Highway 23
Passing Lane Assessment
(I-90 to Willmar, MN)

Final Version 1

Minnesota Department of Transportation (MnDOT) – District 8

SRF Consulting Group, Inc. | Engineers Planners Designers

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SRF No. 013 08331

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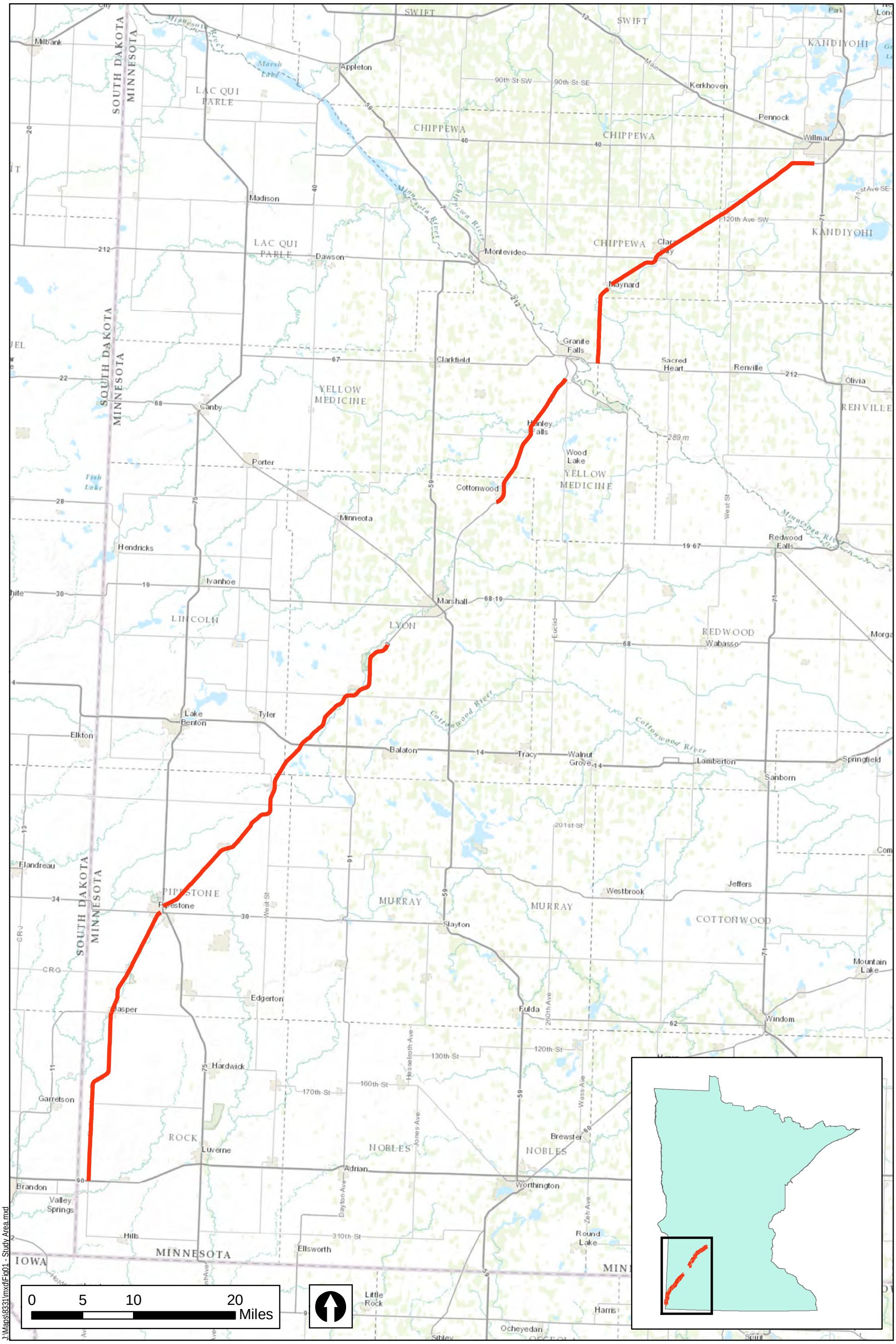
Introduction

This report documents the study process, feasibility and risk assessment, and future transportation system recommendations for the evaluation and determination of passing lane locations along Minnesota Trunk Highway (TH) 23 from Interstate 90 (I-90) to Willmar in southwest Minnesota (see Figure 1). TH 23 is an important interregional corridor (IRC) that is a key artery for the economy in the region. It is predominately a two-lane roadway that connects numerous communities. As traffic volumes increase, particularly freight truck volumes, strategically adding passing lanes is a potential low-cost/high-benefit infrastructure investment to break up traffic platoons. A passing lane location is the construction of an additional lane in each direction unless otherwise specified. This allows for passing to occur with acceptable levels of service while improving the safety of the corridor.

Freight traffic along the TH 23 corridor is a significant part of the overall traffic and an important part of the corridors economic vitality. This sentiment is echoed in District 8's Manufacturers' Perspective Study, more formally known as the *Manufacturers' Perspectives on Minnesota's transportation System: A Pilot Study in Southwest Minnesota.* This study expresses that "Among the Minnesota Department of Transportation's (MnDOT)'s most important customer segments are Minnesota based manufacturers that ship their products over Minnesota roads to local, statewide, national and international markets…in short, economic vitality results when economic development and transportation systems are well aligned."

To help ensure that economic development and transportation systems align, businesses along TH 23 were contacted to understand their perception of passing lanes and where they believe locations may be most advantageous. Based on these conversations and the Manufacturers' Perspective Study, the needs of the corridor are best served with a regional approach to locating passing lanes. This approach strategically identifies passing lane locations throughout the corridor in order to achieve periodic relief from platooning and improved economic mobility. This central philosophy is interwoven throughout this report.



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Study Area

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
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Figure 1

Assessment Goals

The addition of a passing lane in one or both directions of travel on a rural two-lane highway can provide safety and traffic operational benefits when inadequate passing opportunities exist. The purpose of a passing lane is to improve the level of service (reducing delays) of a corridor by breaking up traffic platoons. Passing lanes have been proven to increase average travel speeds and reduce the percent time following along corridors. Both benefits are also realized for some distance downstream of the passing lane section. From a safety perspective, passing lanes provide opportunities for passing without using the opposing lane.

The Minnesota Department of Transportation (MnDOT) has received Corridors of Commerce funding for passing lane improvements along TH 23. The goal of the Highway 23 Passing Lane Assessment is to conduct an evaluation to identify high priority segments along the TH 23 corridor from I-90 to Willmar where a passing lane concept can easily be implemented while providing safety and operational benefits.

The passing lane priorities are categorized into two Tiers of segments. The 1st Tier priority locations are identified in an effort to fulfill the opportunities provided by the projected Corridors of Commerce funding (three passing locations anticipated). The 2nd Tier priority locations identify an additional three segments for further consideration as future funding becomes available or if priorities change due to additional information brought forth in the environmental review process conducted during the Preliminary Engineering phase. As a result, this assessment will:

1. Identify the highest priority segment in each region;
2. Review the highest priority segments in order to recommend the Tier 1 and Tier 2 segments; and
3. Review the two Tiers of segments to determine if any would be feasible for an accelerated schedule (an April of 2015 construction letting was used to assess the feasibility) and review the remaining segments assuming an April of 2016 construction letting.

High priority locations may still have impacts that need to be addressed during the Preliminary Engineering phase; however, potential impacts of a segment will not influence the priority of the segment comparatively but could impact the construction letting timeframe.

Corridor Segments

In order to balance the TH 23 corridor from I-90 to Willmar to provide the most overall regional benefit, the corridor was strategically grouped into four major regions based on IRC corridors, regional centers, speed transition areas and locations adjacent to four-lane roadways. Inside those regions are the 13 segments, which are as follows (see Figure 2):

I-90 to Pipestone

- Segment 1 – I-90 to Jasper
- Segment 2 – Jasper to Pipestone

Pipestone to Marshall

- Segment 3 – Pipestone to Holland
- Segment 4 – Holland to Ruthton
- Segment 5 – Ruthton to Florence
- Segment 6 – Florence to Russell
- Segment 7 – Russell to Lynd

Marshall to TH 212

- Segment 8 – Cottonwood to Hanley Falls
- Segment 9 – Hanley Falls to TH 274

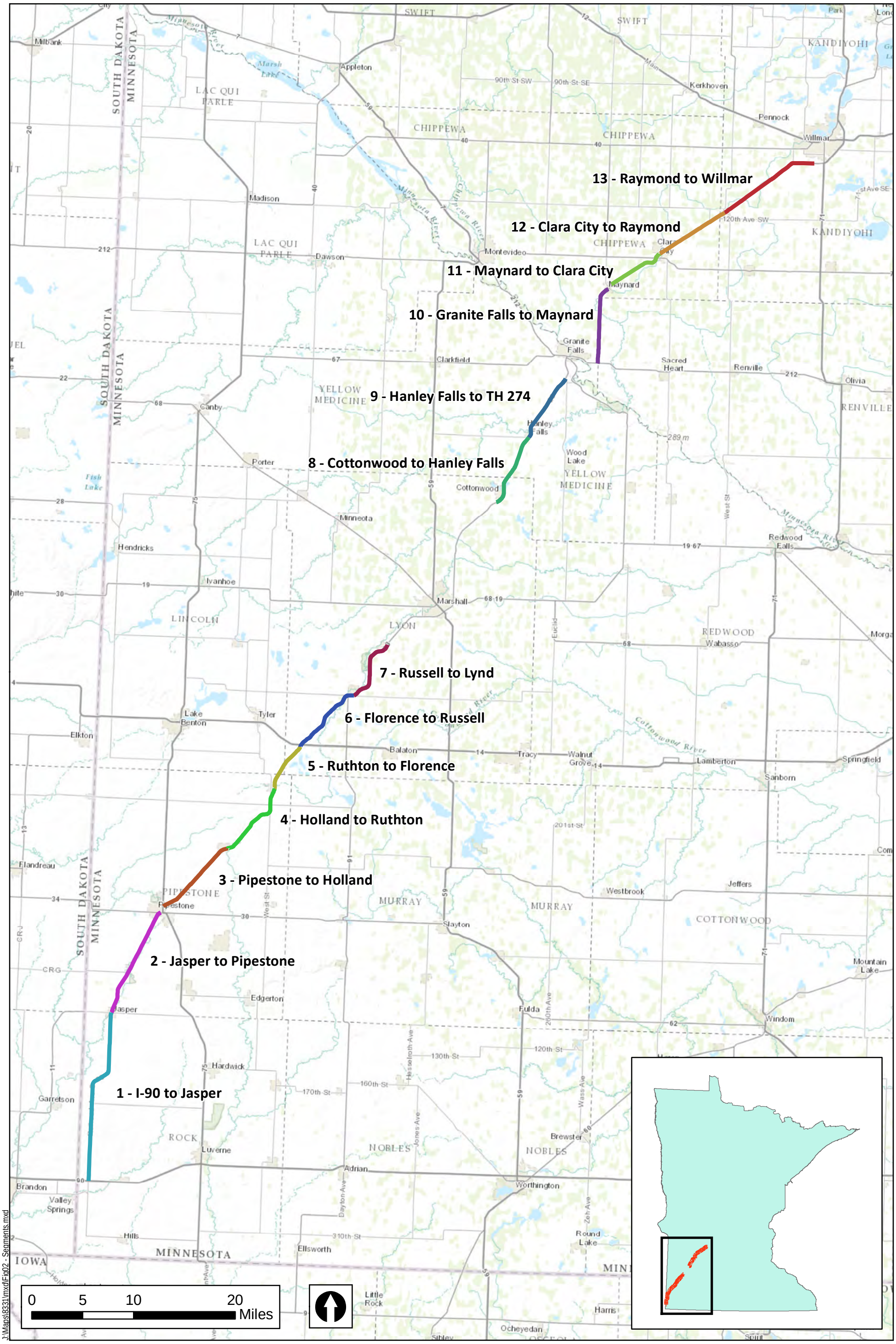
TH 212 to Willmar

- Segment 10 – Granite Falls to Maynard
- Segment 11 – Maynard to Clara City
- Segment 12 – Clara City to Raymond
- Segment 13 – Raymond to Willmar Bypass

Evaluation Process

For evaluating the corridor segments, a process was developed to establish the need for a passing lane; identify which passing lane concept is most appropriate at each location; and to conduct a risk assessment to review any impacts, cost, constructability or project delivery issues with respect to future passing lanes along TH 23. The following summarizes the main components of the evaluation process (see Figure 3):

- Data Collection
- Traffic Projections
- System Capacity Analysis
- Passing Lane Concepts and Typical Sections
- Passing Lane Criteria and Guidelines
- Feasibility and Risk Assessment
- Future Transportation System Recommendations



Corridor Segments

Figure 2

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)

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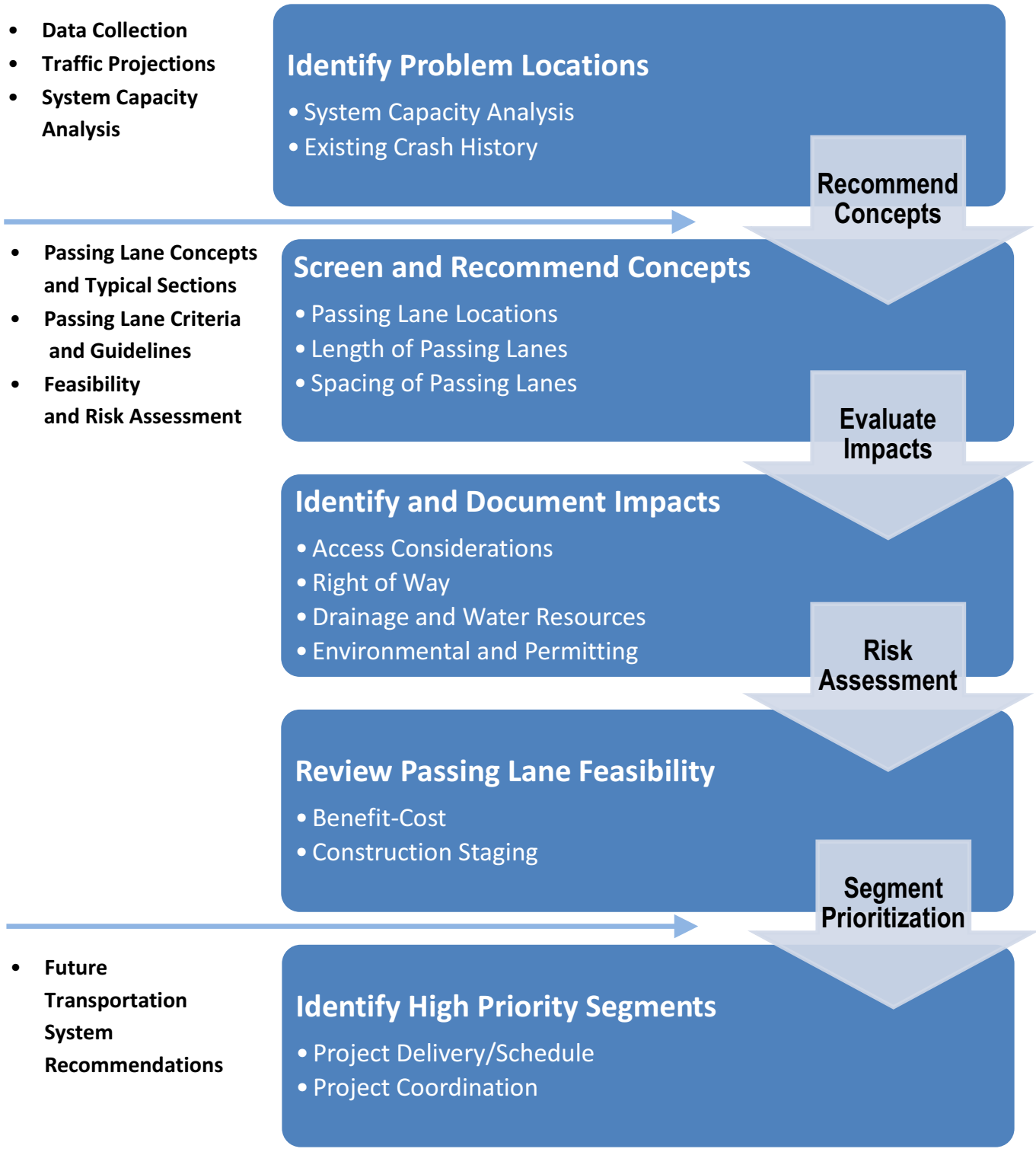
MnDOT District 8



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Evaluation Process

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
MnDOT District 8

Figure 3

Background

Freight Considerations

As previously noted, freight traffic along the TH 23 corridor is a significant part of the overall traffic with heavy vehicle percentages ranging from 8.7 to 16.5 percent. It was identified in the *Manufacturers' Perspectives on Minnesota's transportation System: A Pilot Study in Southwest Minnesota* that "low-cost, high benefit" solutions, including expanding sections of the two-lane to a four-lane highway, would provide economic benefits to businesses and manufacturers who depend on freight vehicles to arrive without delay with consistent travel times.

The study also states the importance of the maintenance and operations of TH 23, "As a main north-south corridor in District 8, Highway 23 was the most heavily used." This heavy use can create additional conflict opportunities between vehicles, which can lead to passing in unsafe ways, or at inopportune times. A passing lane would provide low-cost, high benefit improvements to the study corridor providing consistent travel times, increased corridor safety and reduced congestion between major cities along the TH 23 corridor.

In addition to the Manufacturers' Perspective Study, businesses were contacted for the Highway 23 Passing Lane Assessment to request input on specific locations along the corridor where economic benefits could be expected by implementing passing lanes (see Appendix A). It was noted that the input would be used as an influencing criteria for prioritizing the passing lane locations while being balanced with the other factors (i.e. average daily traffic volumes, number of access points, right of way impacts, terrain and other physical constraints, etc.).

A total of 18 businesses provided input (21 businesses were contacted). The overlying theme of the responses was that passing lanes need to be added between the larger cities and more heavily traveled routes in order to break up the platoons of vehicles (I-90 to Pipestone, Pipestone to Marshall, Marshall to TH 212, and TH 212 to Willmar) with the preference of locating passing lanes immediately after departing the cities. There was also a lot of response about traffic that was exiting and entering at Marshall. Marshall is a key point in the corridor that has connections to major roadways including TH 59, TH 19 and TH 68. According to the responses, the majority of the truck traffic is year round and not seasonal.

Future TH 23 Projects

To assist in coordinating future passing lane projects with future TH 23 projects, MnDOT provided a list of upcoming projects along the corridor (see Appendix A). The following projects could influence the construction letting timeframe of a passing lane project:

- TH 23 Overlay from Clara City to Willmar, FY 2017
- TH 23 Mill and Concrete Overlay from Cottonwood to Granite Falls, FY 2020*

* Please note that this project is outside the four-year State Transportation Improvement Program (STIP) and may be subject to schedule changes.

Crash History

Historical crash data was collected for each corridor segment along the TH 23 corridor for a five-year period from 2009-2013 using the MnCMAT crash mapping and analysis tool (see Appendix A). Most of the segments along TH 23 had lower crash rates than the average crash rates for similar type segments; however, Segments 7, 9 and 11 were over the average crash rate but are still under the critical crash rate. It should be noted that a higher than typical crash rate does not necessarily indicate a significant crash problem. Therefore, the critical crash rates were calculated to determine the statistical significance of the above average crash rates. If the calculated crash rate is below the critical crash rate, crashes that occurred are typically due to the random nature of crashes and are not necessarily a geometric design or traffic control issue. However, if the existing crash rate is above the critical crash rate, there is generally a significant amount of crashes above normal to warrant further review or mitigation. As previously stated, all segments were below the critical crash rate.

Intersection crash rates for a ten-year period from 2003-2012 were provided by MnDOT. For the intersection crash analysis the critical crash rate, severity rate, intersection fatal crash rate, and fatal and serious injury crash rates were all reviewed for the major intersections along the corridor. Intersections that exceeded the critical values for these rates were removed from the rest of the intersections for further analysis. Most of these intersections exceeded the critical severity rate while only three exceeded the critical crash rate. This trend shows that although there are a lower number of crashes along the corridor, the severity of the crashes are higher. Most of the intersections with crash rates above the critical rate are programmed for improvement and these intersections should be avoided within passing lane sections when possible.

Traffic Projections

The existing and historical traffic volume data collection and methodology for the Highway 23 Passing Lane Assessment is documented in *Technical Memorandum No. 1: Traffic Projections* (SRF Consulting Group, January 2014). The memorandum also documents the methodology and assumptions used to developed traffic projections. The memorandum is provided in Appendix B. The following provides a summary (see Figure 4):

Existing Traffic Volumes

Historical Annual Average Daily Traffic (AADT) volume data was obtained from MnDOT's Traffic Forecasting and Analysis office. The published AADT is an estimate of the average overall number of vehicles using a roadway on any given day of the year. Supplemental 24-hour turning movement counts were also collected by video imaging at intersections along the study corridor during the week of December 16, 2013.

Heavy Commercial Historical Annual Average Daily Traffic (HCAADT) data was obtained from MnDOT's Traffic Forecasting and Analysis office. Using the historical HCAADT and AADT volumes the truck percentages were calculated and compared to 2013 SRF truck percentages obtained from the 24-hour counts. The 2013 SRF truck percentages were used where it is comparable with the historical data; otherwise the most recent calculated MnDOT truck percentage was assumed.

The existing traffic volume data collected was used to develop daily volume profiles and establish peak directional flows along the corridor.

Future Traffic Volumes

Daily traffic forecasts for 2020 and 2040 were developed for the 13 segments of TH 23 between I-90 and Willmar. Five-year increment forecasts between 2020 and 2040 were also estimated based on linear interpolation.

The Minnesota Equivalent Single Axle Load (MnESAL) traffic forecasting tool was applied to 2013 SRF 24-hour counts and to 2012 and 2013 MnDOT AADT values to develop the projections. The MnESAL tool uses approximately 20 years of historical AADTs to project a future daily traffic volume based on linear regression.

Forecasts using the MnESAL method had similar growth rates compared to MnDOT forecasts developed in 2008 and 2012 along the corridor, but had a smaller growth rate compared to the forecasts developed in 2002. This difference was caused by little to no growth on Segments 3 and 4 between 2004 and 2012. Annual growth rates along the study area range from 0.5 to 1.9 percent which is consistent with the historical 20 year growth rates which range from 0.0 to 2.1 percent.

Segment 13
Existing AADT: 5,900
Percent Trucks: 8.7%
2020 AADT: 6,300
2025 AADT: 6,600
2030 AADT: 6,900
2035 AADT: 7,100
2040 AADT: 7,400

Segment 12
Existing AADT: 4,700
Percent Trucks: 12.2%
2020 AADT: 5,100
2025 AADT: 5,400
2030 AADT: 5,800
2035 AADT: 6,100
2040 AADT: 6,400

Segment 11
Existing AADT: 3,000
Percent Trucks: 14.9%
2020 AADT: 3,200
2025 AADT: 3,400
2030 AADT: 3,500
2035 AADT: 3,700
2040 AADT: 3,800

Segment 9
Existing AADT: 3,600
Percent Trucks: 13.9%
2020 AADT: 4,000
2025 AADT: 4,300
2030 AADT: 4,600
2035 AADT: 4,800
2040 AADT: 5,100

Segment 10
Existing AADT: 3,000
Percent Trucks: 15.3%
2020 AADT: 3,200
2025 AADT: 3,400
2030 AADT: 3,600
2035 AADT: 3,800
2040 AADT: 4,000

Segment 8
Existing AADT: 3,950
Percent Trucks: 10.6%
2020 AADT: 4,200
2025 AADT: 4,400
2030 AADT: 4,500
2035 AADT: 4,700
2040 AADT: 4,800

Segment 6
Existing AADT: 2,900
Percent Trucks: 16.3%
2020 AADT: 3,000
2025 AADT: 3,100
2030 AADT: 3,200
2035 AADT: 3,200
2040 AADT: 3,300

Segment 4
Existing AADT: 2,700
Percent Trucks: 16.5%
2020 AADT: 2,800
2025 AADT: 2,800
2030 AADT: 2,900
2035 AADT: 2,900
2040 AADT: 3,000

Segment 7
Existing AADT: 4,300
Percent Trucks: 15.3%
2020 AADT: 4,500
2025 AADT: 4,600
2030 AADT: 4,700
2035 AADT: 4,800
2040 AADT: 4,900

Segment 5
Existing AADT: 2,750
Percent Trucks: 15.3%
2020 AADT: 3,000
2025 AADT: 3,200
2030 AADT: 3,300
2035 AADT: 3,500
2040 AADT: 3,600

Segment 2
Existing AADT: 3,000
Percent Trucks: 14.1%
2020 AADT: 3,400
2025 AADT: 3,700
2030 AADT: 4,000
2035 AADT: 4,200
2040 AADT: 4,500

Segment 3
Existing AADT: 2,900
Percent Trucks: 15.2%
2020 AADT: 3,000
2025 AADT: 3,100
2030 AADT: 3,200
2035 AADT: 3,300
2040 AADT: 3,400

Segment 1
Existing AADT: 1,750
Percent Trucks: 11.1%
2020 AADT: 2,000
2025 AADT: 2,100
2030 AADT: 2,200
2035 AADT: 2,300
2040 AADT: 2,400

SRF Count Locations

0 5 10 20 Miles

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Existing and Forecast Traffic Volumes

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Figure 4

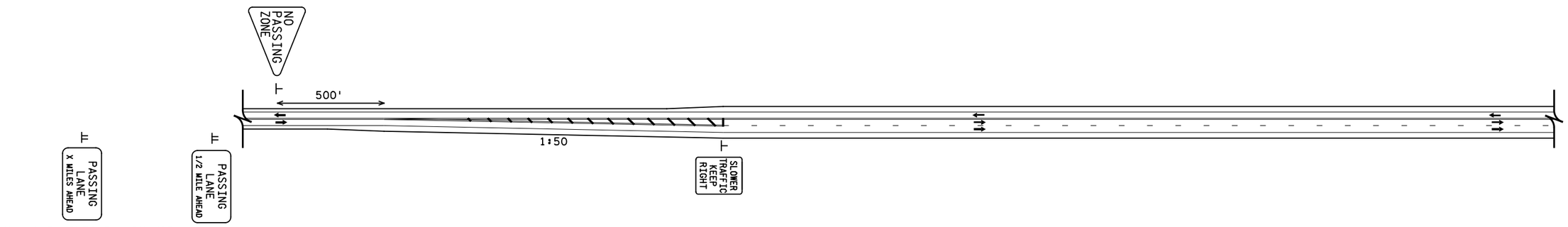
Passing Lane Concepts and Typical Sections

The development of passing lane concepts and typical sections for the Highway 23 Passing Lane Assessment is documented in *Technical Memorandum No. 2: Passing Lane Concepts and Typical Sections* (SRF Consulting Group, April 2014) which is provided in Appendix C. For the purposes of the assessment, four passing lane concepts were developed (see Table 1 and Figures 5-13). All of the concepts direct drivers into the right-lane (non-passing lane) at the lane addition. This results in a more effective passing lane from a safety and operations perspective. Additional discussion regarding the use of cable median barriers and the position of the roadway crown for the 2+1 concept is documented in Appendix C.

Table 1. Summary of Passing Lane Concepts and Typical Sections

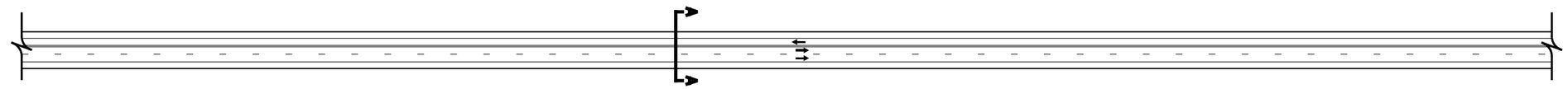
Concept	Overview	Application
3-Lane Section, Outside Lane Addition	• Improves safety and operations at spot locations in one direction at a time • Can be paired in intermittent sections at regular intervals with frequency dependent on desired level of service • Restricts passing opportunities in opposing direction	• Isolated locations • Intermittent sections
4-Lane Section, Outside Lane Addition	• Improves safety and operations at spot locations in both directions at a time • Does not restrict passing opportunities in opposing direction • Physical constraints can limit the ability to implement a 4-lane passing section	• Isolated locations
Super Two, 3-Lane Section with Buffer	• Improves safety and operations at spot locations in one direction at a time • Can be paired in intermittent sections at regular intervals with frequency dependent on desired level of service • Restricts passing opportunities in opposing direction • Includes a centerline "buffer" • Requires wider cross-section than traditional 3-lane section	• Isolated locations • Intermittent sections
2+1, Continuous 3-Lane Section Along Entire Segment with Alternating Passing Lanes and Buffer	• Improves safety and operations at spot locations in one directions at a time • Restricts passing opportunities in opposing direction • Introduces a left-lane drop • Alternating left-lane drops could provide confusion for some motorists	• Continuous sections; Transitions = 500 feet (min.) for "tail-to-tail; 1,500 feet (min.) for head-to-head

3-LANE SECTION, OUTSIDE LANE ADDITION

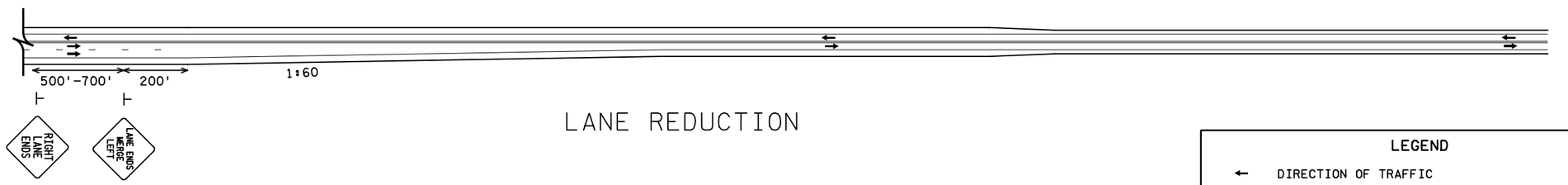


X = 2-5 MILES IN ADVANCE OF PASSING LANE

LANE ADDITION



FULL PASSING LANE SECTION



LANE REDUCTION

LEGEND

- DIRECTION OF TRAFFIC
- BROKEN LINE - WHITE (10' LINE WITH 40' GAP)
- DOUBLE SOLID LINE - YELLOW
- SOLID LINE YELLOW (CROSS HATCH)

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3-Lane Section, Outside Lane Addition

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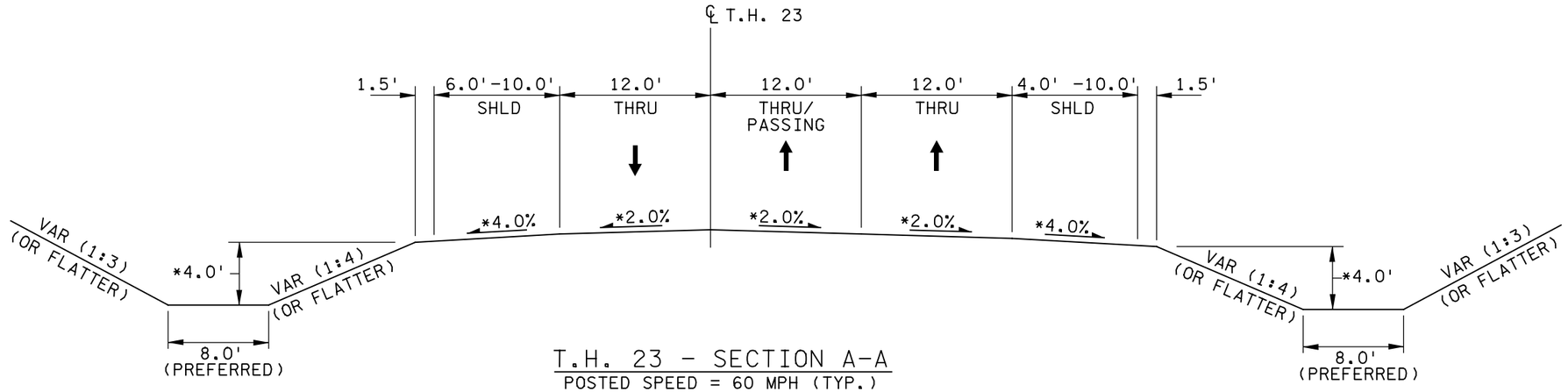
Figure 5

3-LANE SECTION, OUTSIDE LANE ADDITION



T.H. 23 - SECTION A-A

POSTED SPEED = 60 MPH (TYP.)

* - ASSUMED VALUES (FOR COST ESTIMATING)

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3-Lane Section, Outside Lane Addition

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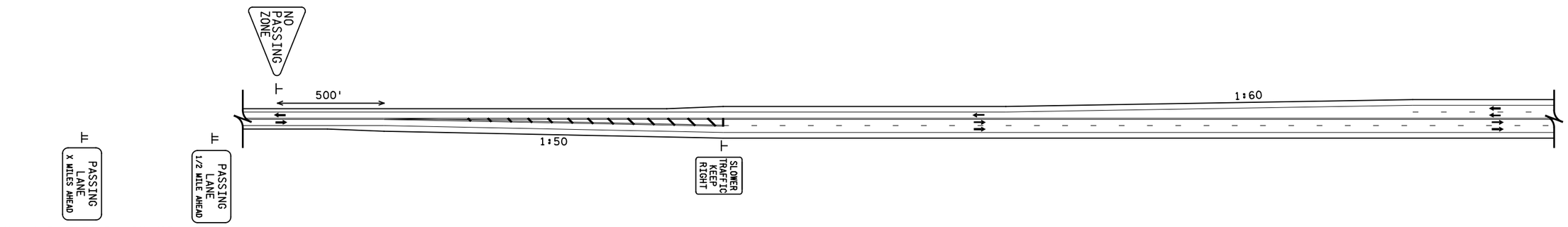
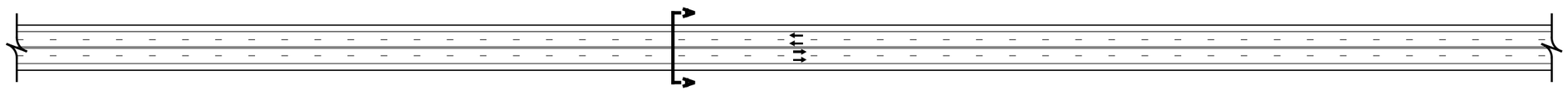
Figure 6

4-LANE SECTION, OUTSIDE LANE ADDITION

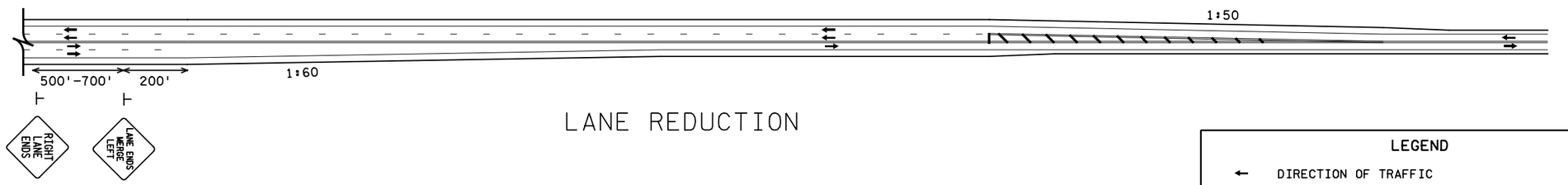


X = 2-5 MILES IN ADVANCE OF PASSING LANE

LANE ADDITION



FULL PASSING LANE SECTION



LANE REDUCTION

LEGEND

- DIRECTION OF TRAFFIC
- BROKEN LINE - WHITE (10' LINE WITH 40' GAP)
- DOUBLE SOLID LINE - YELLOW
- SOLID LINE YELLOW (CROSS HATCH)

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4-Lane Section, Outside Lane Addition

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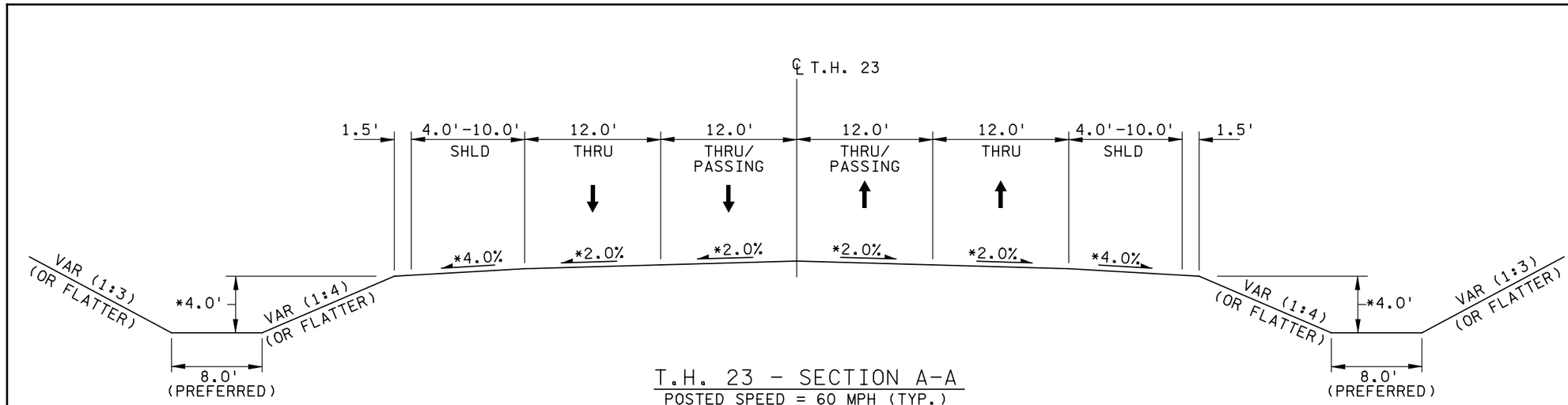
Figure 7

4-LANE SECTION, OUTSIDE LANE ADDITION



T.H. 23 - SECTION A-A

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* - ASSUMED VALUES (FOR COST ESTIMATING)

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4-Lane Section, Outside Lane Addition

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
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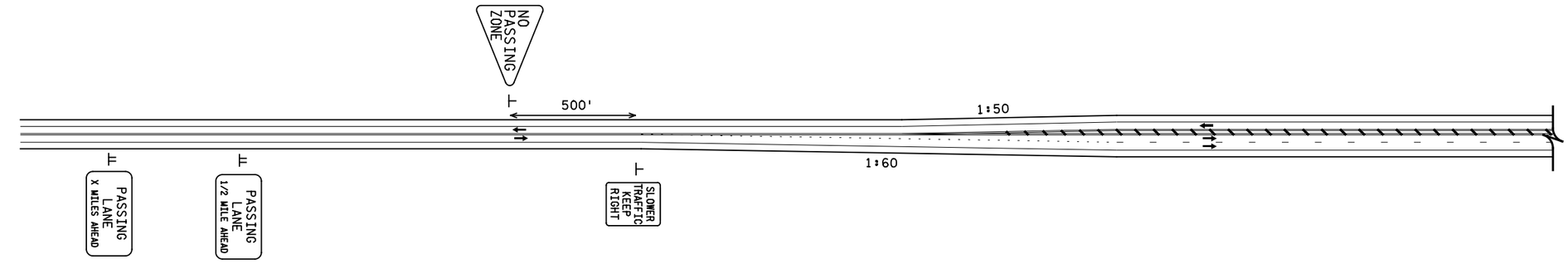
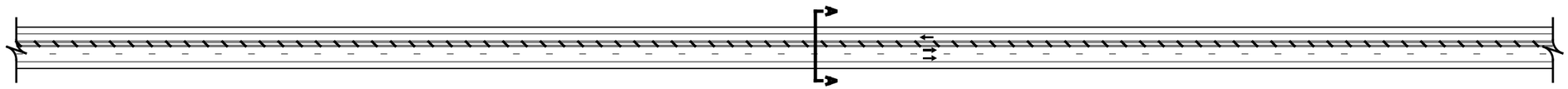
Figure 8

SUPER TWO, 3-LANE SECTION WITH BUFFER

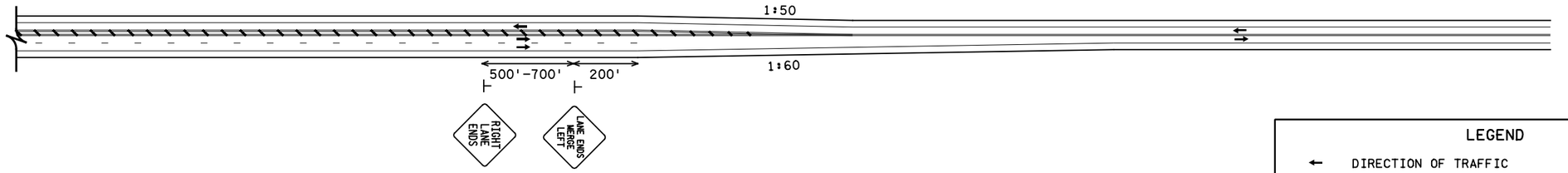


X = 2-5 MILES IN ADVANCE OF PASSING LANE

LANE ADDITION



FULL PASSING LANE SECTION



LANE REDUCTION

LEGEND

- DIRECTION OF TRAFFIC
- BROKEN LINE - WHITE (10' LINE WITH 40' GAP)
- DOTTED LINE - WHITE (3' LINE WITH 12' GAP)
- DOUBLE SOLID LINE - YELLOW SOLID
- SOLID LINE YELLOW (CROSS HATCH)

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Super Two, 3-Lane Section with Buffer

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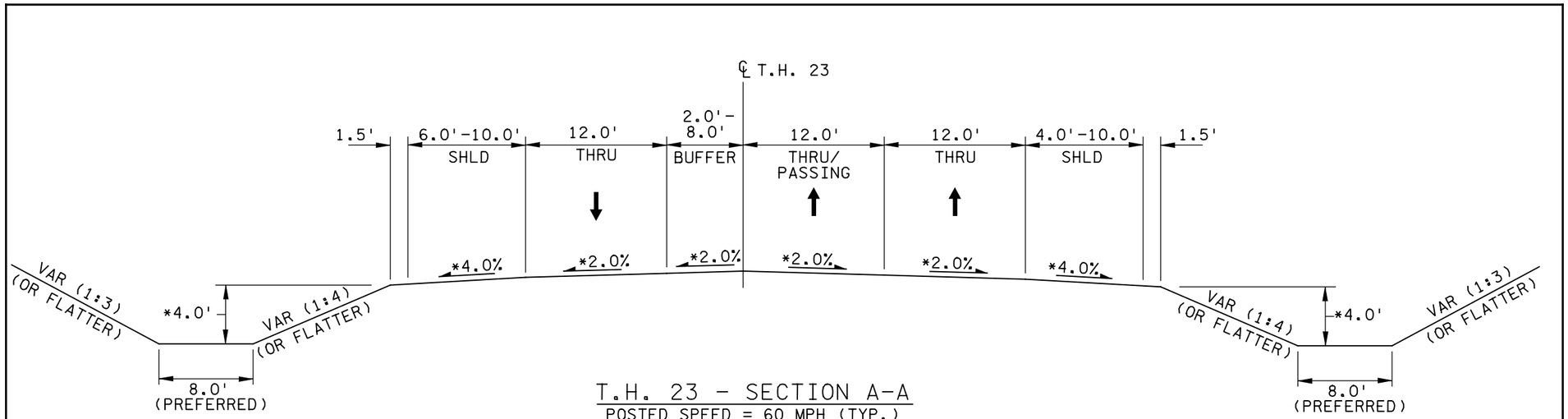
MnDOT District 8

Figure 9

SUPER TWO, 3-LANE SECTION WITH BUFFER



T.H. 23 - SECTION A-A

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* - ASSUMED VALUES (FOR COST ESTIMATING)

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Super Two, 3-Lane Section with Buffer

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
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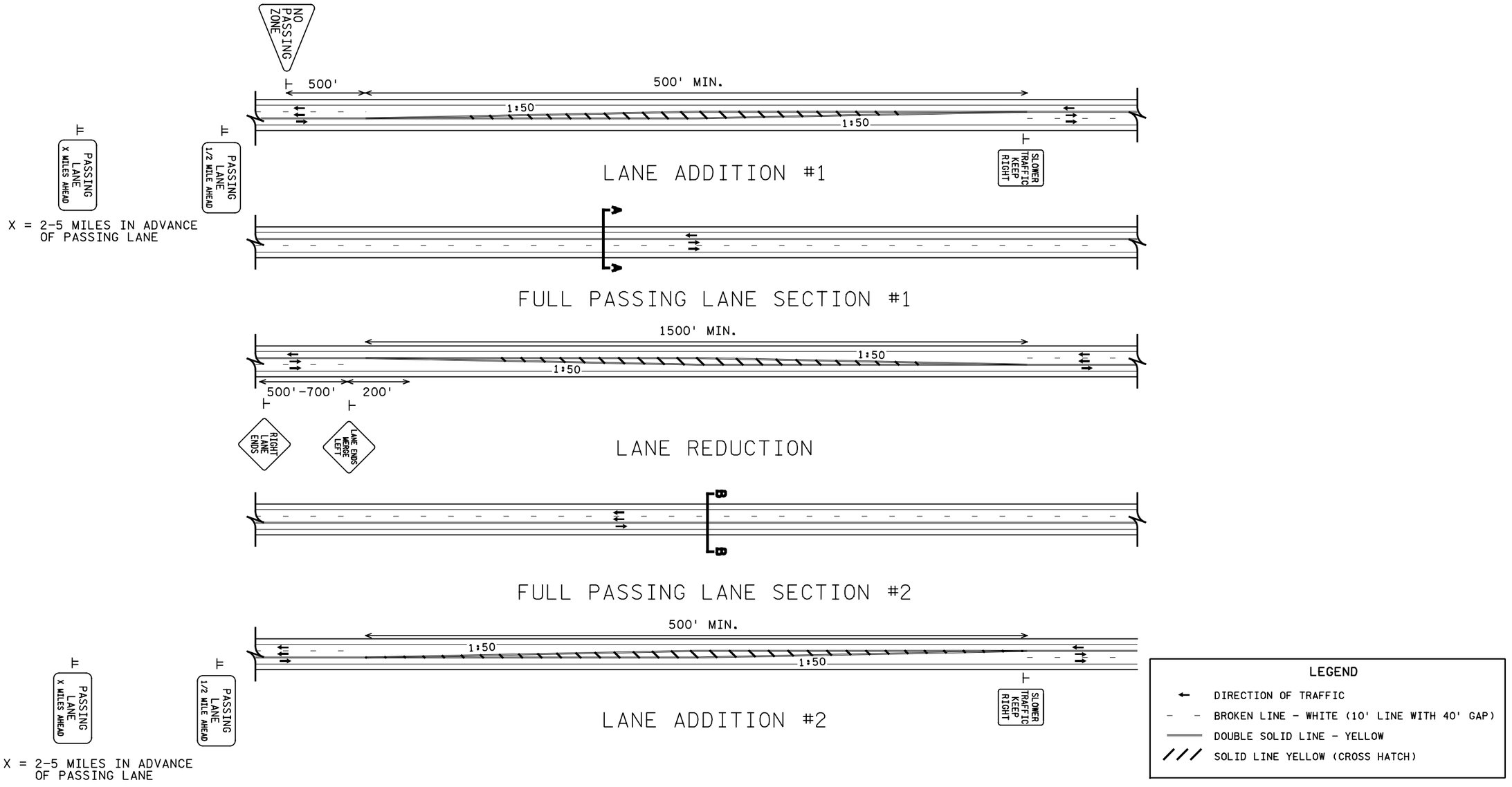
Figure 10

2+1, CONTINUOUS 3-LANE SECTION ALONG ENTIRE SEGMENT WITH ALTERNATING PASSING LANES AND BUFFER



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2+1, Continuous 3-Lane Section Along Entire Segment with Alternating Passing Lanes and Buffer

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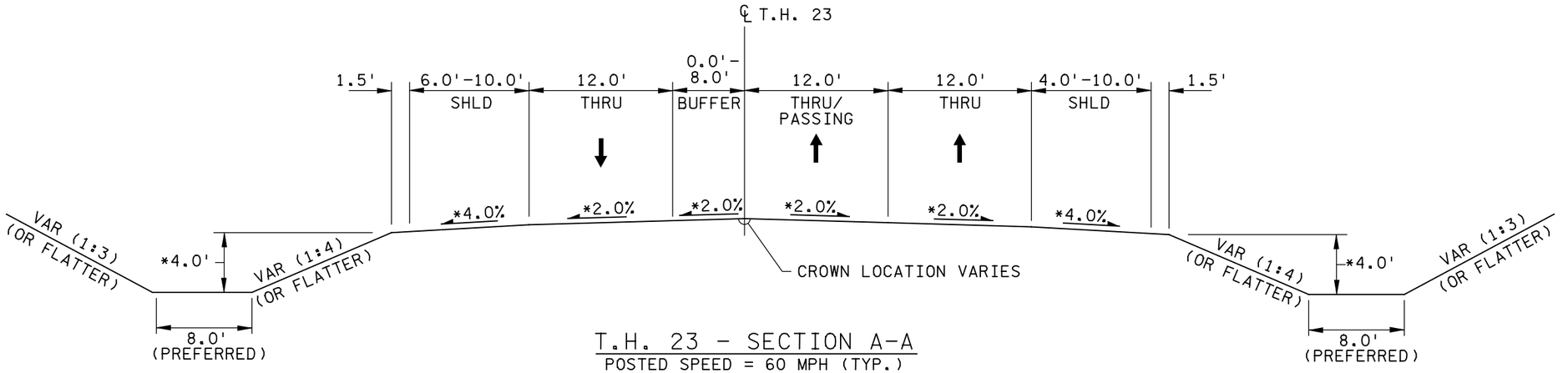
Figure 11

2+1, CONTINUOUS 3-LANE SECTION ALONG ENTIRE SEGMENT WITH ALTERNATING PASSING LANES AND BUFFER



T.H. 23 - SECTION A-A

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* - ASSUMED VALUES (FOR COST ESTIMATING)

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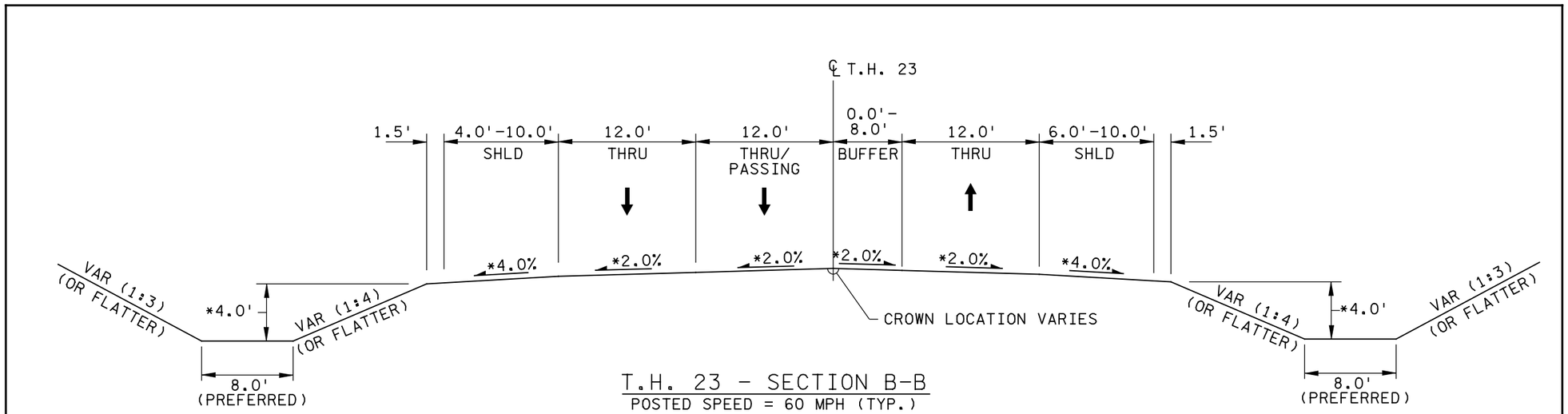
2+1, CONTINUOUS 3-LANE SECTION ALONG ENTIRE SEGMENT WITH ALTERNATING PASSING LANES AND BUFFER



T.H. 23 - SECTION B-B

POSTED SPEED = 60 MPH (TYP.)

* - ASSUMED VALUES (FOR COST ESTIMATING)

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Passing Lane Criteria and Guidelines

The development of passing lane criteria and guidelines for the Highway 23 Passing Lane Assessment is documented in *Technical Memorandum No. 3: Passing Lane Criteria and Guidelines* (SRF Consulting Group, April 2014) which is provided in Appendix D. The evaluation criteria developed is largely based on the MnDOT Road Design Manual with respect to guidance on passing lanes. For each criterion developed, an evaluation objective(s) was identified, as well a measure(s) for comparison purposes. The evaluation criteria include both quantitative and qualitative measures. Table 2 summarizes the criteria developed. Each corridor segment was evaluated based on these criteria to inform the feasibility and risk assessment.

Table 2. Passing Lane Evaluation Criteria

	Evaluation Criteria	Evaluation Objective(s)	Measure(s) for Comparison
Locations Needing Improvement	System Capacity Analysis	• Conduct congestion analysis comparing no passing lane vs. passing lane concept based on daily volume profiles, directional splits and peak hour percentage of daily traffic • Evaluate existing conditions and forecast horizon year 2040	• Average Travel Speed • Percent Time-Spent Following (PTSF) • Existing Percent No Passing
	Existing Crash History	• Identify existing higher risk segments	• Number of Crashes • Average Crash Rate • Critical Crash Rate
Screen and Recommend Concepts	Passing Lane Locations	• Identify locations that would meet driver expectations • Identify segments with high truck volumes • Identify segments with economical improvements for freight	• Existing AADT • Existing HCAADT • Percent Trucks • 2040 AADT
	Length of Passing Lanes	• Provide sufficient passing lane length to have substantial reduction in traffic platooning • Limit passing lane lengths to the appropriate length	• Length of Passing Lane 0.9 to 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8; also consider freight movements during evaluation)
	Spacing of Passing Lanes	• Consider traffic operations based on passing opportunities outside of passing lanes	• Passing Lane Spacing of 5 to 9 miles
Identify and Document Impacts	Access Considerations	• Identify locations with high density of access points • Identify access locations impacted by a passing lane • Avoid access locations in transitions • Minimize access in two-lane passing sections	• Number of Access Points per Mile • Number of Access Points Impacted
	Right of Way	• Identify locations where the Right of Way would be impacted by a passing lane	• Existing ROW • Risk of ROW Impact
	Drainage and Water Resources	• Identify locations where the Drainage or Wetlands would be impacted by a passing lane • Identify locations where bridges would be impacted by a passing lane	• Risk of Wetland Impact • Risk of Bridge Impacts
	Environmental and Permitting	• Identify locations where a passing lane would have an environment impact • Identify locations that would widen the roadway footprint in animal crossing areas	• Risk of Environmental Impact • Risk of Wildlife Impact
Review Concept Feasibility	Benefit-Cost	• Identify the capacity costs of the improvements needed for a passing lane • Identify future maintenance costs associated with a passing lane • Evaluate benefit-cost of passing lane improvement	• Benefit-Cost
	Construction Staging	• Identify locations with potential constructability issues • Review potential construction staging	• Grades • In-slopes • Ditches • Utilities

Segment Maps with Draft Passing Lane Locations

MnDOT and SRF staff conducted a work session to identify Draft potential passing lane locations along each segment. As a general rule, the following guidelines were used:

- A passing lane length of 0.9 to 1.1 miles, not including tapers.
- Passing lane spacing of 5 to 9 miles.
- A center-line buffer of 8 feet for worst case right of way impact and total project length.
- Avoid intersections and access in tapers.
- Minimize the number of public and private accesses within the passing lane section. If a public assess is included, low volume access locations are preferred.
- Avoid locations with physical constraints (box culverts, bridges, buildings, etc.).
- Avoid environmental features which would require additional review and permitting. This includes wetlands, MPCA potentially contaminated sites, scientific and natural areas, wildlife management areas/districts, and MCBS biodiversity sites. Impacts related to these locations can delay the delivery of a project.

Figures 14-26 illustrate the recommended Draft potential locations of passing lanes by segment that were used in the passing lane evaluation and risk assessment.

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Segment 1 - I-90 to Jasper

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 14

Signalized
Stop Controlled
Yield Controlled
Railroad Crossing
Speed Limits

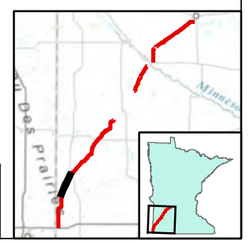
Private Access
Box Culvert
Pipe Culvert
Bridge
Rivers and Streams

Potential Passing Lane Locations and Direction
No Passing Zone
Right-of-Way
Wetlands

Potentially Contaminated Site (MPCA)
Scientific and Natural Area
Wildlife Management Area
Wildlife Management District
MCBS Biodiversity Site

NRHP Eligible Property
Potential Historic Property
Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles



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Segment 2 - Jasper to Pipestone
Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 15

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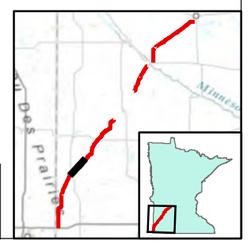
- Signalized
- Stop Controlled
- Yield Controlled
- Railroad Crossing
- Speed Limits
- Private Access
- Box Culvert
- Pipe Culvert
- Bridge
- Rivers and Streams
- Potential Passing Lane Locations and Direction
- No Passing Zone
- Right-of-Way
- Wetlands
- Potentially Contaminated Site (MPCA)
- Scientific and Natural Area
- Wildlife Management Area
- Wildlife Management District
- MCBS Biodiversity Site
- NRHP Eligible Property
- Potential Historic Property
- Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles



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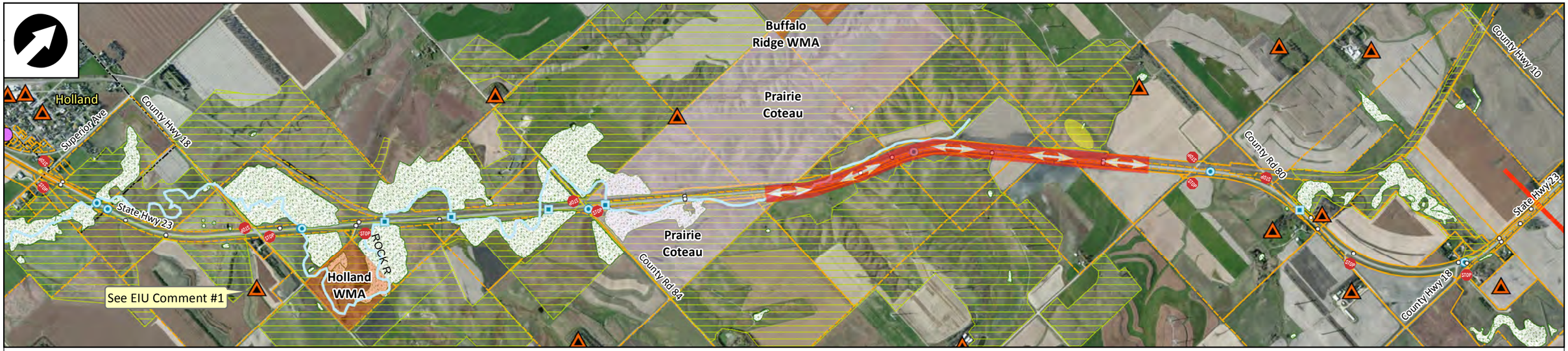
Segment 3 - Pipestone to Holland

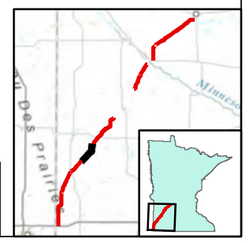
Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 16



- Signalized
- Stop Controlled
- Yield Controlled
- Railroad Crossing
- Speed Limits
- Private Access
- Box Culvert
- Pipe Culvert
- Bridge
- Rivers and Streams
- Potential Passing Lane Locations and Direction
- No Passing Zone
- Right-of-Way
- Wetlands
- Potentially Contaminated Site (MPCA)
- Scientific and Natural Area
- Wildlife Management Area
- Wildlife Management District
- MCBS Biodiversity Site
- NRHP Eligible Property
- Potential Historic Property
- Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles



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Job #013 08331

Segment 4 - Holland to Ruthton
Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 17

- Signalized
- Stop Controlled
- Yield Controlled
- Railroad Crossing
- Speed Limits
- Private Access
- Box Culvert
- Pipe Culvert
- Bridge
- Rivers and Streams
- Potential Passing Lane Locations and Direction
- No Passing Zone
- Right-of-Way
- Wetlands
- Potentially Contaminated Site (MPCA)
- Scientific and Natural Area
- Wildlife Management Area
- Wildlife Management District
- MCBS Biodiversity Site
- NRHP Eligible Property
- Potential Historic Property
- Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles

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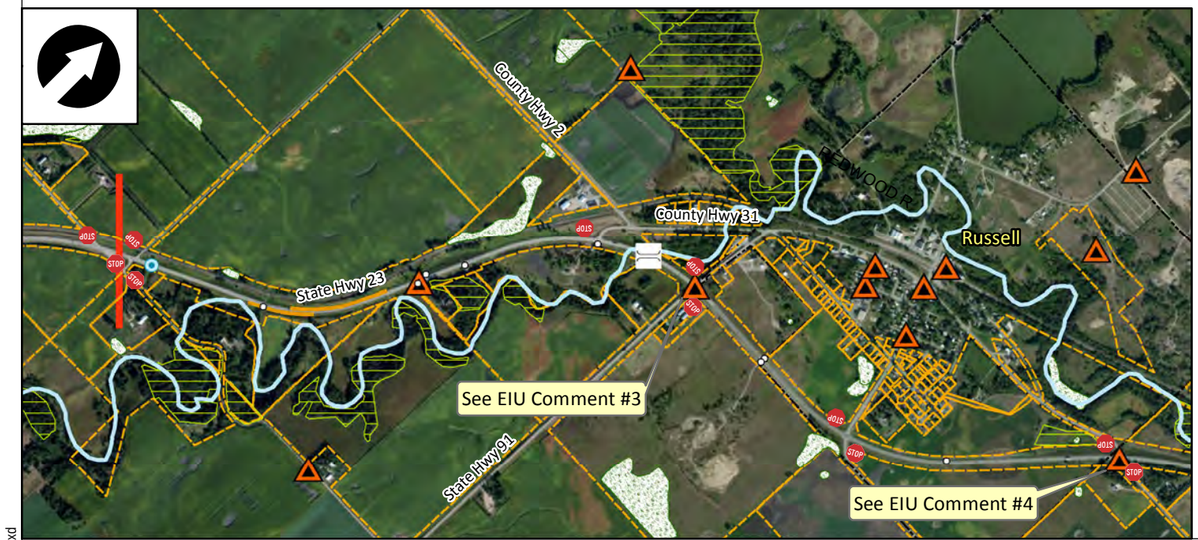
Job #013 08331

Segment 5 - Ruthton to Florence
Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 18



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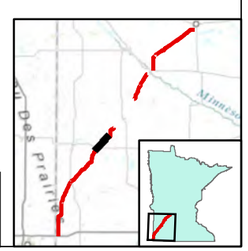
- Signalized
- Stop Controlled
- Yield Controlled
- Railroad Crossing
- Speed Limits
- Private Access
- Box Culvert
- Pipe Culvert
- Bridge
- Rivers and Streams
- Potential Passing Lane Locations and Direction
- No Passing Zone
- Right-of-Way
- Wetlands
- Potentially Contaminated Site (MPCA)
- Scientific and Natural Area
- Wildlife Management Area
- Wildlife Management District
- MCBS Biodiversity Site
- NRHP Eligible Property
- Potential Historic Property
- Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles



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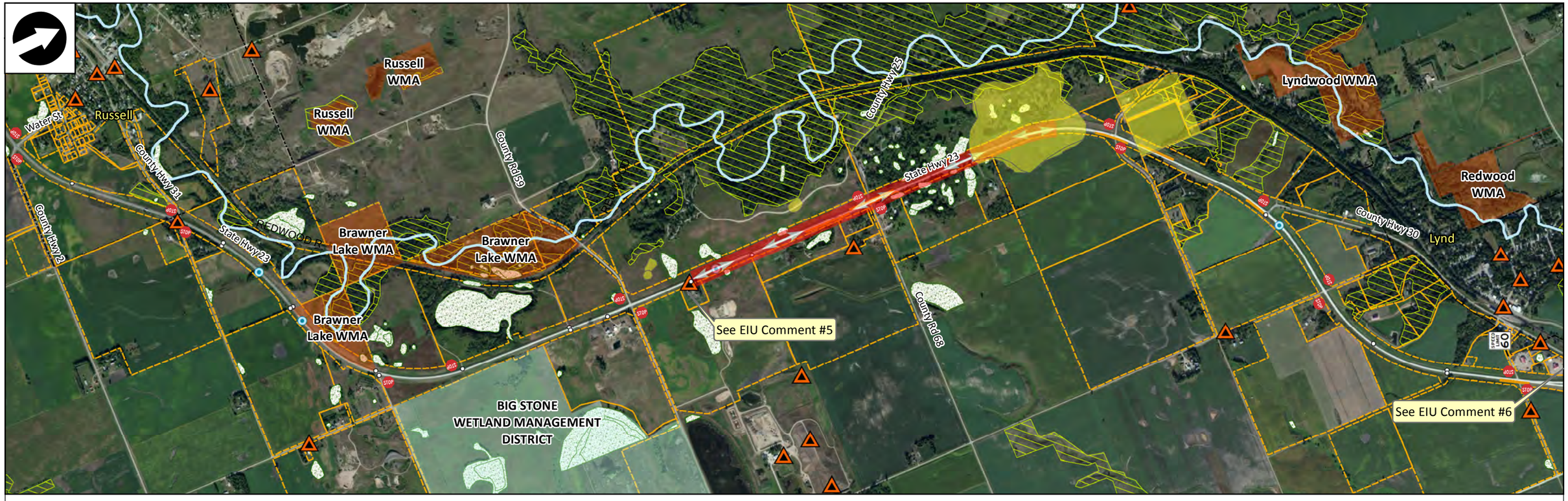
Job #013 08331

Segment 6 - Florence to Russell

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 19



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Segment 7 - Russell to Lynd

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 20

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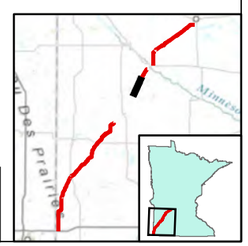
- Signalized
- Stop Controlled
- Yield Controlled
- Railroad Crossing
- Speed Limits
- Private Access
- Box Culvert
- Pipe Culvert
- Bridge
- Rivers and Streams
- Potential Passing Lane Locations and Direction
- No Passing Zone
- Right-of-Way
- Wetlands
- Potentially Contaminated Site (MPCA)
- Scientific and Natural Area
- Wildlife Management Area
- Wildlife Management District
- MCBS Biodiversity Site
- NRHP Eligible Property
- Potential Historic Property
- Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles



Segment 8 - Cottonwood to Hanley Falls

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)

Minnesota Department of Transportation

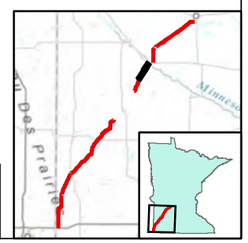
SRF Consulting Group, Inc.

Job #013 08331

Figure 21

- Signalized
- Stop Controlled
- Yield Controlled
- Railroad Crossing
- Speed Limits
- Private Access
- Box Culvert
- Pipe Culvert
- Bridge
- Rivers and Streams
- Potential Passing Lane Locations and Direction
- No Passing Zone
- Right-of-Way
- Wetlands
- Potentially Contaminated Site (MPCA)
- Scientific and Natural Area
- Wildlife Management Area
- Wildlife Management District
- MCBS Biodiversity Site
- NRHP Eligible Property
- Potential Historic Property
- Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles



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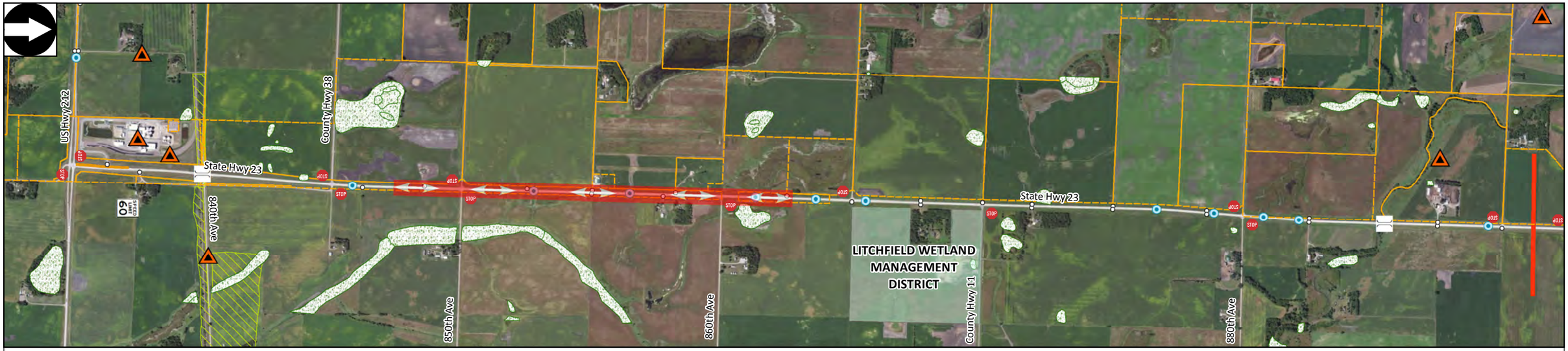
Segment 9 - Hanley Falls to TH 274
Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 22



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- Signalized
- Stop Controlled
- Yield Controlled
- Railroad Crossing
- Speed Limits
- Private Access
- Box Culvert
- Pipe Culvert
- Bridge
- Rivers and Streams
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- Wildlife Management District
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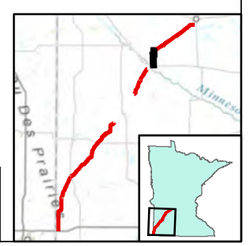
- NRHP Eligible Property
- Potential Historic Property
- Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles



Segment 10 - Granite Falls to Maynard

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)

Minnesota Department of Transportation

Job #013 08331

Figure 23

Signalized
Stop Controlled
Yield Controlled
Railroad Crossing
Speed Limits

Private Access
Box Culvert
Pipe Culvert
Bridge
Rivers and Streams

Potential Passing Lane Locations and Direction
No Passing Zone
Right-of-Way
Wetlands

Potentially Contaminated Site (MPCA)
Scientific and Natural Area
Wildlife Management Area
Wildlife Management District
MCBS Biodiversity Site

NRHP Eligible Property
Potential Historic Property
Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles

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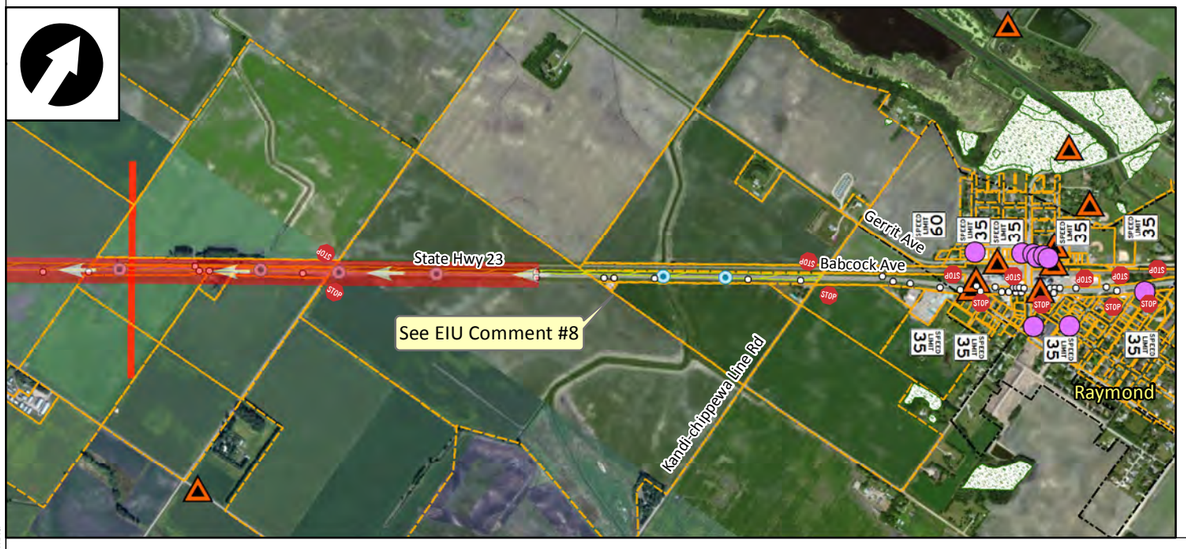
Segment 11 - Maynard to Clara City
Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 24



Signalized
Stop Controlled
Yield Controlled
Railroad Crossing
Speed Limits
Private Access
Box Culvert
Pipe Culvert
Bridge
Rivers and Streams
Potential Passing Lane Locations and Direction
No Passing Zone
Right-of-Way
Wetlands
Potentially Contaminated Site (MPCA)
Scientific and Natural Area
Wildlife Management Area
Wildlife Management District
MCBS Biodiversity Site
NRHP Eligible Property
Potential Historic Property
Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles

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SRF Consulting Group, Inc.
Job #013 08331

Segment 12 - Clara City to Raymond
Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 25

- Signalized
- Stop Controlled
- Yield Controlled
- Railroad Crossing
- Speed Limits
- Private Access
- Box Culvert
- Pipe Culvert
- Bridge
- Rivers and Streams
- Potential Passing Lane Locations and Direction
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- Wildlife Management District
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- NRHP Eligible Property
- Potential Historic Property
- Previously Surveyed Archaeological Site

0 0.25 0.5 1 Miles

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Job #013 08331

Segment 13 - Raymond to Willmar
Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
Minnesota Department of Transportation

Figure 26

System Capacity Analysis

The methodology and assumptions used to conduct the system capacity analysis for the Highway 23 Passing Lane Assessment are documented in *Technical Memorandum No. 4: System Capacity Analysis* (SRF Consulting Group, April 2014) which is provided in Appendix E. The following provides a summary of the memorandum:

- The segments were analyzed using the Highway Capacity Software 2010 (HCS). HCS utilizes the two-lane highway methodology presented in the *Highway Capacity Manual* (HCM) to determine the average travel speed and percent time-spent following. For the purposes of this analysis, segments were compared by using the percent time-spent following results to give more definitive differentiation between segments.

- The two-lane highway methodology utilizes roadway geometric data, demand volume and field-measured speed or estimated base free-flow speed inputs. Adjustments are made based on lane and shoulder widths, roadway grades and the length of no passing zones, access-point density, flow rate, heavy vehicle percentage, and the peak hour factor.

- The lane width, shoulder width, roadway grades and length of no passing zones, and access-point density were determined from MnDOT roadway video logs and corridor aerial imagery.

- Existing traffic volumes indicate the p.m. peak hour is the heaviest period of traffic on all corridor segments except Segment 6. The existing a.m. peak hour represents the heaviest period of traffic for Segment 6.

- The effective length of a passing lane is typically greater than the actual length of the passing lane. More specifically, passing lanes provide benefit to traffic flows downstream of the passing lane section. The effective length ranges from 5 to 13 miles depending on the demand flow rate. As a result, the analysis segment lengths for the future build conditions include the full length of the passing lane's downstream effect.

A summary of the system capacity analysis for Existing 2014, Future 2040 No Build and Future 2040 Build conditions is provided in Table 3.

Table 3. System Capacity Analysis Summary

Location	Peak Hour	Travel Direction	Existing 2014 Conditions		Future 2040 No Build Conditions		Future 2040 Build Conditions	
			Average Travel Speed (mph)	Percent Time-Spent Following	Average Travel Speed (mph)	Percent Time-Spent Following	Average Travel Speed (mph)	Percent Time-Spent Following
Segment 1: I-90 to Jasper	PM	NB	61.4	28.4	60.6	31.8	61.3	25.5
		SB	61.0	29.7	60.3	33.7	61.0	27.0
Segment 2: Jasper to Pipestone	PM	NB	60.4	26.5	58.6	35.6	59.4	28.4
		SB	60.3	21.7	59.0	29.8	59.7	23.8
Segment 3: Pipestone to Holland	PM	NB	61.1	26.2	60.6	29.2	61.3	23.1
		SB	60.6	18.4	60.0	20.5	60.7	16.1
Segment 4: Holland to Ruthton	PM	NB	61.3	19.0	61.0	20.7	61.6	16.7
		SB	61.2	18.8	60.8	20.2	61.5	16.5
Segment 5: Ruthton to Florence	PM	NB	60.8	17.1	59.6	21.3	60.3	16.9
		SB	61.2	22.5	60.1	27.6	60.9	21.7
Segment 6: Florence to Russell	AM	NB	60.8	20.9	60.3	23.4	61.0	18.3
		SB	60.8	21.8	60.3	24.3	60.9	20.1
Segment 7: Russell to Lynd	PM	NB	59.1	30.0	58.7	32.8	59.4	26.5
		SB	59.1	37.5	58.5	40.3	59.3	32.3
Segment 8: Cottonwood to Hanley Falls	PM	NB	59.6	30.8	58.7	35.1	59.6	27.5
		SB	59.3	24.8	58.9	29.8	59.6	24.2
Segment 9: Hanley Falls to TH 274	PM	NB	60.1	27.4	58.8	35.8	59.6	28.4
		SB	59.9	24.0	58.9	32.6	59.5	25.2
Segment 10: Granite Falls to Maynard	PM	NB	60.7	24.2	59.5	30.5	60.3	23.9
		SB	60.6	23.7	59.4	29.8	60.0	24.6
Segment 11: Maynard to Clara City	PM	NB	59.8	28.9	58.7	34.7	59.6	26.7
		SB	60.0	30.4	59.0	36.0	59.6	29.3
Segment 12: Clara City to Raymond	PM	NB	58.0	34.2	57.0	42.3	58.0	32.6
		SB	58.5	38.5	57.4	47.4	58.4	38.2
Segment 13: Raymond to Willmar Bypass	PM	NB	58.1	34.9	57.2	41.2	58.1	32.4
		SB	58.0	47.8	57.1	54.5	58.1	45.7

Feasibility and Risk Assessment

The feasibility and risk assessment for the Highway 23 Passing Lane Assessment is based on evaluating each passing location with respect to the passing lane evaluation criteria guidelines developed. Ultimately, the risk assessment provides a review of each location for any potential impacts, cost, or construction staging and project delivery issues with respect to future passing lanes along TH 23.

Evaluation Assumptions

The following summarizes the assumptions used with respect to the passing lane evaluation criteria and guidelines:

Right of Way

Right of way information was obtained from MnDOT plats along Highway 23 for each segment at the locations where passing lanes were identified. This information was then verified with Geographic Information System (GIS) data that was received from each County along the corridor.

Most of the corridor averages a right of way width of 150 feet with 75 feet on either side of centerline. The right of way narrows on the west side of Segments 12 and 13 to 45 feet with as little as 25 feet in some locations. This does not preclude a passing lane section but it may dictate the passing lane be placed on the east side of the roadway rather than the west.

Drainage and Water Resources

As previously noted, when determining the most appropriate locations for passing lanes the areas within the segments that did not contain box culverts were preferred along with locations that had minimal culvert crossings that would need to be extended.

It is expected following the construction of a passing lane the existing ditch grades and drainage systems will remain the same; however, there may be impacts to the existing drain tile systems and any impacts should be addressed during the Preliminary Engineering phase.

Environmental and Permitting

Each passing lane location will impact greater than one acre of construction area and therefore will require a National Pollutant Discharge Elimination System (NPDES) permit. Depending on which passing lane concept is ultimately selected for a given segment, the new impervious area could exceed one acre and a permanent Best Management Practices (BMP) may be needed to meet the requirement of the NPDES permit.

Benefit-Cost

Capital costs were determined using SRF's cost estimate best practices (see Appendix F) which are an enhanced version of MnDOT's LWD (Length Width Depth) Cost Estimating method used to capture all influences that affect project costs. Recognizing that total project cost estimates extend beyond the "construction cost" the template utilizes methods for project cost estimation to capture these many aspects:

- Construction costs – Grading, paving, drainage, signing and striping, mobilization, construction staging and traffic control, contingencies for "non-quantified known items" and contingencies for "risk" or the unknown items and conditions.
- Project delivery costs – Preliminary and final engineering and construction administration, etc.

In developing costs for the passing lane concepts it was assumed that a passing lane in each direction would be utilized for a length of 1.1 miles with a two foot buffer. Eight inches of bituminous along with 16 inches of aggregate base was the assumed pavement section based on record plans that were obtained for the corridor. The shoulders would consist of four inches of bituminous and 20 inches of aggregate base. The costs assume the removal of the existing 10 foot shoulder and the addition of the required pavement width which is dependent on the passing lane option and a minimum four foot shoulder. Earthwork was developed based on the assumption that the existing in-slope is a 1:4 and the ditch depth is four feet deep. Striping, drainage and other miscellaneous items are also included for each concept.

Details of the Benefit-Cost analysis are provided in Appendix F.

Construction Staging

There are several ways that passing lane construction could be staged to accommodate traffic; however, it will be highly dependent on how the passing lanes are added onto the existing typical section and what can be tolerated to travel delays. A few different alternatives have been identified that could be utilized:

- Construct the new embankment and reconstruct the new ditch, temporarily narrow the existing lanes and reduce speeds on mainline. Remove the shoulder and while the subgrade is being constructed a flagger would need to be utilized and TH 23 would be reduced to one lane. Pave the new lane and shoulder, stripe and re-open to traffic.
- Close TH 23 and provide a detour during construction. Although this has a greater impact on traffic the construction duration would be reduced.
- Shift traffic to the existing 10 foot shoulder and construct the new lane and embankment with barrels separating traffic and construction. It would be recommended to reduce speed in this scenario as well. A possible issue with this option would be if there is a shoulder in poor condition it may not hold up to the traffic. Therefore, it would

be recommended to review the shoulder condition and either repave the shoulder prior to use or use a different construction method if the shoulder cannot carry the anticipated traffic.

Evaluation Results

As previously noted, in order to balance the TH 23 corridor from I-90 to Willmar to provide the most overall benefit, the corridor was strategically grouped into four major regions based on IRC corridors, regional centers, speed transition areas and locations adjacent to four-lane roadways. Inside those regions are the 13 segments, which are as follows:

I-90 to Pipestone

- Segment 1 – I-90 to Jasper
- Segment 2 – Jasper to Pipestone

Pipestone to Marshall

- Segment 3 – Pipestone to Holland
- Segment 4 – Holland to Ruthton
- Segment 5 – Ruthton to Florence
- Segment 6 – Florence to Russell
- Segment 7 – Russell to Lynd

Marshall to TH 212

- Segment 8 – Cottonwood to Hanley Falls
- Segment 9 – Hanley Falls to TH 274

TH 212 to Willmar

- Segment 10 – Granite Falls to Maynard
- Segment 11 – Maynard to Clara City
- Segment 12 – Clara City to Raymond
- Segment 13 – Raymond to Willmar Bypass

Results of the passing lane evaluation by segment for the Highway 23 Passing Lane Assessment are shown in Tables 4-7. Based on the results, Table 8 summarizes the high priority screening of the segments using the prioritization criteria developed.

Potential passing lane locations were prioritized based the overall ranking (or highest ranked within region) of corridor segments by region. Additionally, potential impacts with respect to drainage and water resources, environmental and permitting, and the inclusion of freight industry input were considered to help determine the potential construction letting timeframe.

Table 4. Passing Lane Evaluation (Segments 1-2)

Evaluation Criteria		Segment 1: I-90 to Jasper	Segment 2: Jasper to Pipestone
Identify Problem Locations	System Capacity Analysis	Existing • Average Speed: 61.4 (NB) / 61.0 (SB) • PTSF: 28.4% (NB) / 29.7% (SB) • Percent No Passing: 68.2% 2040 No Build • Average Speed: 60.6 (NB) / 60.3 (SB) • PTSF: 31.8% (NB) / 33.7% (SB) 2040 Build • Average Speed: 61.3 (NB) / 61.0 (SB) • PTSF: 25.5% (NB) / 27.0% (SB)	Existing • Average Speed: 60.4 (NB) / 60.3 (SB) • PTSF: 26.5% (NB) / 21.7% (SB) • Percent No Passing: 8.2% 2040 No Build • Average Speed: 58.6 (NB) / 59.0 (SB) • PTSF: 35.6% (NB) / 29.8% (SB) 2040 Build • Average Speed: 59.4 (NB) / 59.7 (SB) • PTSF: 28.4% (NB) / 23.8% (SB)
	Existing Crash History	• Number of Crashes: 18 (0 fatal / 6 injury) • Average Crash Rate: 0.33 MEV • Critical Crash Rate: 1.03 MEV	• Number of Crashes: 30 (1 fatal / 7 injury) • Average Crash Rate: 0.50 MEV • Critical Crash Rate: 1.01 MEV
Screen and Recommend Concepts	Passing Lane Locations	• 1 (NB / SB) and 2 (1 NB only and 1 SB only) • Existing AADT: 1,750 • Existing HCAADT: 220 (11.1 %) • 2040 AADT: 2,400	• 2 (1 NB only and 1 SB only) • Existing AADT: 3,000 • Existing HCAADT: 480 (14.1 %) • 2040 AADT: 4,500
	Length of Passing Lanes	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)
	Spacing of Passing Lanes	• Adequate spacing provided	• Adequate spacing provided
Identify and Document Impacts	Access Considerations	• Access Point Density (NB): 2.8 • Access Point Density (SB): 2.0 • Access Points Impacted: 13 (NB /SB) • Access Points Impacted: 13 (NB) and 6 (SB)	• Access Point Density (NB): 1.4 • Access Point Density (SB): 3.2 • Access Points Impacted: 6 (NB) and 10 (SB)
	Right of Way	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts
	Drainage and Water Resources	• Culvert Impacts: 4 (NB / SB) • Culvert Impacts: 2 (NB) and 1 (SB) • Low risk for Wetland impacts • Low risk for bridge impacts	• Culvert Impacts: 3 (NB) and 4 (SB) • Potential risk for Wetland impacts • Potential risk for bridge impacts
	Environmental and Permitting	• Potential risk for Environmental impacts • Low risk for Wildlife impacts • Potential risk for MCBS Biodiversity Site	• Potential risk for Environmental impacts • Low risk for Wildlife impacts • Potential risk for MCBS Biodiversity Site
Review Concept Feasibility	Benefit-Cost	• Rank 12 of 13	• Rank 3 of 13
	Constructability	• Vertical Grades: Rolling • In-slopes: Flat • Ditches: Shallow • Utilities: None • Other: New pavement, rumble strips on shoulder, right-turn lanes at CR 5	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: OH power at right of way, railroad • Other: Rumble strips on shoulder

Table 5. Passing Lane Evaluation (Segments 3-7)

	Evaluation Criteria	Segment 3: Pipestone to Holland	Segment 4: Holland to Ruthton	Segment 5: Ruthton to Florence	Segment 6: Florence to Russell	Segment 7: Russell to Lynd
Identify Problem Locations	System Capacity Analysis	Existing • Average Speed: 61.1 (NB) / 60.6 (SB) • PTSF: 26.2% (NB) / 18.4% (SB) • Percent No Passing: 7.7% 2040 No Build • Average Speed: 60.6 (NB) / 60.0 (SB) • PTSF: 29.2% (NB) / 20.5% (SB) 2040 Build • Average Speed: 61.3 (NB) / 60.7 (SB) • PTSF: 23.1% (NB) / 16.1% (SB)	Existing • Average Speed: 61.3 (NB) / 61.2 (SB) • PTSF: 19.0% (NB) / 18.8% (SB) • Percent No Passing: 4.1% 2040 No Build • Average Speed: 61.0 (NB) / 60.8 (SB) • PTSF: 20.7% (NB) / 20.2% (SB) 2040 Build • Average Speed: 61.6 (NB) / 61.5 (SB) • PTSF: 16.7% (NB) / 16.5% (SB)	Existing • Average Speed: 60.8 (NB) / 61.2 (SB) • PTSF: 17.1% (NB) / 22.5% (SB) • Percent No Passing: 0% 2040 No Build • Average Speed: 59.6 (NB) / 60.1 (SB) • PTSF: 21.3% (NB) / 27.6% (SB) 2040 Build • Average Speed: 60.3 (NB) / 60.9 (SB) • PTSF: 16.9% (NB) / 21.7% (SB)	Existing • Average Speed: 60.8 (NB) / 60.8 (SB) • PTSF: 20.9% (NB) / 21.8% (SB) • Percent No Passing: 5.7% 2040 No Build • Average Speed: 60.3 (NB) / 60.3 (SB) • PTSF: 23.4% (NB) / 24.3% (SB) 2040 Build • Average Speed: 61.0 (NB) / 60.9 (SB) • PTSF: 18.3% (NB) / 20.1% (SB)	Existing • Average Speed: 59.1 (NB) / 59.1 (SB) • PTSF: 30.0% (NB) / 37.5% (SB) • Percent No Passing: 13.4% 2040 No Build • Average Speed: 58.7 (NB) / 58.5 (SB) • PTSF: 32.8% (NB) / 40.3% (SB) 2040 Build • Average Speed: 59.4 (NB) / 59.3 (SB) • PTSF: 26.5% (NB) / 32.3% (SB)
	Existing Crash History	• Number of Crashes: 20 (1 fatal / 7 injury) • Average Crash Rate: 0.43 MEV • Critical Crash Rate: 1.07 MEV	• Number of Crashes: 22 (1 fatal / 5 injury) • Average Crash Rate: 0.56 MEV • Critical Crash Rate: 1.12 MEV	• Number of Crashes: 10 (0 fatal / 0 injury) • Average Crash Rate: 0.38 MEV • Critical Crash Rate: 1.25 MEV	• Number of Crashes: 16 (0 fatal / 3 injury) • Average Crash Rate: 0.40 MEV • Critical Crash Rate: 1.11 MEV	• Number of Crashes: 44 (0 fatal / 10 injury) • Average Crash Rate: 0.85 MEV • Critical Crash Rate: 1.04 MEV
Screen and Recommend Concepts	Passing Lane Locations	• 2 (1 NB only and 1 SB only) • Existing AADT: 2,900 • Existing HCAADT: 455 (15.2 %) • 2040 AADT: 3,400	• 1 (NB / SB) • Existing AADT: 2,700 • Existing HCAADT: 460 (16.5 %) • 2040 AADT: 3,000	• 1 (NB / SB) • Existing AADT: 2,750 • Existing HCAADT: 460 (15.3 %) • 2040 AADT: 3,600	• 1 (NB / SB) • Existing AADT: 2,900 • Existing HCAADT: 490 (16.3 %) • 2040 AADT: 3,300	• 1 (NB / SB) • Existing AADT: 4,300 • Existing HCAADT: 690 (15.3 %) • 2040 AADT: 4,900
	Length of Passing Lanes	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)
	Spacing of Passing Lanes	• Adequate spacing provided	• Adequate spacing provided	• Adequate spacing provided	• Adequate spacing provided	• Four-lane roadway from Lynd to Marshall
Identify and Document Impacts	Access Considerations	• Access Point Density (NB): 2.1 • Access Point Density (SB): 1.9 • Access Points Impacted: 6 (NB) and 4 (SB)	• Access Point Density (NB): 1.6 • Access Point Density (SB): 1.6 • Access Points Impacted: 5	• Access Point Density (NB): 2.1 • Access Point Density (SB): 1.9 • Access Points Impacted: 6	• Access Point Density (NB): 1.1 • Access Point Density (SB): 2.0 • Access Points Impacted: 5	• Access Point Density (NB): 1.7 • Access Point Density (SB): 2.0 • Access Points Impacted: 4
	Right of Way	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts
	Drainage and Water Resources	• Culvert Impacts: 3 (NB) and 3 (SB) • Low risk for Wetland impacts	• Culvert Impacts: 1 • Potential risk for Wetland impacts	• Culvert Impacts: 0 • Potential risk for Wetland impacts	• Culvert Impacts: 1 • Potential risk for Wetland impacts	• Culvert Impacts: 1 • Potential risk for Wetland impacts
	Environmental and Permitting	• Low risk for Environmental impacts • Low risk for Wildlife impacts • Low risk for MCBS Biodiversity Site	• Potential risk for Environmental impacts • Low risk for Wildlife impacts • Potential risk for MCBS Biodiversity Site	• Low risk for Environmental impacts • Low risk for Wildlife impacts • Low risk for MCBS Biodiversity Site	• Potential risk for Environmental impacts • Low risk for Wildlife impacts • Potential risk for MCBS Biodiversity Site	• Potential risk for Environmental impacts • Low risk for Wildlife impacts • Potential risk for MCBS Biodiversity Site
Review Concept Feasibility	Benefit-Cost	• Rank 4 of 13	• Rank 2 of 13	• Rank 13 of 13	• Rank 11 of 13	• Rank 9 of 13
	Constructability	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: Railroad • Other: Rumble strips on shoulder, right-turn lanes at CR 70	• Vertical Grades: Steep (up from south) • In-slopes: Flat • Ditches: Shallow • Utilities: Railroad • Other: Rumble strips on shoulder	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: Railroad • Other: Rumble strips on shoulder	• Vertical Grades: Minimal • In-slopes: Steep • Ditches: Shallow to deep • Utilities: Railroad • Other: Rumble strips on shoulder, large fill area at BR 5746, horizontal curve	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: OH power at right of way, railroad • Other: Rumble strips on shoulder, right-turn lanes at CR 68/Park Entrance

Table 6. Passing Lane Evaluation (Segments 8-9)

Evaluation Criteria		Segment 8: Cottonwood to Hanley Falls	Segment 9: Hanley Falls to TH 274
Identify Problem Locations	System Capacity Analysis	Existing • Average Speed: 59.6 (NB) / 59.3 (SB) • PTSF: 30.8% (NB) / 24.8% (SB) • Percent No Passing: 1.9% 2040 No Build • Average Speed: 58.7 (NB) / 58.9 (SB) • PTSF: 35.1% (NB) / 29.8% (SB) 2040 Build • Average Speed: 59.7 (NB) / 59.6 (SB) • PTSF: 27.5% (NB) / 24.2% (SB)	Existing • Average Speed: 60.1 (NB) / 59.9 (SB) • PTSF: 27.4% (NB) / 24.0% (SB) • Percent No Passing: 1% 2040 No Build • Average Speed: 58.8 (NB) / 58.9 (SB) • PTSF: 35.8% (NB) / 32.6% (SB) 2040 Build • Average Speed: 59.6 (NB) / 59.5 (SB) • PTSF: 28.4% (NB) / 25.2% (SB)
	Existing Crash History	• Number of Crashes: 14 (1 fatal / 6 injury) • Average Crash Rate: 0.27 MEV • Critical Crash Rate: 1.04 MEV	• Number of Crashes: 36 (1 fatal / 8 injury) • Average Crash Rate: 0.87 MEV • Critical Crash Rate: 1.10 MEV
Screen and Recommend Concepts	Passing Lane Locations	• 1 (SB only) • Existing AADT: 3,950 • Existing HCAADT: 445 (10.6 %) • 2040 AADT: 4,800	• 1 (NB only) • Existing AADT: 3,600 • Existing HCAADT: 555 (13.9 %) • 2040 AADT: 5,100
	Length of Passing Lanes	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)
	Spacing of Passing Lanes	• Four-lane roadway south of Cottonwood	• Four-lane roadway south of Granite Falls
Identify and Document Impacts	Access Considerations	• Access Point Density (NB): 1.1 • Access Point Density (SB): 1.2 • Access Points Impacted: 7	• Access Point Density (NB): 1.2 • Access Point Density (SB): 1.0 • Access Points Impacted: 4
	Right of Way	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts
	Drainage and Water Resources	• Culvert Impacts: 0 • Potential risk for Wetland impacts	• Culvert Impacts: 3 • Low risk for Wetland impacts
	Environmental and Permitting	• Low risk for Environmental impacts • Low risk for Wildlife impacts • Low risk for MCBS Biodiversity Site	• Low risk for Environmental impacts • Low risk for Wildlife impacts • Low risk for MCBS Biodiversity Site
Review Concept Feasibility	Benefit-Cost	• Rank 8 of 13	• Rank 6 of 13
	Constructability	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: Railroad • Other: Steep road grade between railroad and 160th Ave	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: Railroad • Other: Right-turn lanes at 70th St

Table 7. Passing Lane Evaluation (Segments 10-13)

Evaluation Criteria		Segment 10: Granite Falls to Maynard	Segment 11: Maynard to Clara City	Segment 12: Clara City to Raymond	Segment 13: Raymond to Willmar
Identify Problem Locations	System Capacity Analysis	Existing • Average Speed: 60.7 (NB) / 60.6 (SB) • PTSF: 24.2% (NB) / 23.7% (SB) • Percent No Passing: 11.6% 2040 No Build • Average Speed: 59.5 (NB) / 59.4 (SB) • PTSF: 30.5% (NB) / 29.8% (SB) 2040 Build • Average Speed: 60.3 (NB) / 60.0 (SB) • PTSF: 23.9% (NB) / 24.6% (SB)	Existing • Average Speed: 59.8 (NB) / 60.0 (SB) • PTSF: 28.9% (NB) / 30.4% (SB) • Percent No Passing: 23.8% 2040 No Build • Average Speed: 58.7 (NB) / 59.0 (SB) • PTSF: 34.7% (NB) / 36.0% (SB) 2040 Build • Average Speed: 59.6 (NB) / 59.6 (SB) • PTSF: 26.7% (NB) / 29.3% (SB)	Existing • Average Speed: 58.0 (NB) / 58.5 (SB) • PTSF: 34.2% (NB) / 38.5% (SB) • Percent No Passing: 10.1% 2040 No Build • Average Speed: 57.0 (NB) / 57.4 (SB) • PTSF: 42.3% (NB) / 47.4% (SB) 2040 Build • Average Speed: 58.0 (NB) / 58.4 (SB) • PTSF: 32.6% (NB) / 38.2% (SB)	Existing • Average Speed: 58.1 (NB) / 58.0 (SB) • PTSF: 34.9% (NB) / 47.8% (SB) • Percent No Passing: 15.3% 2040 No Build • Average Speed: 57.2 (NB) / 57.1 (SB) • PTSF: 41.2% (NB) / 54.5% (SB) 2040 Build • Average Speed: 58.1 (NB) / 58.1 (SB) • PTSF: 32.4% (NB) / 45.7% (SB)
	Existing Crash History	• Number of Crashes: 7 (0 fatal / 2 injury) • Average Crash Rate: 0.16 MEV • Critical Crash Rate: 1.09 MEV	• Number of Crashes: 23 (2 fatal / 11 injury) • Average Crash Rate: 0.69 MEV • Critical Crash Rate: 1.17 MEV	• Number of Crashes: 24 (1 fatal / 13 injury) • Average Crash Rate: 0.37 MEV • Critical Crash Rate: 0.99 MEV	• Number of Crashes: 51 (0 fatal / 24 injury) • Average Crash Rate: 0.46 MEV • Critical Crash Rate: 1.01 MEV
Screen and Recommend Concepts	Passing Lane Locations	• 1 (NB / SB) • Existing AADT: 3,000 • Existing HCAADT: 490 (15.3 %) • 2040 AADT: 4,000	• 1 (NB / SB) • Existing AADT: 3,000 • Existing HCAADT: 475 (14.9 %) • 2040 AADT: 3,800	• 2 (1 NB only and 1 SB only) • Existing AADT: 4,700 • Existing HCAADT: 620 (12.2 %) • 2040 AADT: 6,400	• 1 (NB only) • Existing AADT: 5,900 • Existing HCAADT: 548 (8.7 %) • 2040 AADT: 7,400
	Length of Passing Lanes	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)	• 1.1 miles excluding tapers (consistent with typical lengths in MnDOT District 8)
	Spacing of Passing Lanes	• Adequate spacing provided	• Adequate spacing provided	• Adequate spacing provided	• Four-lane roadway near Willmar
Identify and Document Impacts	Access Considerations	• Access Point Density (NB): 1.8 • Access Point Density (SB): 1.9 • Access Points Impacted: 9	• Access Point Density (NB): 2.5 • Access Point Density (SB): 3.6 • Access Points Impacted: 5	• Access Point Density (NB): 2.7 • Access Point Density (SB): 5.2 • Access Points Impacted: 10	• Access Point Density (NB): 1.7 • Access Point Density (SB): 3.4 • Access Points Impacted: 5
	Right of Way	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts	• Existing: Typically 75 feet each side of centerline • Low risk for ROW impacts	• Existing: Varies 25-45 feet each side of centerline • Potential risk for ROW impacts	• Existing: Varies 25-45 feet each side of centerline • Potential risk for ROW impacts
	Drainage and Water Resources	• Culvert Impacts: 3 • Potential risk for Wetland impacts	• Culvert Impacts: 0 • Low risk for Wetland impacts	• Culvert Impacts: 4 • Potential risk for Wetland impacts	• Culvert Impacts: 3 • Low risk for Wetland impacts
	Environmental and Permitting	• Low risk for Environmental impacts • Low risk for Wildlife impacts • Low risk for MCBS Biodiversity Site	• Potential risk for Environmental impacts • Low risk for Wildlife impacts • Potential risk for MCBS Biodiversity Site	• Low risk for Environmental impacts • Low risk for Wildlife impacts • Potential risk for MCBS Biodiversity Site	• Potential risk for Environmental impacts • Low risk for Wildlife impacts • Low risk for MCBS Biodiversity Site
Review Concept Feasibility	Benefit-Cost	• Rank 10 of 13	• Rank 1 of 13	• Rank 5 of 13	• Rank 7 of 13
	Constructability	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: OH power at right of way • Other: Right-turn lanes at 880th Ave, 870th Ave, 125th St, 860th Ave, and 850th Ave	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: Railroad • Other: Right-turn lanes at 520th St, 220th Ave, and 230th Ave	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: Railroad • Other: Right-turn lanes at 160th Ave and 130th Ave	• Vertical Grades: Minimal • In-slopes: Flat • Ditches: Shallow • Utilities: OH power at right of way, railroad • Other: Passing lane at 128th St and right-turn lane

Table 8. High Priority Segment Screening

			I-90		Pipestone					Marshall		TH 212				Willmar
	Prioritization Criteria	(6)	Segment 1: I-90 to Jasper	Segment 2: Jasper to Pipestone	Segment 3: Pipestone to Holland	Segment 4: Holland to Ruthton	Segment 5: Ruthton to Florence	Segment 6: Florence to Russell	Segment 7: Russell to Lynd	Segment 8: Cottonwood to Hanley Falls	Segment 9: Hanley Falls to TH 274	Segment 10: Granite Falls to Maynard	Segment 11: Maynard to Clara City	Segment 12: Clara City to Raymond	Segment 13: Raymond to Willmar
Passing Lane Need	Prioritize segments with high projected 2040 AADT	Mobility	Low	Med-High	Low-Med	Low-Med	Low-Med	Low-Med	Med-High	Med-High	High	Med-High	Low-Med	High	High
	Prioritize segments with high existing percentage of no passing	Mobility	High	Low	Low	Low	Low	Low	Medium	Low	Low	Medium	Medium	Medium	Medium
	Prioritize segments based on 2040 No Build PTSF[5]	Mobility	Medium	Medium	Low	Low	Low	Low	High	Medium	Medium	Medium	Medium	High	High
	Prioritize segments greatest 2040 decrease in PTSF from passing lane(s)	Mobility	Med-High	Med-High	Low-Med	Low	Low-Med	Low	Med-High	Med-High	Med-High	Low-Med	Med-High	High	High
	Prioritize segments with high existing average crash rates	Safety	Low	Medium	Medium	Medium	Low	Medium	High	Low	High	Low	High	Low	Medium
	Prioritizes segments with low impacts to existing access points	Safety	Low	Low	Medium	Medium	Medium	High	High	Medium	High	Medium	High	Medium	Medium
	Prioritize segments with high projected 2040 HCAADT (Heavy Commercial)	Economic	Low	Med-High	Low-Med	Low	Low-Med	Low-Med	High	Low-Med	High	Med-High	Low-Med	High	Med-High
	Prioritize segments based on high benefit-cost ratio	Economic	Low	Medium	Medium	Medium	Low	Low	Low	Medium	Medium	Low	High	Medium	Medium
Priority Segment by Region			2	1	2	4	5	3	1[1]	2[1]	1[1]	4	3	2	1[1]
Project Delivery	Potential for any impacts (Environmental, ROW, etc.)[7] that could delay an April of 2015 construction letting?		Medium	High	Low	High	Low	High	High	Low	Low	Low	Medium	High	Medium
Project Delivery	Are there any proposed roadway projects that would influence the construction letting time frame?		No	No	No	No	No	No	No	Yes (FY 2020)	Yes (FY 2020)	No	No	Yes (FY 2017)	Yes (FY 2017)
Priority Segment (1st Tier, 2nd Tier)				1st Tier	2nd Tier			1st Tier[2]		2nd Tier				2nd Tier[4]	1st Tier[3]
Highest Potential for Accelerated Schedule			—	—	X	—	—	—	—	X		—	—	—	

Notes:

(1) Segment is adjacent to a four-lane highway or passing lane where passing opportunities provide benefit well past their termini. For this reason, any passing lanes within this segment shall be placed as far away from the existing passing opportunity as possible, or adjusted to the next closet segment.

(2) Since Segment 7 from Russell to Lynd is adjacent to a four-lane highway and it is a shorter segment, the 1st Tier priority was shifted to Segment 6, which will still provide benefit to Segment 7.

(3) Provide northbound in segment 13 and southbound in Segment 12 as close to Raymond City limits as is feasible.

(4) Provide northbound only as close to Clara City limits as is feasible.

(5) PTSF = Percent Time Spent Following.

(6) The High to Low rating represents as follows: High = more advantageous for a passing lane and Low = less advantageous.

(7) For this application, High means higher potential for impacts and Low means lower potential.

The following is a brief description, including the risks and limitations, of each segment:

Segment 1 – I-90 to Jasper

Segment 1 includes the potential for two three-lane passing sections and a four-lane passing section. The passing lane on the north end would provide passing opportunities for the speed transition leaving Jasper. On the south end, the passing lane would provide passing opportunities for traffic entering TH 23 from I-90. This segment has low average daily traffic and truck traffic and a lower crash rate, comparatively. High impacts to existing access points are expected. Passing lanes would have an above average improvement in percent time-spent following given the lack of existing passing opportunities. There is an average risk for environmental and permitting issues due to existing Potentially Contaminated and MCBS Biodiversity sites. There are no future roadway projects that would influence the construction letting timeframe; however, this segment has new pavement and rumble strips on the shoulders.

Segment 2 – Jasper to Pipestone

Segment 2 includes the potential for two three-lane passing sections. These would provide passing opportunities for the speed transitions leaving Jasper and Pipestone. This segment has above average daily traffic and truck traffic and an average crash rate, comparatively. High impacts to existing access points are expected. Passing lanes would have an above average improvement in percent time-spent following even though sufficient opportunities for passing currently exist. There is a high risk for environmental and permitting issues due to existing Wetlands, Potentially Contaminated and MCBS Biodiversity sites. There are no future roadway projects that would influence the construction letting timeframe; however, there is existing overhead power at the roadway right-of-way.

Segment 3 – Pipestone to Holland

Segment 3 includes the potential for two three-lane passing sections. The passing lane on the north end would capture traffic entering TH 23 from Holland. On the south end, the passing lane would provide passing opportunities for the speed transition leaving Pipestone. This segment has below average daily traffic and truck traffic and an average crash rate, comparatively. Average impacts to existing access points are expected. Passing lanes would create an improvement in percent time-spent following, especially during peak hours, but the improvement would be below the average for the corridor since opportunities for passing currently exist. There is a low risk for environmental and permitting issues; however, some drainage issues may exist. There are no future roadway projects that would influence the construction letting timeframe.

Segment 4 – Holland to Ruthton

Segment 4 includes the potential for one four-lane passing section. This segment has below average daily traffic and truck traffic and an average crash rate, comparatively. Average impacts to existing access points are expected. Passing lanes would create an improvement in percent time-spent following, especially during peak hours, but the improvement would be below the average for the corridor since opportunities for passing currently exist. There is a high risk for environmental and permitting issues due to Wetlands, Potentially Contaminated and MCBS Biodiversity sites. There are no future roadway projects that would influence the construction letting timeframe; however, this segment has steep grades in locations.

Segment 5 – Ruthton to Florence

Segment 5 includes the potential for one four-lane passing section. This segment has a below average daily traffic and truck traffic and a lower crash rate, comparatively. Average impacts to existing access points are expected. Passing lanes would create an improvement in percent time-spent following, especially during peak hours, but the improvement would be below the average for the corridor since opportunities for passing currently exist. There is a low risk for environmental and permitting issues. There are no future roadway projects that would influence the construction letting timeframe.

Segment 6 – Florence to Russell

Segment 6 includes the potential for one four-lane passing section. This segment has below average daily traffic and truck traffic and an average crash rate, comparatively. Low impacts to existing access points are expected. Passing lanes would create an improvement in percent time-spent following, especially during peak hours, but the improvement would be below the average for the corridor since opportunities for passing currently exist. Segment 6 is adjacent to Segment 7 creating an improvement in percent time-spent following in Segment 7 since passing lanes also provide benefits to traffic downstream of the passing lane. There is a high risk for environmental and permitting issues due to existing Wetlands, Potentially Contaminated and MCBS Biodiversity sites. There are no future roadway projects that would influence the construction letting timeframe; however, there is a large fill area at Bridge 5746 and the ditches are steep in locations.

Segment 7 – Russell to Lynd

Segment 7 includes the potential for one four-lane passing section. Segment 7 is adjacent to the existing four-lane roadway from Lynd to Marshall. This segment has above average daily traffic, high truck traffic and a higher crash rate, comparatively. Low impacts to existing access points are expected. Passing lanes would have an above average improvement in percent time-spent following even though average opportunities for passing currently exist. There is a high risk for environmental and permitting issues due to existing Wetlands, Potentially Contaminated and MCBS Biodiversity sites. There are no future roadway projects that would influence the construction letting timeframe; however, there is existing overhead power at the roadway right-of-way.

Segment 8 – Cottonwood to Hanley Falls

Segment 8 includes the potential for one three-lane passing section. Segment 8 is adjacent to the existing four-lane roadway south of Cottonwood. This segment has above average daily traffic, below average truck traffic and a lower crash rate, comparatively. Average impacts to existing access points are expected. Passing lanes would have an above average improvement in percent time-spent following even though sufficient opportunities for passing currently exist. There is a low risk for environmental and permitting issues. Future roadway projects could potentially influence the construction letting timeframe for this segment.

Segment 9 – Hanley Falls to TH 274

Segment 9 includes the potential for one three-lane passing section. Segment 9 is adjacent to the existing four-lane roadway south of Granite Falls. This segment has high average daily traffic and truck traffic and a higher crash rate, comparatively. Low impacts to existing access points are expected. Passing lanes would have an above average improvement in percent time-spent following even though sufficient opportunities for passing currently exist. There is a low risk for environmental or permitting issues; however, some drainage issues may exist. Future roadway projects could potentially influence the construction letting time frame for this segment.

Segment 10 – Granite Falls to Maynard

Segment 10 includes the potential for one four-lane passing section. This segment has above average daily traffic and truck traffic and a lower crash rate, comparatively. Average impacts to existing access points are expected. Passing lanes would create an improvement in percent time-spent following, especially during peak hours, but the improvement would be below the average for the corridor since opportunities for passing currently exist. There is a low risk for environmental or permitting issues; however, some drainage issues may exist. There are no future roadway projects that would influence the construction letting timeframe; however, there is existing overhead power at the roadway right-of-way.

Segment 11 – Maynard to Clara City

Segment 11 includes the potential for one four-lane passing section. This segment has below average daily traffic and truck traffic and a higher crash rate, comparatively. Low impacts to existing access points are expected. Passing lanes would have an above average improvement in percent time-spent following even though average opportunities for passing currently exist. There is an average risk for environmental and permitting issues due to existing Potentially Contaminated and MCBS Biodiversity sites. There are no future roadway projects that would influence the construction letting timeframe.

Segment 12 – Clara City to Raymond

Segment 12 includes the potential for two three-lane passing sections. These would provide passing opportunities for the speed transitions leaving Clara City and Raymond. This segment has high average daily traffic and truck traffic and a lower crash rate, comparatively. Average impacts to existing access points are expected. Passing lanes would have a high improvement in percent time-spent following even though average opportunities for passing currently exist. There is a high risk for environmental and permitting issues due to existing Wetlands and MCBS Biodiversity sites. Future roadway projects could potentially influence the construction letting timeframe for this segment. There is a potential risk for right-of-way impacts.

Segment 13 – Raymond to Willmar Bypass

Segment 13 includes the potential for one three-lane passing section. This would provide passing opportunities for the speed transition leaving Raymond. Segment 13 is adjacent to the existing four-lane roadway near Willmar. This segment has high average daily traffic, above average truck traffic and an average crash rate, comparatively. Average impacts to existing access points are expected. Passing lanes would have a high improvement in percent time-spent following even though average opportunities for passing currently exist. There is an average risk for environmental and permitting issues due to existing Wetlands. Future roadway projects could potentially influence the construction letting timeframe for this segment. There is a potential risk for right-of-way impacts and overhead power is at the roadway right-of-way.

Future Transportation System Recommendations

The addition of a passing lane in one or both directions of travel on a rural two-lane highway can provide safety and traffic operational benefits when inadequate passing opportunities exist. The purpose of a passing lane is to improve the level of service (reducing delays) of a corridor by breaking up traffic platoons. Passing lanes have been proven to increase average travel speeds and reduce the percent time following along corridors. From a safety perspective, passing lanes provide opportunities for passing to occur instead of having drivers using the opposing lane to make a passing maneuver.

The goal of the assessment is to identify high priority segments along the TH 23 corridor from I-90 to Willmar in southwest Minnesota where a passing lane concept can easily be implemented while providing safety and operational benefits. In order to balance the TH 23 corridor from I-90 to Willmar to provide the most overall benefit it was determined that the corridor should be strategically grouped into four major groups based on regional business centers, speed transition areas and locations adjacent to four-lane roadways.

The "Super Two, 3-Lane Section with Buffer" is recommended for the locations where 3-lane passing lane sections are recommended. The "buffer" provides an enhanced safety benefit. The "4-Lane Section, Outside Lane Addition" is typically recommended for the locations where limited roadway is available for expansion due to infield constraints.

It should be noted that high priority locations may still have impacts that are currently unknown and they will need to be addressed during the environment review process of the Preliminary Engineering phase. The intent of this assessment was to recommended locations with the lowest risk for these potential impacts.

Based on the results of the Highway 23 Passing Lane assessment, the following summarizes the future transportation system recommendations (see Figure 27):

Tier 1 Passing Lane Locations

Segment 2:

Segment 2 is recommended for Tier 1 based on: 1) the ability to provide passing opportunities for the speed transitions leaving Jasper and Pipestone; 2) the segment has above average daily traffic and truck traffic; and 3) passing lanes would have an above average improvement in percent time-spent following. Also, a passing lane leaving Jasper provides opportunities to pass along TH 23 between I-90 and Pipestone. TH 23 gains traffic in Pipestone from Hwy 30.

Existing Passing Locations
(4-Lane Divided or 3-Lane)

Proposed Passing Lanes
(Contingent on Funding and
Environmental Study Outcomes)

City

Township

Tier 2
Concept: 3-Lane Section
Length: Approximately 1.1 Miles Excluding Tapers
Direction: Northbound Only

Tier 2
Concept: 3-Lane Sections
Length: Approximately 1.1 Miles Excluding Tapers
Direction: Northbound north of Hanley Falls, Southbound south of Hanley Falls

Tier 1
Concept: 3-Lane Sections
Length: Approximately 1.1 Miles Excluding Tapers
Direction: Northbound north of Raymond, Southbound south of Raymond

Tier 2
Concept: 3-Lane Sections
Length: Approximately 1.1 Miles Excluding Tapers
Direction: Northbound and Southbound

Tier 1
Concept: 4-Lane Section
Consider Two 3-Lane Sections Contingent on Environmental Study
Length: Approximately 1.1 Miles Excluding Tapers
Direction: Northbound and Southbound

Tier 1
Concept: 3-Lane Sections
Length: Approximately 1.1 Miles Excluding Tapers
Direction: Northbound and Southbound

City of Willmar
Raymond
Clara City
Maynard
Granite Falls
Hanley Falls
Cottonwood
Marshall
Lynd
Russell
Florence
Ruthton
Holland
Pipestone
Jasper

0 5 10 20 Miles

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Future Transportation System Recommendations

Highway 23 Passing Lane Assessment (I-90 to Willmar, MN)
MnDOT District 8

Figure 27

Segment 6:

Segment 7 was the higher ranked segment in this region but it is adjacent to a four-lane roadway which already provides a breakup of platooning vehicles with a benefit that extends well into Segment 7. Segment 7 is also one of the shorter segments so a passing lane would be within three miles of the existing four-lane roadway. Therefore, Segment 6 is recommended for Tier 1 because passing lanes in Segment 6 will also provide benefit to Segment 7, as well as to Segments 5 and 6, providing more widespread benefit to the corridor. The need for passing improvements in Segment 7 is based on having above average daily traffic, high truck traffic and a higher crash rate.

Segments 12 (southbound only)/13 (northbound only):

Segments 12 (southbound only) and 13 (northbound only) are recommended for Tier 1 based on: 1) the ability to provide passing opportunities for the speed transitions leaving Raymond; 2) they have high average daily traffic and truck traffic compared to the other segments; and 3) passing lanes would have a high improvement in percent time-spent following.

Tier 2 Passing Lane Locations

Segment 3:

The benefit of passing lanes in Segment 3 is the ability to provide passing opportunities for traffic entering TH 23 from Holland and for the speed transition leaving Pipestone. Also, a passing lane in Segment 3 will provide additional passing opportunities as freight and motorists travel between Marshall and I-90.

Segments 8/9:

The benefit of passing lanes in Segments 8 and 9 is the above average improvement in percent time-spent following and the periodic passing opportunity that is provided between Marshall and TH 212.

Segment 12 (northbound only):

The benefits of a passing lane in Segment 12 (northbound only) are: 1) the ability to provide passing opportunities for the speed transition leaving Clara City; 2) the segment has high average daily traffic and truck traffic; and 3) passing lanes would have a high improvement in the percent time-spent following. The addition of a passing lane in Segment 12 in the southbound direction is a Tier 1 recommendation.

As previously noted, the purpose of a passing lane is to provide safety and traffic operational benefits when inadequate passing opportunities exist. Passing lanes have been proven to improve safety, increase average travel speeds, and reduce the percent time-spent following along corridors while also providing this benefit for some distance downstream of the passing lane section.