NO
VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
(12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - B	WARRANT 1B - B	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	hr	hr	B
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	94	32	10	0	126	10	NO / NO	NO / NO	NO / NO
7:00 - 8:00	105	46	15	0	151	15	NO / NO	NO / NO	NO / NO
8:00 - 9:00	123	39	13	0	162	13	NO / NO	NO / NO	NO / NO
9:00 - 10:00	112	27	13	0	139	13	NO / NO	NO / NO	NO / NO
10:00 - 11:00	74	37	13	0	111	13	NO / NO	NO / NO	NO / NO
11:00 - 12:00	77	33	10	0	110	10	NO / NO	NO / NO	NO / NO
12:00 - 13:00	69	32	10	0	101	10	NO / NO	NO / NO	NO / NO
13:00 - 14:00	90	38	12	0	128	12	NO / NO	NO / NO	NO / NO
14:00 - 15:00	124	50	6	0	174	6	NO / NO	NO / NO	NO / NO
15:00 - 16:00	126	70	7	0	196	7	NO / NO	NO / NO	NO / NO
16:00 - 17:00	155	71	13	0	226	13	NO / NO	NO / NO	NO / NO
17:00 - 18:00	140	61	9	0	201	9	NO / NO	NO / NO	NO / NO
18:00 - 19:00	77	33	4	0	110	4	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1366	569	135	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C2c

**2040 No Build - CSAH 5 at CSAH 55
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	1680
55	Major App3: CSAH 5/CSAH 15 SB	2	700
55	Minor App2: CSAH 55 EB	2	422
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	115	40	33	0	155	33	NO / NO
7:00 - 8:00	129	57	45	0	186	45	NO / NO
8:00 - 9:00	152	48	38	0	200	38	NO / NO
9:00 - 10:00	139	33	36	0	172	36	NO / NO
10:00 - 11:00	91	46	36	0	137	36	NO / NO
11:00 - 12:00	94	41	31	0	135	31	NO / NO
12:00 - 13:00	85	39	25	0	124	25	NO / NO
13:00 - 14:00	111	46	43	0	157	43	NO / NO
14:00 - 15:00	153	62	24	0	215	24	YES / NO
15:00 - 16:00	155	85	22	0	240	22	YES / NO
16:00 - 17:00	190	87	40	0	277	40	YES / NO
17:00 - 18:00	172	75	36	0	247	36	YES / NO
18:00 - 19:00	94	41	13	0	135	13	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1680	700	422	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C2d

**2040 No Build - CSAH 5 at CSAH 55
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1680
55	Major App3: CSAH 5/CSAH 15 SB	2	700
55	Minor App2: CSAH 55 EB	1	325
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

CORRECTABLE CRASHES: 0
 (12-month period)

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP. 1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	115	40	25	0	155	25	NO / NO	NO / NO	NO / NO
7:00 - 8:00	129	57	35	0	186	35	NO / NO	NO / NO	NO / NO
8:00 - 9:00	152	48	30	0	200	30	NO / NO	NO / NO	NO / NO
9:00 - 10:00	139	33	29	0	172	29	NO / NO	NO / NO	NO / NO
10:00 - 11:00	91	46	29	0	137	29	NO / NO	NO / NO	NO / NO
11:00 - 12:00	94	41	24	0	135	24	NO / NO	NO / NO	NO / NO
12:00 - 13:00	85	39	21	0	124	21	NO / NO	NO / NO	NO / NO
13:00 - 14:00	111	46	32	0	157	32	NO / NO	NO / NO	NO / NO
14:00 - 15:00	153	62	17	0	215	17	NO / NO	NO / NO	NO / NO
15:00 - 16:00	155	85	17	0	240	17	NO / NO	NO / NO	NO / NO
16:00 - 17:00	190	87	31	0	277	31	NO / NO	NO / NO	NO / NO
17:00 - 18:00	172	75	25	0	247	25	NO / NO	NO / NO	NO / NO
18:00 - 19:00	94	41	10	0	135	10	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1680	700	325	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C3a

**2017 Build - CSAH 5/CSAH 15 at CSAH 5 Bridge
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5/CSAH 15 at CSAH 5 Bridge
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5/CSAH 15 NB	2	1318
55	Major App3: CSAH 5/CSAH 15 WB	2	991
55	Minor App2: CSAH 5 Bridge NB	2	478
55	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	92	62	36	0	154	36	NO / NO
7:00 - 8:00	105	62	89	0	167	89	NO / NO
8:00 - 9:00	117	68	50	0	185	50	NO / NO
9:00 - 10:00	114	48	37	0	162	37	NO / NO
10:00 - 11:00	78	70	36	0	148	36	NO / NO
11:00 - 12:00	74	51	31	0	125	31	NO / NO
12:00 - 13:00	66	52	35	0	118	35	NO / NO
13:00 - 14:00	89	61	26	0	150	26	NO / NO
14:00 - 15:00	116	95	19	0	211	19	YES / NO
15:00 - 16:00	114	115	32	0	229	32	YES / NO
16:00 - 17:00	143	136	31	0	279	31	YES / NO
17:00 - 18:00	137	108	35	0	245	35	YES / NO
18:00 - 19:00	73	63	21	0	136	21	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1318	991	478	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit C3b

2017 Build - CSAH 5/CSAH 15 at CSAH 5 Bridge SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5/CSAH 15 at CSAH 5 Bridge

COUNTY: Kandiyohi

REF. POINT: 0

DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5/CSAH 15 NB	2	1318
55	Major App3: CSAH 5/CSAH 15 WB	2	991
55	Minor App2: CSAH 5 Bridge NB	1	93
55	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
POPULATION < 10,000? NO
VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
(12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR	MAX MINOR	WARRANT 1A - 8	WARRANT 1B - 8	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	APPROACH TOTAL Σ (APP.1 + APP. 3)	APPROACH (APP. 2 or 4)	hr MAJOR/MINOR	hr MAJOR/MINOR	hr MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	92	62	4	0	154	4	NO / NO	NO / NO	NO / NO
7:00 - 8:00	105	62	14	0	167	14	NO / NO	NO / NO	NO / NO
8:00 - 9:00	117	68	9	0	185	9	NO / NO	NO / NO	NO / NO
9:00 - 10:00	114	48	4	0	162	4	NO / NO	NO / NO	NO / NO
10:00 - 11:00	78	70	7	0	148	7	NO / NO	NO / NO	NO / NO
11:00 - 12:00	74	51	9	0	125	9	NO / NO	NO / NO	NO / NO
12:00 - 13:00	66	52	10	0	118	10	NO / NO	NO / NO	NO / NO
13:00 - 14:00	89	61	6	0	150	6	NO / NO	NO / NO	NO / NO
14:00 - 15:00	116	95	4	0	211	4	NO / NO	NO / NO	NO / NO
15:00 - 16:00	114	115	10	0	229	10	NO / NO	NO / NO	NO / NO
16:00 - 17:00	143	136	7	0	279	7	NO / NO	NO / NO	NO / NO
17:00 - 18:00	137	108	6	0	245	6	NO / NO	NO / NO	NO / NO
18:00 - 19:00	73	63	3	0	136	3	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1318	991	93	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C3c

**2040 No Build - CSAH 5/CSAH 15 at CSAH 5 Bridge
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5/CSAH 15 at CSAH 5 Bridge
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5/CSAH 15 EB	2	1623
55	Major App3: CSAH 5/CSAH 15 WB	2	1223
55	Minor App2: CSAH 5 Bridge NB	2	591
55	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	114	77	45	0	191	45	NO / NO
7:00 - 8:00	129	77	110	0	206	110	NO / NO
8:00 - 9:00	144	84	62	0	228	62	YES / NO
9:00 - 10:00	141	60	45	0	201	45	NO / NO
10:00 - 11:00	96	86	45	0	182	45	NO / NO
11:00 - 12:00	91	63	39	0	154	39	NO / NO
12:00 - 13:00	81	64	44	0	145	44	NO / NO
13:00 - 14:00	110	75	32	0	185	32	NO / NO
14:00 - 15:00	143	116	23	0	259	23	YES / NO
15:00 - 16:00	140	142	39	0	282	39	YES / NO
16:00 - 17:00	176	168	38	0	344	38	YES / NO
17:00 - 18:00	168	134	44	0	302	44	YES / NO
18:00 - 19:00	90	77	25	0	167	25	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1623	1223	591	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C3d

2040 No Build - CSAH 5/CSAH 15 at CSAH 5 Bridge SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5/CSAH 15 at CSAH 5 Bridge

COUNTY: Kandiyohi

REF. POINT: 0

DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5/CSAH 15 EB	2	1623
55	Major App3: CSAH 5/CSAH 15 WB	2	1223
55	Minor App2: CSAH 5 Bridge NB	1	206
55	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

Minimum Volume Requirement			
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - B	WARRANT 1B - B	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	hr	hr	B
	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	114	77	13	0	191	13	NO / NO	NO / NO	NO / NO
7:00 - 8:00	129	77	35	0	206	35	NO / NO	NO / NO	NO / NO
8:00 - 9:00	144	84	21	0	228	21	NO / NO	NO / NO	NO / NO
9:00 - 10:00	141	60	12	0	201	12	NO / NO	NO / NO	NO / NO
10:00 - 11:00	96	86	16	0	182	16	NO / NO	NO / NO	NO / NO
11:00 - 12:00	91	63	17	0	154	17	NO / NO	NO / NO	NO / NO
12:00 - 13:00	81	64	19	0	145	19	NO / NO	NO / NO	NO / NO
13:00 - 14:00	110	75	12	0	185	12	NO / NO	NO / NO	NO / NO
14:00 - 15:00	143	116	8	0	259	8	NO / NO	NO / NO	NO / NO
15:00 - 16:00	140	142	17	0	282	17	NO / NO	NO / NO	NO / NO
16:00 - 17:00	176	168	14	0	344	14	NO / NO	NO / NO	NO / NO
17:00 - 18:00	168	134	15	0	302	15	NO / NO	NO / NO	NO / NO
18:00 - 19:00	90	77	7	0	167	7	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1623	1223	206	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit C4b

2017 Alternative 1 - CSAH 5 at CSAH 55 SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 at CSAH 55
COUNTY: Kandiyohi
REF. POINT: 0
DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1482
55	Major App3: CSAH 5 SB	2	991
55	Minor App2: CSAH 55 EB	1	11
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
POPULATION < 10,000? NO
VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
(12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	113	62	0	0	175	0	NO / NO	NO / NO	NO / NO
7:00 - 8:00	173	62	2	0	235	2	NO / NO	NO / NO	NO / NO
8:00 - 9:00	161	68	1	0	229	1	NO / NO	NO / NO	NO / NO
9:00 - 10:00	135	48	0	0	183	0	NO / NO	NO / NO	NO / NO
10:00 - 11:00	91	70	1	0	161	1	NO / NO	NO / NO	NO / NO
11:00 - 12:00	86	51	1	0	137	1	NO / NO	NO / NO	NO / NO
12:00 - 13:00	92	52	1	0	144	1	NO / NO	NO / NO	NO / NO
13:00 - 14:00	86	61	1	0	147	1	NO / NO	NO / NO	NO / NO
14:00 - 15:00	107	95	0	0	202	0	NO / NO	NO / NO	NO / NO
15:00 - 16:00	115	115	1	0	230	1	NO / NO	NO / NO	NO / NO
16:00 - 17:00	134	136	2	0	270	2	NO / NO	NO / NO	NO / NO
17:00 - 18:00	119	108	1	0	227	1	NO / NO	NO / NO	NO / NO
18:00 - 19:00	70	63	0	0	133	0	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1482	991	11	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C4c

2040 Alternative 1 - CSAH 5 at CSAH 55 ALL WAY STOP WARRANT ANALYSIS

LOCATION: CSAH 5 at CSAH 55

COUNTY: Kandiyohi

REF. POINT: 0

DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	1827
55	Major App3: CSAH 5 SB	2	1223
55	Minor App2: CSAH 55 EB	2	422
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP. 1 + APP. 3)	Σ (APP. 2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	140	77	33	0	217	33	YES / NO
7:00 - 8:00	213	77	45	0	290	45	YES / NO
8:00 - 9:00	199	84	38	0	283	38	YES / NO
9:00 - 10:00	166	60	36	0	226	36	YES / NO
10:00 - 11:00	112	86	36	0	198	36	NO / NO
11:00 - 12:00	106	63	31	0	169	31	NO / NO
12:00 - 13:00	113	64	25	0	177	25	NO / NO
13:00 - 14:00	107	75	43	0	182	43	NO / NO
14:00 - 15:00	132	116	24	0	248	24	YES / NO
15:00 - 16:00	142	142	22	0	284	22	YES / NO
16:00 - 17:00	165	168	40	0	333	40	YES / NO
17:00 - 18:00	146	134	36	0	280	36	YES / NO
18:00 - 19:00	86	77	13	0	163	13	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1827	1223	422	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant:

Not satisfied

REMARKS:

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SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C4d

**2040 Alternative 1 - CSAH 5 at CSAH 55
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1827
55	Major App3: CSAH 5 SB	2	1223
55	Minor App2: CSAH 55 EB	1	201
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR	MAX MINOR	WARRANT 1A - 8	WARRANT 1B - 8	WARRANT 1A &
	APP. 1	APP. 3	APP. 2	APP. 4	APPROACH TOTAL Σ (APP. 1 + APP. 3)	APPROACH (APP. 2 or 4)	hr MAJOR/MINOR	hr MAJOR/MINOR	B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	140	77	15	0	217	15	NO / NO	NO / NO	NO / NO
7:00 - 8:00	213	77	22	0	290	22	NO / NO	NO / NO	NO / NO
8:00 - 9:00	199	84	18	0	283	18	NO / NO	NO / NO	NO / NO
9:00 - 10:00	166	60	16	0	226	16	NO / NO	NO / NO	NO / NO
10:00 - 11:00	112	86	17	0	198	17	NO / NO	NO / NO	NO / NO
11:00 - 12:00	106	63	15	0	169	15	NO / NO	NO / NO	NO / NO
12:00 - 13:00	113	64	12	0	177	12	NO / NO	NO / NO	NO / NO
13:00 - 14:00	107	75	21	0	182	21	NO / NO	NO / NO	NO / NO
14:00 - 15:00	132	116	11	0	248	11	NO / NO	NO / NO	NO / NO
15:00 - 16:00	142	142	11	0	284	11	NO / NO	NO / NO	NO / NO
16:00 - 17:00	165	168	20	0	333	20	NO / NO	NO / NO	NO / NO
17:00 - 18:00	146	134	17	0	280	17	NO / NO	NO / NO	NO / NO
18:00 - 19:00	86	77	6	0	163	6	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1827	1223	201	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C5a

**2017 Alternative 1 - CSAH 5 North Ramp
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	1271
55	Major App3: CSAH 5 SB	2	1186
40	Minor App2: TH 23 Ramp WB	2	532
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? **Yes**

Minimum Volume Requirement
210 140

HOURLY	MAJOR		MINOR		MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	95	79	34	0	174	34	NO / NO
7:00 - 8:00	155	83	37	0	238	37	YES / NO
8:00 - 9:00	132	87	41	0	219	41	YES / NO
9:00 - 10:00	119	63	28	0	182	28	NO / NO
10:00 - 11:00	85	87	25	0	172	25	NO / NO
11:00 - 12:00	72	66	34	0	138	34	NO / NO
12:00 - 13:00	71	65	33	0	136	33	NO / NO
13:00 - 14:00	74	82	41	0	156	41	NO / NO
14:00 - 15:00	91	107	46	0	198	46	NO / NO
15:00 - 16:00	99	122	49	0	221	49	YES / NO
16:00 - 17:00	112	153	69	0	265	69	YES / NO
17:00 - 18:00	101	122	67	0	223	67	YES / NO
18:00 - 19:00	65	70	28	0	135	28	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1271	1186	532	0			

Hours met for warrant: **Met (Hr) 0 Required (Hr) 8**

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C5b

2017 Alternative 1 - CSAH 5 North Ramp SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1271
55	Major App3: CSAH 5 SB	2	1186
40	Minor App2: TH 23 Ramp WB	1	309
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	95	79	16	0	174	16	NO / NO	NO / NO	NO / NO
7:00 - 8:00	155	83	19	0	238	19	NO / NO	NO / NO	NO / NO
8:00 - 9:00	132	87	12	0	219	12	NO / NO	NO / NO	NO / NO
9:00 - 10:00	119	63	12	0	182	12	NO / NO	NO / NO	NO / NO
10:00 - 11:00	85	87	19	0	172	19	NO / NO	NO / NO	NO / NO
11:00 - 12:00	72	66	19	0	138	19	NO / NO	NO / NO	NO / NO
12:00 - 13:00	71	65	11	0	136	11	NO / NO	NO / NO	NO / NO
13:00 - 14:00	74	82	29	0	156	29	NO / NO	NO / NO	NO / NO
14:00 - 15:00	91	107	28	0	198	28	NO / NO	NO / NO	NO / NO
15:00 - 16:00	99	122	29	0	221	29	NO / NO	NO / NO	NO / NO
16:00 - 17:00	112	153	46	0	265	46	NO / NO	NO / NO	NO / NO
17:00 - 18:00	101	122	47	0	223	47	NO / NO	NO / NO	NO / NO
18:00 - 19:00	65	70	22	0	135	22	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1271	1186	309	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C5c

**2040 Alternative 1 - CSAH 5 North Ramp
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	1562
55	Major App3: CSAH 5 SB	2	1455
40	Minor App2: TH 23 Ramp WB	2	657
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	117	97	42	0	214	42	YES / NO
7:00 - 8:00	190	102	45	0	292	45	YES / NO
8:00 - 9:00	162	106	51	0	268	51	YES / NO
9:00 - 10:00	147	77	35	0	224	35	YES / NO
10:00 - 11:00	104	107	30	0	211	30	YES / NO
11:00 - 12:00	88	82	43	0	170	43	NO / NO
12:00 - 13:00	87	79	41	0	166	41	NO / NO
13:00 - 14:00	90	100	51	0	190	51	NO / NO
14:00 - 15:00	113	131	56	0	244	56	YES / NO
15:00 - 16:00	122	151	61	0	273	61	YES / NO
16:00 - 17:00	138	188	85	0	326	85	YES / NO
17:00 - 18:00	124	150	82	0	274	82	YES / NO
18:00 - 19:00	80	85	35	0	165	35	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1562	1455	657	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C5d

**2040 Alternative 1 - CSAH 5 North Ramp
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1562
55	Major App3: CSAH 5 SB	2	1455
40	Minor App2: TH 23 Ramp WB	1	434
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	117	97	24	0	214	24	NO / NO	NO / NO	NO / NO
7:00 - 8:00	190	102	27	0	292	27	NO / NO	NO / NO	NO / NO
8:00 - 9:00	162	106	22	0	268	22	NO / NO	NO / NO	NO / NO
9:00 - 10:00	147	77	19	0	224	19	NO / NO	NO / NO	NO / NO
10:00 - 11:00	104	107	24	0	211	24	NO / NO	NO / NO	NO / NO
11:00 - 12:00	88	82	28	0	170	28	NO / NO	NO / NO	NO / NO
12:00 - 13:00	87	79	19	0	166	19	NO / NO	NO / NO	NO / NO
13:00 - 14:00	90	100	39	0	190	39	NO / NO	NO / NO	NO / NO
14:00 - 15:00	113	131	38	0	244	38	NO / NO	NO / NO	NO / NO
15:00 - 16:00	122	151	41	0	273	41	NO / NO	NO / NO	NO / NO
16:00 - 17:00	138	188	62	0	326	62	NO / NO	NO / YES	NO / NO
17:00 - 18:00	124	150	62	0	274	62	NO / NO	NO / YES	NO / NO
18:00 - 19:00	80	85	29	0	165	29	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1562	1455	434	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C6a

**2017 Alternative 1 - CSAH 5 South Ramp
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	660
55	Major App3: CSAH 5 SB	2	948
40	Minor App2: TH 23 Ramp EB	2	834
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? **Yes**

**Minimum Volume Requirement
 210 140**

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP. 1 + APP. 3)	Σ (APP. 2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	51	60	60	0	111	60	NO / NO
7:00 - 8:00	123	62	68	0	185	68	NO / NO
8:00 - 9:00	67	62	82	0	129	82	NO / NO
9:00 - 10:00	46	50	84	0	96	84	NO / NO
10:00 - 11:00	53	71	49	0	124	49	NO / NO
11:00 - 12:00	46	55	43	0	101	43	NO / NO
12:00 - 13:00	50	50	36	0	100	36	NO / NO
13:00 - 14:00	40	69	49	0	109	49	NO / NO
14:00 - 15:00	24	83	78	0	107	78	NO / NO
15:00 - 16:00	37	90	77	0	127	77	NO / NO
16:00 - 17:00	42	129	86	0	171	86	NO / NO
17:00 - 18:00	47	108	73	0	155	73	NO / NO
18:00 - 19:00	34	59	49	0	93	49	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	660	948	834	0			

Hours met for warrant: **Met (Hr) 0 Required (Hr) 8**

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C6b

2017 Alternative 1 - CSAH 5 South Ramp SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	660
55	Major App3: CSAH 5 SB	2	948
40	Minor App2: TH 23 Ramp EB	1	793
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	51	60	59	0	111	59	NO / NO	NO / YES	NO / NO
7:00 - 8:00	123	62	66	0	185	66	NO / NO	NO / YES	NO / NO
8:00 - 9:00	67	62	82	0	129	82	NO / NO	NO / YES	NO / NO
9:00 - 10:00	46	50	82	0	96	82	NO / NO	NO / YES	NO / NO
10:00 - 11:00	53	71	49	0	124	49	NO / NO	NO / NO	NO / NO
11:00 - 12:00	46	55	41	0	101	41	NO / NO	NO / NO	NO / NO
12:00 - 13:00	50	50	36	0	100	36	NO / NO	NO / NO	NO / NO
13:00 - 14:00	40	69	48	0	109	48	NO / NO	NO / NO	NO / NO
14:00 - 15:00	24	83	72	0	107	72	NO / NO	NO / YES	NO / NO
15:00 - 16:00	37	90	67	0	127	67	NO / NO	NO / YES	NO / NO
16:00 - 17:00	42	129	81	0	171	81	NO / NO	NO / YES	NO / NO
17:00 - 18:00	47	108	66	0	155	66	NO / NO	NO / YES	NO / NO
18:00 - 19:00	34	59	44	0	93	44	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	660	948	793	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C6c

**2040 Alternative 1 - CSAH 5 South Ramp
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	810
55	Major App3: CSAH 5 SB	2	1165
40	Minor App2: TH 23 Ramp EB	2	1024
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	63	73	74	0	136	74	NO / NO
7:00 - 8:00	152	76	83	0	228	83	YES / NO
8:00 - 9:00	82	76	100	0	158	100	NO / NO
9:00 - 10:00	57	61	103	0	118	103	NO / NO
10:00 - 11:00	65	87	61	0	152	61	NO / NO
11:00 - 12:00	56	68	52	0	124	52	NO / NO
12:00 - 13:00	60	62	44	0	122	44	NO / NO
13:00 - 14:00	50	85	61	0	135	61	NO / NO
14:00 - 15:00	29	102	96	0	131	96	NO / NO
15:00 - 16:00	45	110	95	0	155	95	NO / NO
16:00 - 17:00	51	160	105	0	211	105	YES / NO
17:00 - 18:00	58	134	89	0	192	89	NO / NO
18:00 - 19:00	42	71	61	0	113	61	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	810	1165	1024	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C6d

2040 Alternative 1 - CSAH 5 South Ramp SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	810
55	Major App3: CSAH 5 SB	2	1165
40	Minor App2: TH 23 Ramp EB	1	983
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

Minimum Volume Requirement			
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	63	73	73	0	136	73	NO / NO	NO / YES	NO / NO
7:00 - 8:00	152	76	81	0	228	81	NO / NO	NO / YES	NO / NO
8:00 - 9:00	82	76	100	0	158	100	NO / NO	NO / YES	NO / YES
9:00 - 10:00	57	61	101	0	118	101	NO / NO	NO / YES	NO / YES
10:00 - 11:00	65	87	61	0	152	61	NO / NO	NO / YES	NO / NO
11:00 - 12:00	56	68	50	0	124	50	NO / NO	NO / NO	NO / NO
12:00 - 13:00	60	62	44	0	122	44	NO / NO	NO / NO	NO / NO
13:00 - 14:00	50	85	60	0	135	60	NO / NO	NO / YES	NO / NO
14:00 - 15:00	29	102	90	0	131	90	NO / NO	NO / YES	NO / YES
15:00 - 16:00	45	110	85	0	155	85	NO / NO	NO / YES	NO / YES
16:00 - 17:00	51	160	100	0	211	100	NO / NO	NO / YES	NO / YES
17:00 - 18:00	58	134	82	0	192	82	NO / NO	NO / YES	NO / NO
18:00 - 19:00	42	71	56	0	113	56	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	810	1165	983	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C7a

**2017 Alternative 2 - CSAH 5 North Ramp
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	1271
55	Major App3: CSAH 5 SB	2	991
40	Minor App2: TH 23 Ramp WB	2	532
55	Minor App4: CSAH 55 EB	2	232

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	95	62	34	18	157	52	NO / NO
7:00 - 8:00	155	62	37	25	217	62	YES / NO
8:00 - 9:00	132	68	41	21	200	62	NO / NO
9:00 - 10:00	119	48	28	20	167	48	NO / NO
10:00 - 11:00	85	70	25	20	155	45	NO / NO
11:00 - 12:00	72	51	34	17	123	51	NO / NO
12:00 - 13:00	71	52	33	14	123	47	NO / NO
13:00 - 14:00	74	61	41	23	135	64	NO / NO
14:00 - 15:00	91	95	46	13	186	59	NO / NO
15:00 - 16:00	99	115	49	12	214	61	YES / NO
16:00 - 17:00	112	136	69	22	248	91	YES / NO
17:00 - 18:00	101	108	67	20	209	87	NO / NO
18:00 - 19:00	65	63	28	7	128	35	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1271	991	532	232			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.
 10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C7b

**2017 Alternative 2 - CSAH 5 North Ramp
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1271
55	Major App3: CSAH 5 SB	2	991
40	Minor App2: TH 23 Ramp WB	1	354
55	Minor App4: CSAH 55 EB	1	108

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES
 CORRECTABLE CRASHES: 0
 (12-month period)

Minimum Volume Requirement			
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	95	62	19	8	157	19	NO / NO	NO / NO	NO / NO
7:00 - 8:00	155	62	22	12	217	22	NO / NO	NO / NO	NO / NO
8:00 - 9:00	132	68	17	9	200	17	NO / NO	NO / NO	NO / NO
9:00 - 10:00	119	48	14	7	167	14	NO / NO	NO / NO	NO / NO
10:00 - 11:00	85	70	20	8	155	20	NO / NO	NO / NO	NO / NO
11:00 - 12:00	72	51	24	8	123	24	NO / NO	NO / NO	NO / NO
12:00 - 13:00	71	52	16	5	123	16	NO / NO	NO / NO	NO / NO
13:00 - 14:00	74	61	31	12	135	31	NO / NO	NO / NO	NO / NO
14:00 - 15:00	91	95	32	7	186	32	NO / NO	NO / NO	NO / NO
15:00 - 16:00	99	115	34	6	214	34	NO / NO	NO / NO	NO / NO
16:00 - 17:00	112	136	52	11	248	52	NO / NO	NO / NO	NO / NO
17:00 - 18:00	101	108	51	12	209	51	NO / NO	NO / NO	NO / NO
18:00 - 19:00	65	63	22	3	128	22	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1271	991	354	108					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C7c

2040 Alternative 2 - CSAH 5 North Ramp ALL WAY STOP WARRANT ANALYSIS

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	1562
55	Major App3: CSAH 5 SB	2	1223
40	Minor App2: TH 23 Ramp WB	2	657
55	Minor App4: CSAH 55 EB	2	422

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP. 1 + APP. 3)	Σ (APP. 2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	117	77	42	33	194	75	NO / NO
7:00 - 8:00	190	77	45	45	267	90	YES / NO
8:00 - 9:00	162	84	51	38	246	89	YES / NO
9:00 - 10:00	147	60	35	36	207	71	NO / NO
10:00 - 11:00	104	86	30	36	190	66	NO / NO
11:00 - 12:00	88	63	43	31	151	74	NO / NO
12:00 - 13:00	87	64	41	25	151	66	NO / NO
13:00 - 14:00	90	75	51	43	165	94	NO / NO
14:00 - 15:00	113	116	56	24	229	80	YES / NO
15:00 - 16:00	122	142	61	22	264	83	YES / NO
16:00 - 17:00	138	168	85	40	306	125	YES / NO
17:00 - 18:00	124	134	82	36	258	118	YES / NO
18:00 - 19:00	80	77	35	13	157	48	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1562	1223	657	422			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C7d

**2040 Alternative 2 - CSAH 5 North Ramp
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1562
55	Major App3: CSAH 5 SB	2	1223
40	Minor App2: TH 23 Ramp WB	1	479
55	Minor App4: CSAH 55 EB	1	298

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

Minimum Volume Requirement			
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	117	77	27	23	194	27	NO / NO	NO / NO	NO / NO
7:00 - 8:00	190	77	30	32	267	32	NO / NO	NO / NO	NO / NO
8:00 - 9:00	162	84	27	26	246	27	NO / NO	NO / NO	NO / NO
9:00 - 10:00	147	60	21	23	207	23	NO / NO	NO / NO	NO / NO
10:00 - 11:00	104	86	25	24	190	25	NO / NO	NO / NO	NO / NO
11:00 - 12:00	88	63	33	22	151	33	NO / NO	NO / NO	NO / NO
12:00 - 13:00	87	64	24	16	151	24	NO / NO	NO / NO	NO / NO
13:00 - 14:00	90	75	41	32	165	41	NO / NO	NO / NO	NO / NO
14:00 - 15:00	113	116	42	18	229	42	NO / NO	NO / NO	NO / NO
15:00 - 16:00	122	142	46	16	264	46	NO / NO	NO / NO	NO / NO
16:00 - 17:00	138	168	68	29	306	68	NO / NO	NO / YES	NO / NO
17:00 - 18:00	124	134	66	28	258	66	NO / NO	NO / YES	NO / NO
18:00 - 19:00	80	77	29	9	157	29	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1562	1223	479	298					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C8a

2017 Alternative 2 - CSAH 5 South Ramp ALL WAY STOP WARRANT ANALYSIS

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	660
55	Major App3: CSAH 5 SB	2	948
40	Minor App2: TH 23 Ramp EB	2	834
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	51	60	60	0	111	60	NO / NO
7:00 - 8:00	123	62	68	0	185	68	NO / NO
8:00 - 9:00	67	62	82	0	129	82	NO / NO
9:00 - 10:00	46	50	84	0	96	84	NO / NO
10:00 - 11:00	53	71	49	0	124	49	NO / NO
11:00 - 12:00	46	55	43	0	101	43	NO / NO
12:00 - 13:00	50	50	36	0	100	36	NO / NO
13:00 - 14:00	40	69	49	0	109	49	NO / NO
14:00 - 15:00	24	83	78	0	107	78	NO / NO
15:00 - 16:00	37	90	77	0	127	77	NO / NO
16:00 - 17:00	42	129	86	0	171	86	NO / NO
17:00 - 18:00	47	108	73	0	155	73	NO / NO
18:00 - 19:00	34	59	49	0	93	49	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	660	948	834	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant:

Not satisfied

REMARKS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C8b

**2017 Alternative 2 - CSAH 5 South Ramp
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	660
55	Major App3: CSAH 5 SB	2	948
40	Minor App2: TH 23 Ramp EB	1	793
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES
 CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - B	WARRANT 1B - B	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP. 1 + APP. 3)	(APP. 2 or 4)	hr	hr	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	51	60	59	0	111	59	NO / NO	NO / YES	NO / NO
7:00 - 8:00	123	62	66	0	185	66	NO / NO	NO / YES	NO / NO
8:00 - 9:00	67	62	82	0	129	82	NO / NO	NO / YES	NO / NO
9:00 - 10:00	46	50	82	0	96	82	NO / NO	NO / YES	NO / NO
10:00 - 11:00	53	71	49	0	124	49	NO / NO	NO / NO	NO / NO
11:00 - 12:00	46	55	41	0	101	41	NO / NO	NO / NO	NO / NO
12:00 - 13:00	50	50	36	0	100	36	NO / NO	NO / NO	NO / NO
13:00 - 14:00	40	69	48	0	109	48	NO / NO	NO / NO	NO / NO
14:00 - 15:00	24	83	72	0	107	72	NO / NO	NO / YES	NO / NO
15:00 - 16:00	37	90	67	0	127	67	NO / NO	NO / YES	NO / NO
16:00 - 17:00	42	129	81	0	171	81	NO / NO	NO / YES	NO / NO
17:00 - 18:00	47	108	66	0	155	66	NO / NO	NO / YES	NO / NO
18:00 - 19:00	34	59	44	0	93	44	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	660	948	793	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C8c

**2040 Alternative 2 - CSAH 5 South Ramp
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	810
55	Major App3: CSAH 5 SB	2	1165
40	Minor App2: TH 23 Ramp EB	2	1024
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? **Yes**

**Minimum Volume Requirement
 210 140**

HOUR	MAJOR		MINOR		MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	63	73	74	0	136	74	NO / NO
7:00 - 8:00	152	76	83	0	228	83	YES / NO
8:00 - 9:00	82	76	100	0	158	100	NO / NO
9:00 - 10:00	57	61	103	0	118	103	NO / NO
10:00 - 11:00	65	87	61	0	152	61	NO / NO
11:00 - 12:00	56	68	52	0	124	52	NO / NO
12:00 - 13:00	60	62	44	0	122	44	NO / NO
13:00 - 14:00	50	85	61	0	135	61	NO / NO
14:00 - 15:00	29	102	96	0	131	96	NO / NO
15:00 - 16:00	45	110	95	0	155	95	NO / NO
16:00 - 17:00	51	160	105	0	211	105	YES / NO
17:00 - 18:00	58	134	89	0	192	89	NO / NO
18:00 - 19:00	42	71	61	0	113	61	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	810	1165	1024	0			

Hours met for warrant: **Met (Hr) 0 Required (Hr) 8**

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit C8d

2040 Alternative 2 - CSAH 5 South Ramp SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 South Ramp
COUNTY: Kandiyohi
REF. POINT: 0
DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	810
55	Major App3: CSAH 5 SB	2	1165
40	Minor App2: TH 23 Ramp EB	1	983
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
POPULATION < 10,000? NO
VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
(12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	63	73	73	0	136	73	NO / NO	NO / YES	NO / NO
7:00 - 8:00	152	76	81	0	228	81	NO / NO	NO / YES	NO / NO
8:00 - 9:00	82	76	100	0	158	100	NO / NO	NO / YES	NO / YES
9:00 - 10:00	57	61	101	0	118	101	NO / NO	NO / YES	NO / YES
10:00 - 11:00	65	87	61	0	152	61	NO / NO	NO / YES	NO / NO
11:00 - 12:00	56	68	50	0	124	50	NO / NO	NO / NO	NO / NO
12:00 - 13:00	60	62	44	0	122	44	NO / NO	NO / NO	NO / NO
13:00 - 14:00	50	85	60	0	135	60	NO / NO	NO / YES	NO / NO
14:00 - 15:00	29	102	90	0	131	90	NO / NO	NO / YES	NO / YES
15:00 - 16:00	45	110	85	0	155	85	NO / NO	NO / YES	NO / YES
16:00 - 17:00	51	160	100	0	211	100	NO / NO	NO / YES	NO / YES
17:00 - 18:00	58	134	82	0	192	82	NO / NO	NO / YES	NO / NO
18:00 - 19:00	42	71	56	0	113	56	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	810	1165	983	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C9a

**2017 Alternative 3 - CSAH 5 at CSAH 55
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 SB	2	752
55	Major App3: N/A	2	0
55	Minor App2: CSAH 55 EB	2	232
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	44	0	18	0	44	18	NO / NO
7:00 - 8:00	61	0	25	0	61	25	NO / NO
8:00 - 9:00	58	0	21	0	58	21	NO / NO
9:00 - 10:00	38	0	20	0	38	20	NO / NO
10:00 - 11:00	46	0	20	0	46	20	NO / NO
11:00 - 12:00	46	0	17	0	46	17	NO / NO
12:00 - 13:00	45	0	14	0	45	14	NO / NO
13:00 - 14:00	51	0	23	0	51	23	NO / NO
14:00 - 15:00	64	0	13	0	64	13	NO / NO
15:00 - 16:00	89	0	12	0	89	12	NO / NO
16:00 - 17:00	96	0	22	0	96	22	NO / NO
17:00 - 18:00	73	0	20	0	73	20	NO / NO
18:00 - 19:00	41	0	7	0	41	7	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	752	0	232	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C9b

**2017 Alternative 3 - CSAH 5 at CSAH 55
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 SB	2	752
55	Major App3: N/A	2	0
55	Minor App2: CSAH 55 EB	1	135
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	44	0	10	0	44	10	NO / NO	NO / NO	NO / NO
7:00 - 8:00	61	0	15	0	61	15	NO / NO	NO / NO	NO / NO
8:00 - 9:00	58	0	13	0	58	13	NO / NO	NO / NO	NO / NO
9:00 - 10:00	38	0	13	0	38	13	NO / NO	NO / NO	NO / NO
10:00 - 11:00	46	0	13	0	46	13	NO / NO	NO / NO	NO / NO
11:00 - 12:00	46	0	10	0	46	10	NO / NO	NO / NO	NO / NO
12:00 - 13:00	45	0	10	0	45	10	NO / NO	NO / NO	NO / NO
13:00 - 14:00	51	0	12	0	51	12	NO / NO	NO / NO	NO / NO
14:00 - 15:00	64	0	6	0	64	6	NO / NO	NO / NO	NO / NO
15:00 - 16:00	89	0	7	0	89	7	NO / NO	NO / NO	NO / NO
16:00 - 17:00	96	0	13	0	96	13	NO / NO	NO / NO	NO / NO
17:00 - 18:00	73	0	9	0	73	9	NO / NO	NO / NO	NO / NO
18:00 - 19:00	41	0	4	0	41	4	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	752	0	135	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C9c

**2017 Alternative 3 - CSAH 5 at CSAH 55
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 SB	2	925
55	Major App3: N/A	2	0
55	Minor App2: CSAH 55 EB	2	422
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	54	0	33	0	54	33	NO / NO
7:00 - 8:00	75	0	45	0	75	45	NO / NO
8:00 - 9:00	72	0	38	0	72	38	NO / NO
9:00 - 10:00	47	0	36	0	47	36	NO / NO
10:00 - 11:00	57	0	36	0	57	36	NO / NO
11:00 - 12:00	56	0	31	0	56	31	NO / NO
12:00 - 13:00	55	0	25	0	55	25	NO / NO
13:00 - 14:00	62	0	43	0	62	43	NO / NO
14:00 - 15:00	79	0	24	0	79	24	NO / NO
15:00 - 16:00	109	0	22	0	109	22	NO / NO
16:00 - 17:00	118	0	40	0	118	40	NO / NO
17:00 - 18:00	90	0	36	0	90	36	NO / NO
18:00 - 19:00	51	0	13	0	51	13	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	925	0	422	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C9d

**2017 Alternative 3 - CSAH 5 at CSAH 55
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 SB	2	925
55	Major App3: N/A	2	0
55	Minor App2: CSAH 55 EB	1	325
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR	MAX MINOR	WARRANT 1A - 8	WARRANT 1B - 8	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	TOTAL Σ (APP.1 + APP. 3)	APPROACH (APP. 2 or 4)	hr MAJOR/MINOR	hr MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	54	0	25	0	54	25	NO / NO	NO / NO	NO / NO
7:00 - 8:00	75	0	35	0	75	35	NO / NO	NO / NO	NO / NO
8:00 - 9:00	72	0	30	0	72	30	NO / NO	NO / NO	NO / NO
9:00 - 10:00	47	0	29	0	47	29	NO / NO	NO / NO	NO / NO
10:00 - 11:00	57	0	29	0	57	29	NO / NO	NO / NO	NO / NO
11:00 - 12:00	56	0	24	0	56	24	NO / NO	NO / NO	NO / NO
12:00 - 13:00	55	0	21	0	55	21	NO / NO	NO / NO	NO / NO
13:00 - 14:00	62	0	32	0	62	32	NO / NO	NO / NO	NO / NO
14:00 - 15:00	79	0	17	0	79	17	NO / NO	NO / NO	NO / NO
15:00 - 16:00	109	0	17	0	109	17	NO / NO	NO / NO	NO / NO
16:00 - 17:00	118	0	31	0	118	31	NO / NO	NO / NO	NO / NO
17:00 - 18:00	90	0	25	0	90	25	NO / NO	NO / NO	NO / NO
18:00 - 19:00	51	0	10	0	51	10	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	925	0	325	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C10a

**2017 Alternative 3 - CSAH 5 North Ramp
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	1283
55	Major App3: CSAH 5 SB	2	639
40	Minor App2: TH 23 Ramp WB	2	532
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP. 1 + APP. 3)	Σ (APP. 2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	95	44	34	0	139	34	NO / NO
7:00 - 8:00	155	43	37	0	198	37	NO / NO
8:00 - 9:00	132	50	41	0	182	41	NO / NO
9:00 - 10:00	119	38	28	0	157	28	NO / NO
10:00 - 11:00	85	52	25	0	137	25	NO / NO
11:00 - 12:00	73	36	34	0	109	34	NO / NO
12:00 - 13:00	72	39	33	0	111	33	NO / NO
13:00 - 14:00	74	40	41	0	114	41	NO / NO
14:00 - 15:00	93	55	46	0	148	46	NO / NO
15:00 - 16:00	103	61	49	0	164	49	NO / NO
16:00 - 17:00	113	83	69	0	196	69	NO / NO
17:00 - 18:00	103	61	67	0	164	67	NO / NO
18:00 - 19:00	66	37	28	0	103	28	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1283	639	532	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C10b

**2017 Alternative 3 - CSAH 5 North Ramp
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1283
55	Major App3: CSAH 5 SB	2	639
40	Minor App2: TH 23 Ramp WB	1	309
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	95	44	16	0	139	16	NO / NO	NO / NO	NO / NO
7:00 - 8:00	155	43	19	0	198	19	NO / NO	NO / NO	NO / NO
8:00 - 9:00	132	50	12	0	182	12	NO / NO	NO / NO	NO / NO
9:00 - 10:00	119	38	12	0	157	12	NO / NO	NO / NO	NO / NO
10:00 - 11:00	85	52	19	0	137	19	NO / NO	NO / NO	NO / NO
11:00 - 12:00	73	36	19	0	109	19	NO / NO	NO / NO	NO / NO
12:00 - 13:00	72	39	11	0	111	11	NO / NO	NO / NO	NO / NO
13:00 - 14:00	74	40	29	0	114	29	NO / NO	NO / NO	NO / NO
14:00 - 15:00	93	55	28	0	148	28	NO / NO	NO / NO	NO / NO
15:00 - 16:00	103	61	29	0	164	29	NO / NO	NO / NO	NO / NO
16:00 - 17:00	113	83	46	0	196	46	NO / NO	NO / NO	NO / NO
17:00 - 18:00	103	61	47	0	164	47	NO / NO	NO / NO	NO / NO
18:00 - 19:00	66	37	22	0	103	22	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1283	639	309	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C10c

**2040 Alternative 3 - CSAH 5 North Ramp
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	1578
55	Major App3: CSAH 5 SB	2	787
40	Minor App2: TH 23 Ramp WB	2	657
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	117	54	42	0	171	42	NO / NO
7:00 - 8:00	190	53	45	0	243	45	YES / NO
8:00 - 9:00	162	61	51	0	223	51	YES / NO
9:00 - 10:00	147	47	35	0	194	35	NO / NO
10:00 - 11:00	104	64	30	0	168	30	NO / NO
11:00 - 12:00	90	45	43	0	135	43	NO / NO
12:00 - 13:00	89	49	41	0	138	41	NO / NO
13:00 - 14:00	90	50	51	0	140	51	NO / NO
14:00 - 15:00	115	67	56	0	182	56	NO / NO
15:00 - 16:00	127	75	61	0	202	61	NO / NO
16:00 - 17:00	139	102	85	0	241	85	YES / NO
17:00 - 18:00	127	74	82	0	201	82	NO / NO
18:00 - 19:00	81	46	35	0	127	35	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	1578	787	657	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C10d

2040 Alternative 3 - CSAH 5 North Ramp SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 North Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	1578
55	Major App3: CSAH 5 SB	2	787
40	Minor App2: TH 23 Ramp WB	1	434
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	117	54	24	0	171	24	NO / NO	NO / NO	NO / NO
7:00 - 8:00	190	53	27	0	243	27	NO / NO	NO / NO	NO / NO
8:00 - 9:00	162	61	22	0	223	22	NO / NO	NO / NO	NO / NO
9:00 - 10:00	147	47	19	0	194	19	NO / NO	NO / NO	NO / NO
10:00 - 11:00	104	64	24	0	168	24	NO / NO	NO / NO	NO / NO
11:00 - 12:00	90	45	28	0	135	28	NO / NO	NO / NO	NO / NO
12:00 - 13:00	89	49	19	0	138	19	NO / NO	NO / NO	NO / NO
13:00 - 14:00	90	50	39	0	140	39	NO / NO	NO / NO	NO / NO
14:00 - 15:00	115	67	38	0	182	38	NO / NO	NO / NO	NO / NO
15:00 - 16:00	127	75	41	0	202	41	NO / NO	NO / NO	NO / NO
16:00 - 17:00	139	102	62	0	241	62	NO / NO	NO / YES	NO / NO
17:00 - 18:00	127	74	62	0	201	62	NO / NO	NO / YES	NO / NO
18:00 - 19:00	81	46	29	0	127	29	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	1578	787	434	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C11a

2017 Alternative 3 - CSAH 5 South Ramp ALL WAY STOP WARRANT ANALYSIS

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	660
55	Major App3: CSAH 5 SB	2	948
40	Minor App2: TH 23 Ramp EB	2	834
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR		MINOR		MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	51	60	60	0	111	60	NO / NO
7:00 - 8:00	123	62	68	0	185	68	NO / NO
8:00 - 9:00	67	62	82	0	129	82	NO / NO
9:00 - 10:00	46	50	84	0	96	84	NO / NO
10:00 - 11:00	53	71	49	0	124	49	NO / NO
11:00 - 12:00	46	55	43	0	101	43	NO / NO
12:00 - 13:00	50	50	36	0	100	36	NO / NO
13:00 - 14:00	40	69	49	0	109	49	NO / NO
14:00 - 15:00	24	83	78	0	107	78	NO / NO
15:00 - 16:00	37	90	77	0	127	77	NO / NO
16:00 - 17:00	42	129	86	0	171	86	NO / NO
17:00 - 18:00	47	108	73	0	155	73	NO / NO
18:00 - 19:00	34	59	49	0	93	49	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	660	948	834	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.
 10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C11b

**2017 Alternative 3 - CSAH 5 South Ramp
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	660
55	Major App3: CSAH 5 SB	2	948
40	Minor App2: TH 23 Ramp EB	1	793
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	51	60	59	0	111	59	NO / NO	NO / YES	NO / NO
7:00 - 8:00	123	62	66	0	185	66	NO / NO	NO / YES	NO / NO
8:00 - 9:00	67	62	82	0	129	82	NO / NO	NO / YES	NO / NO
9:00 - 10:00	46	50	82	0	96	82	NO / NO	NO / YES	NO / NO
10:00 - 11:00	53	71	49	0	124	49	NO / NO	NO / NO	NO / NO
11:00 - 12:00	46	55	41	0	101	41	NO / NO	NO / NO	NO / NO
12:00 - 13:00	50	50	36	0	100	36	NO / NO	NO / NO	NO / NO
13:00 - 14:00	40	69	48	0	109	48	NO / NO	NO / NO	NO / NO
14:00 - 15:00	24	83	72	0	107	72	NO / NO	NO / YES	NO / NO
15:00 - 16:00	37	90	67	0	127	67	NO / NO	NO / YES	NO / NO
16:00 - 17:00	42	129	81	0	171	81	NO / NO	NO / YES	NO / NO
17:00 - 18:00	47	108	66	0	155	66	NO / NO	NO / YES	NO / NO
18:00 - 19:00	34	59	44	0	93	44	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	660	948	793	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C11c

**2040 Alternative 3 - CSAH 5 South Ramp
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	810
55	Major App3: CSAH 5 SB	2	1165
40	Minor App2: TH 23 Ramp EB	2	1024
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH	MINOR APPROACH	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	TOTAL Σ (APP.1 + APP. 3)	TOTAL Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	63	73	74	0	136	74	NO / NO
7:00 - 8:00	152	76	83	0	228	83	YES / NO
8:00 - 9:00	82	76	100	0	158	100	NO / NO
9:00 - 10:00	57	61	103	0	118	103	NO / NO
10:00 - 11:00	65	87	61	0	152	61	NO / NO
11:00 - 12:00	56	68	52	0	124	52	NO / NO
12:00 - 13:00	60	62	44	0	122	44	NO / NO
13:00 - 14:00	50	85	61	0	135	61	NO / NO
14:00 - 15:00	29	102	96	0	131	96	NO / NO
15:00 - 16:00	45	110	95	0	155	95	NO / NO
16:00 - 17:00	51	160	105	0	211	105	YES / NO
17:00 - 18:00	58	134	89	0	192	89	NO / NO
18:00 - 19:00	42	71	61	0	113	61	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	810	1165	1024	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C11d

2040 Alternative 3 - CSAH 5 South Ramp SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 South Ramp
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	810
55	Major App3: CSAH 5 SB	2	1165
40	Minor App2: TH 23 Ramp EB	1	983
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	63	73	73	0	136	73	NO / NO	NO / YES	NO / NO
7:00 - 8:00	152	76	81	0	228	81	NO / NO	NO / YES	NO / NO
8:00 - 9:00	82	76	100	0	158	100	NO / NO	NO / YES	NO / YES
9:00 - 10:00	57	61	101	0	118	101	NO / NO	NO / YES	NO / YES
10:00 - 11:00	65	87	61	0	152	61	NO / NO	NO / YES	NO / NO
11:00 - 12:00	56	68	50	0	124	50	NO / NO	NO / NO	NO / NO
12:00 - 13:00	60	62	44	0	122	44	NO / NO	NO / NO	NO / NO
13:00 - 14:00	50	85	60	0	135	60	NO / NO	NO / YES	NO / NO
14:00 - 15:00	29	102	90	0	131	90	NO / NO	NO / YES	NO / YES
15:00 - 16:00	45	110	85	0	155	85	NO / NO	NO / YES	NO / YES
16:00 - 17:00	51	160	100	0	211	100	NO / NO	NO / YES	NO / YES
17:00 - 18:00	58	134	82	0	192	82	NO / NO	NO / YES	NO / NO
18:00 - 19:00	42	71	56	0	113	56	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	810	1165	983	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C12a

2017 Alternative 3 - CSAH 5 at CSAH 55 ALL WAY STOP WARRANT ANALYSIS

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	135
55	Major App3: CSAH 5 SB	2	1003
55	Minor App2: CSAH 5 Bridge WB	2	1494
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	10	62	113	0	72	113	NO / NO
7:00 - 8:00	15	62	173	0	77	173	NO / YES
8:00 - 9:00	13	68	161	0	81	161	NO / YES
9:00 - 10:00	13	48	135	0	61	135	NO / NO
10:00 - 11:00	13	70	91	0	83	91	NO / NO
11:00 - 12:00	10	52	87	0	62	87	NO / NO
12:00 - 13:00	10	53	93	0	63	93	NO / NO
13:00 - 14:00	12	61	86	0	73	86	NO / NO
14:00 - 15:00	6	97	109	0	103	109	NO / NO
15:00 - 16:00	7	119	119	0	126	119	NO / NO
16:00 - 17:00	13	137	135	0	150	135	NO / NO
17:00 - 18:00	9	110	121	0	119	121	NO / NO
18:00 - 19:00	4	64	71	0	68	71	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	135	1003	1494	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C12b

2017 Alternative 3 - CSAH 5 at CSAH 55 SIGNAL WARRANT ANALYSIS

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	135
55	Major App3: CSAH 5 SB	2	1003
55	Minor App2: CSAH 5 Bridge WB	1	264
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

Minimum Volume Requirement			
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP. 1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	10	62	16	0	72	16	NO / NO	NO / NO	NO / NO
7:00 - 8:00	15	62	29	0	77	29	NO / NO	NO / NO	NO / NO
8:00 - 9:00	13	68	28	0	81	28	NO / NO	NO / NO	NO / NO
9:00 - 10:00	13	48	15	0	61	15	NO / NO	NO / NO	NO / NO
10:00 - 11:00	13	70	16	0	83	16	NO / NO	NO / NO	NO / NO
11:00 - 12:00	10	52	21	0	62	21	NO / NO	NO / NO	NO / NO
12:00 - 13:00	10	53	22	0	63	22	NO / NO	NO / NO	NO / NO
13:00 - 14:00	12	61	19	0	73	19	NO / NO	NO / NO	NO / NO
14:00 - 15:00	6	97	16	0	103	16	NO / NO	NO / NO	NO / NO
15:00 - 16:00	7	119	25	0	126	25	NO / NO	NO / NO	NO / NO
16:00 - 17:00	13	137	31	0	150	31	NO / NO	NO / NO	NO / NO
17:00 - 18:00	9	110	16	0	119	16	NO / NO	NO / NO	NO / NO
18:00 - 19:00	4	64	10	0	68	10	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	135	1003	264	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C12c

**2040 Alternative 3 - CSAH 5 at CSAH 55
 ALL WAY STOP
 WARRANT ANALYSIS**

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017
 OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
55	Major App1: CSAH 5 NB	2	162
55	Major App3: CSAH 5 SB	2	1239
55	Minor App2: CSAH 5 Bridge WB	2	1842
30	Minor App4: N/A	1	0

0.70 SPEED FACTOR USED? Yes

Minimum Volume Requirement
 210 140

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	12	77	140	0	89	140	NO / YES
7:00 - 8:00	18	77	213	0	95	213	NO / YES
8:00 - 9:00	16	84	199	0	100	199	NO / YES
9:00 - 10:00	16	60	166	0	76	166	NO / YES
10:00 - 11:00	15	86	112	0	101	112	NO / NO
11:00 - 12:00	12	64	108	0	76	108	NO / NO
12:00 - 13:00	12	65	114	0	77	114	NO / NO
13:00 - 14:00	15	75	107	0	90	107	NO / NO
14:00 - 15:00	8	119	134	0	127	134	NO / NO
15:00 - 16:00	7	147	147	0	154	147	NO / YES
16:00 - 17:00	17	170	166	0	187	166	NO / YES
17:00 - 18:00	10	136	149	0	146	149	NO / YES
18:00 - 19:00	4	79	87	0	83	87	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	162	1239	1842	0			

Hours met for warrant: Met (Hr) 0 Required (Hr) 8

All-way Stop Warrant: **Not satisfied**

REMARKS: _____



SHORT ELLIOTT HENDRICKSON INC.
 10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

Exhibit C12d

**2040 Alternative 3 - CSAH 5 at CSAH 55
 SIGNAL WARRANT
 ANALYSIS**

LOCATION: CSAH 5 at CSAH 55
 COUNTY: Kandiyohi
 REF. POINT: 0
 DATE: 6/29/2017

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach
55	Major App1: CSAH 5 NB	2	162
55	Major App3: CSAH 5 SB	2	1239
55	Minor App2: CSAH 5 Bridge WB	1	612
30	Minor App4: N/A	1	0

40 MPH OR FASTER? YES
 POPULATION < 10,000? NO
 VOLUME REQ. AT 70%? YES

CORRECTABLE CRASHES: 0
 (12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	420	630	504
Minor Approach	105	53	84

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	12	77	43	0	89	43	NO / NO	NO / NO	NO / NO
7:00 - 8:00	18	77	69	0	95	69	NO / NO	NO / YES	NO / NO
8:00 - 9:00	16	84	66	0	100	66	NO / NO	NO / YES	NO / NO
9:00 - 10:00	16	60	46	0	76	46	NO / NO	NO / NO	NO / NO
10:00 - 11:00	15	86	37	0	101	37	NO / NO	NO / NO	NO / NO
11:00 - 12:00	12	64	42	0	76	42	NO / NO	NO / NO	NO / NO
12:00 - 13:00	12	65	43	0	77	43	NO / NO	NO / NO	NO / NO
13:00 - 14:00	15	75	40	0	90	40	NO / NO	NO / NO	NO / NO
14:00 - 15:00	8	119	41	0	127	41	NO / NO	NO / NO	NO / NO
15:00 - 16:00	7	147	53	0	154	53	NO / NO	NO / YES	NO / NO
16:00 - 17:00	17	170	62	0	187	62	NO / NO	NO / YES	NO / NO
17:00 - 18:00	10	136	44	0	146	44	NO / NO	NO / NO	NO / NO
18:00 - 19:00	4	79	26	0	83	26	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	162	1239	612	0					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	0	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B Combination of Warrants	0	8	Not satisfied
Warrant 2 Four Hour Volumes	0	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	0	8	Not satisfied

COMMENTS:

Appendix D

Operational Exhibits and Tables

Table D2
No Build
2040
Willmar, MN

Intersection	Approach	Demand Volumes						Delay (s/veh)						LOS By Approach			LOS By Intersection			Through						Queuing Information (feet)					
		L		R		Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Link Length	Avg.	Max	Storage	Avg.	Max	Storage	Avg.	Max	Storage	Avg.	Max			
AM Peak Hour	CSAH 5 at CSAH 23	NB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
		SB	0	55	55	0.0	A	0.2	A	2.4	A	2.4	A	1.3	A	1.3	A	0			0			0			1000		63		
		WB	118	148	267	1.7	A	0.8	A	0.4	A	0.4	A	1.2	A	1.2	A	0			300	14	61	0			0				
	CSAH 5 at CSAH 55	NB	34	131	165	1.9	A	0.5	A	0.0	A	0.0	A	0.8	A	0.8	A	0			0			0			1001				
		SB	0	35	35	0.4	A	0.4	A	0.0	A	0.0	A	0.3	A	0.3	A	0			0			0			150	14	63		
		WB	33	0	33	3.5	A	0.0	A	1.5	A	1.5	A	2.8	A	2.8	A	0			0			0			0				
	CSAH 5 at CSAH 5 Bridge	NB	11	0	11	2.8	A	0.0	A	1.9	A	1.9	A	2.0	A	2.0	A	0			0			0			300		22		
		SB	0	0	0	0.0	A	0.4	A	0.0	A	0.0	A	0.6	A	0.6	A	0			0			0			1002				
		WB	48	43	91	0.8	A	0.7	A	0.0	A	0.0	A	0.8	A	0.8	A	0			0			0			0				
	CSAH 5 South Ramp	NB	0	92	92	0.0	A	0.3	A	0.2	A	0.2	A	0.3	A	0.3	A	0			0			0			1003				
		SB	25	64	89	0.6	A	0.6	A	0.0	A	0.0	A	0.7	A	0.7	A	0			0			0			0				
		WB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0				
CSAH 5 at CSAH 23	NB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			1000	25	68			
	SB	105	137	242	2.2	A	0.9	A	0.0	A	0.0	A	1.5	A	1.5	A	0			300	16	66	0			0					
	WB	0	159	159	0.0	A	1.9	A	0.7	A	0.7	A	1.5	A	1.5	A	0			0			0			0					
CSAH 5 at CSAH 55	NB	35	155	190	2.1	A	0.6	A	0.0	A	0.0	A	0.9	A	0.9	A	0			0			0			0					
	SB	0	75	75	0.0	A	0.5	A	0.0	A	0.0	A	0.4	A	0.4	A	0			0			0			0					
	WB	20	0	20	3.2	A	0.0	A	1.3	A	1.3	A	2.5	A	2.5	A	0			0			0			150	8	39			
CSAH 5 at CSAH 5 Bridge	NB	7	0	7	3.4	A	0.0	A	1.4	A	1.4	A	1.7	A	1.7	A	0			0			0			0					
	SB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
	WB	87	83	170	1.0	A	1.1	A	0.0	A	0.0	A	1.0	A	1.0	A	0			0			0			0					
CSAH 5 South Ramp	NB	0	38	38	0.0	A	0.1	A	0.0	A	0.0	A	0.1	A	0.1	A	0			0			0			0					
	SB	11	151	162	0.4	A	0.3	A	0.0	A	0.0	A	0.3	A	0.3	A	0			0			0			0					
	WB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
PM Peak Hour	CSAH 5 at CSAH 23	NB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0				
		SB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0				
		WB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0				
CSAH 5 at CSAH 55	NB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
	SB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
	WB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
CSAH 5 at CSAH 5 Bridge	NB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
	SB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
	WB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
CSAH 5 South Ramp	NB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
	SB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					
	WB	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0			0			0			0					

Table D4
 Alternative 2 - Folded Diamond Interchange
 2040
 Willmar, MN

Intersection	Approach	Demand Volumes						Delay (s/veh)						LOS By Approach		LOS By Intersection		Through			Left Turn			Right Turn		
		L		R		Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Link Length	Avg.	Max	Storage	Avg.	Max	Storage	Avg.	Max	
		L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Link Length	Avg.	Max	Storage	Avg.	Max	Storage	Avg.	Max		
CSAH 5 at CSAH 55 AM Peak Hour	NB	38	170	0	208	16	A	1.2	A	0.0	A	1.3	A	1.8	A	581	2	30	0			0				
	SB	37	45	9	91	10	A	0.7	A	0.0	A	0.7	A	1.8	A	378	5	49	0			1000				
	EB	10	18	25	53	3.8	A	9.3	A	1.4	A	4.8	A			677	18	68	0			300	11	59		
	WB	17	6	24	47	4.6	A	6.2	A	1.7	A	3.2	A			215	14	52	0			0	15	58		
CSAH 5 North Ramp	NB	0	92	35	127	0.0	A	0.8	A	0.2	A	0.6	A	1.9	A	0	3	39	0			0				
	SB	24	62	0	86	1.4	A	1.0	A	0.0	A	1.1	A			581	1	21	300	35	69	1001				
	EB	116	0	2	118	4.1	A	0.0	A	0.9	A	4.0	A			827	1	21	300	35	69	0				
	WB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0				
CSAH 5 at CSAH 55 PM Peak Hour	NB	34	105	0	140	1.7	A	1.4	A	0.0	A	1.5	A	2.2	A	581	3	50	0			0				
	SB	76	87	8	171	1.0	A	1.3	A	0.0	A	1.1	A			378	6	46	0			1000				
	EB	4	16	17	37	5.6	A	8.9	A	1.5	A	5.1	A			677	10	38	0			300	8	37		
	WB	52	9	21	82	5.4	A	7.3	A	1.5	A	4.4	A			215	28	64	0			0	17	53		
CSAH 5 North Ramp	NB	0	38	12	50	0.0	A	0.6	A	0.0	A	0.5	A	1.9	A	0			0			0				
	SB	11	146	0	157	1.2	A	1.0	A	0.0	A	1.0	A			581	2	28	300	30	69	1001				
	EB	101	0	5	106	4.0	A	0.0	A	1.1	A	3.9	A			827	2	28	300	30	69	0				
	WB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0				

