INTERSTATE OPERATIONS STUDY & PLAN FOR FUTURE IMPROVEMENTS

FINAL REPORT | JULY 2023

METROCOG

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

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LIST OF ABBREVIATIONS

- **AASHTO:** American Association of State Highway and Transportation Officials
- **ADT:** Average Daily Traffic
- **BNSF:** Burlington Northern Santa Fe
- **CCTV:** Closed-Circuit Television
- **CMF:** Crash Modification Factor
- **Directions:**
  - **NB:** Northbound
  - **SB:** Southbound
  - **EB:** Eastbound
  - **WB:** Westbound
  - **NE:** Northeast
  - **NW:** Northwest
  - **SE:** Southeast
  - **SW:** Southwest
- **DMS:** Dynamic Message Sign
- **DOT:** Department of Transportation
- **IOS:** Interstate Operations Study
- **LOS:** Level of Service
- **Metro COG:** Metropolitan Council of Governments
- **MTP:** Metropolitan Transportation Plan
- **NPMRDS:** National Performance Management Research Data Set
- **ODME:** Origin-Destination Matrix Estimation
- **Parclo:** Partial Cloverleaf Interchange (e.g. University & I-94)
- **ROW:** Right-of-Way
- **RRFB:** Rectangular Rapid Flashing Beacon
- **RTOR:** Right Turn on Red
- **SPUI:** Single Point Urban Interchange
- **SRC:** Study Review Committee
- **TAZ:** Traffic Analysis Zone
- **TDM:** Travel Demand Model
- **TIM:** Traffic Incident Management
- **TMC:** Traffic Management Center
- **TOC:** Traffic Operations Center
- **TOD:** Time-of-Day
- **TSMO:** Transportation Systems Management & Operations
- **V/C:** Volume to Capacity

1 | Introduction

Fargo Moorhead Metro COG and its partner agencies have conducted the Interstate Operations Study and Plan for Future Improvements as a high-level study to identify prioritized improvements to improve safety, traffic operations, and mobility for the Interstate system within the Fargo-Moorhead metropolitan area. The project study area is shown in **Figure 1.1** and is defined by the following limits:

INTERSTATE 94

- **West Limit:** 165th Avenue / Cass County 15
- **East Limit:** Minnesota 336

INTERSTATE 29

- **North Limit:** Cass County 4 (Argusville)
- **South Limit:** 100th Avenue S / Cass County 14

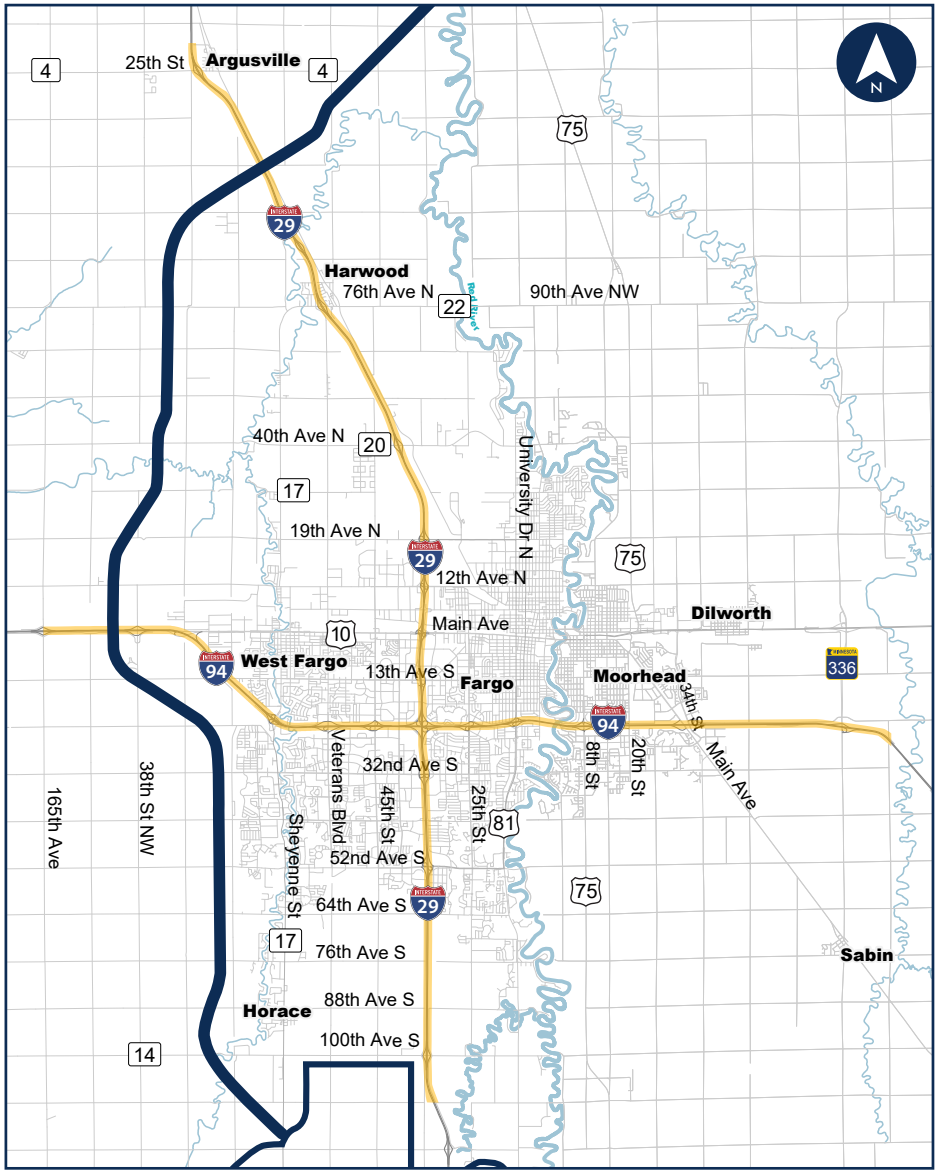
The study area includes Interstate mainline segments, system ramps, service ramps, rest areas, and ramp terminal intersections along I-29 and I-94.

Study Objectives

The objectives and anticipated outcomes for this study include:

- Present a clear menu of recommended improvements aimed at addressing identified deficiencies in operations, safety, reliability, etc.
- Recommend project priorities and staging based on expected increases in traffic volumes combined with planned system preservation projects
- Provide operational and analytical data to assist with later project development phases
- Determine the potential use of a perimeter route around the metro area and identify how such a route affects volumes on the Interstate system.

Figure 1.1. Study Area



Previous Study Review

The previous Interstate Operations Study for the Fargo-Moorhead area was completed in 2011. Since 2011, many of the previous study recommendations have been implemented along I-29 and I-94.

Recommendations

Recommendations from the previous study that have not been implemented in the metro area are listed below.

- Travel Demand Management Strategies
- ITS / Incident Management Strategies
  - Including Regional Traffic Operations Center
- Capacity Improvements (Remaining as of July 2023)
  - Phase 1
    - Extend I-94 EB Auxiliary Lane through 8th Street Interchange
    - Rebuild 20th Street Interchange (in Moorhead)
    - I-94 Auxiliary Lanes between 45th Street and Veterans Blvd
    - I-29 SB to I-94 EB Two-Lane Flyover with EB Auxiliary Lane to 25th Street
  - Phase 2
    - I-94 WB Auxiliary Lanes
      - University Drive to 25th Street
      - 25th Street to I-29 (recommended 2 Auxiliary Lanes)
    - I-94 EB Auxiliary Lane from 25th Street to University Drive
    - I-29: I-94 to 13th Ave S
      - Two-Lane WB to NB Ramp at System Interchange
      - I-29 NB Auxiliary Lane to 13th Ave S
- Ramp Metering

Prioritization & Steps to Implementation

- Establish a Transportation Management Organization
- Initiate efforts to develop a Regional Traffic Operations Center
  - Deploy ITS Infrastructure
  - Develop Incident Management Plans
- Capacity Improvements (as operational conditions indicate needs)
- Perform Detailed Study of Ramp Meter Implementation

Changes Since 2011

As discussed in Chapter 5, some recommendations from the previous study that have not been constructed were incorporated into the implementation plan. Some of the strategies, specifically capacity improvements, have changed due to the following factors.

Forecasted traffic growth patterns in the Fargo-Moorhead metro area have shifted since 2011, specifically the amount of anticipated growth in the southwest portion of the metro area. These projected traffic assumptions impact Interstate growth throughout the metro area, resulting in different future operational needs on the Interstate system.

This study focused on reducing fatal and serious injury crashes on the Interstate System. The previous study recommended Transportation Systems Management & Operations strategies like ramp metering and incident management strategies. These strategies have the largest impact on safety, and were enhanced further as part of this IOS update.

Currently, I-29 in the southern portion of the study area does not have an access point between 100th Avenue S and 52nd Avenue S. Metro area transportation plans have always included a future interchange on I-29 at 76th Avenue S, and more recent plans have resulted in efforts to seek interchange approval at 64th Ave S.

The pavement on I-94 from Sheyenne Street to MN 336 (including the I-94 Red River bridge) will reach the end of its useful life within the next 10-20 years. This plan addresses implications of a full replacement of Interstate mainline and the I-94 Red River bridge on the Interstate system. A combination of TSMO and off-system strategies may improve safety within work zones and lessen Interstate demand during construction reducing excessive delays during construction.

Agency & Stakeholder Coordination

Input received from one-on-one, study review committee, focus group, and DOT management team meetings were an integral part of the strategy and implementation plan development. A complete list of agency representatives, meeting notes, and presentation slides are included in **Appendix A**.

One-on-One Meetings

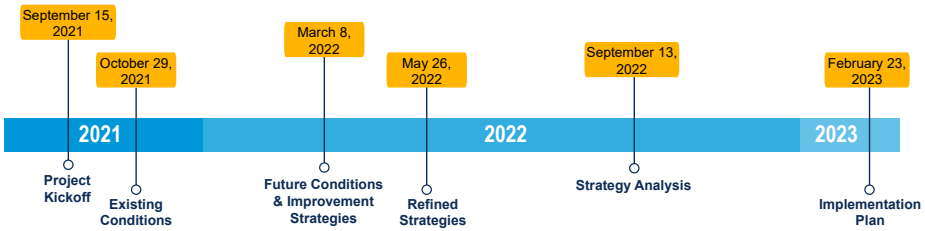
The study team utilized one-on-one meetings with various agencies to gather information, discuss specific projects, and gain feedback on projects that may impact their system. These meetings were utilized to keep SRC meetings on topic and get the most out of group discussions that helped drive study recommendations. During the IOS, the study team met individually with the following agencies.

- North Dakota DOT (Fargo District)
- Minnesota DOT (District 4)
- City of Fargo
- City of West Fargo
- City of Moorhead

Study Review Committee Meetings

The SRC consisted of representatives from the following agencies:

The study team presented to the SRC at six key milestones to gather information and gain feedback. Discussion at SRC meetings helped form the strategies and recommendations for the IOS.

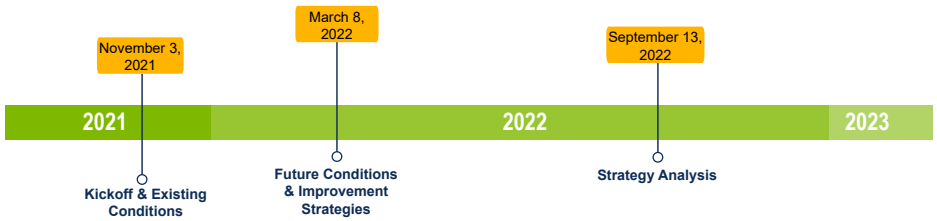


Focus Group Meetings

Focus groups were established to help inform the study and provide input at key milestones. Focus group representatives were split into the following groups:

- First Responders
- Local Officials
- Freight Industry / MATBUS

The study team met with focus group members at three key milestones to gather information and gain feedback.



DOT Management Meetings

The study team presented the implementation plan to the North Dakota and Minnesota DOT management teams during the development of the final recommendations for the study. Feedback from the management team meetings were incorporated into the implementation plan detailed in Chapter 5.

2 | Study Methodology

Data Collection

The IOS required gathering and analyzing the following data sets to complete the various components of the study:

- Peak Travel Times & Speeds
- Traffic Count Data
- Origin & Destination Volumes (Including Freight)
- Safety Data

Peak Travel Times & Speeds

Historical peak travel times from 2019 were collected from the NPMRDS. The data were used to investigate areas of recurring and non-recurring congestion as part of the existing conditions assessment.

NPMRDS travel times and speeds were also used to calibrate the microsimulation model discussed later in this chapter.

Traffic Count Data

Traffic data were collected from the following sources:

- Miovision Counts
- Metro COG Interstate Counts
- NDDOT Interstate Counts
- Automatic Traffic Recorder Counts
- StreetLight Data

These counts were used to establish baseline/existing peak hour volumes and future year 2045 peak hour volumes for operational analysis and microsimulation model development. AADT maps were developed for I-29 and I-94 mainline and ramp segments and are detailed in **Appendix B**.

Origin & Destination Volumes

StreetLight data were collected from Metro COG's StreetLight data subscription. The data were used to develop seed matrices for microsimulation demand development and to analyze potential perimeter routes (including regional freight movements) as part of the existing conditions assessment.

Streetlight data were also used to develop seed matrices for OD-Matrix-Estimation and to analyze weaving percentages between interchanges later in the study.

Safety Data

Four years of pre-COVID safety data (2016-2019) were collected from NDDOT and MnDOT. The data were used for crash analysis for all Interstate segments, ramps, and ramp terminal intersections. Due to the change in travel patterns beginning in March 2020, safety data from 2020 was collected as a reference, but not used for crash analysis.

The data were used to analyze patterns in crashes occurring along the study corridors as part of the existing conditions assessment.

Traffic Forecasting

Travel Demand Model Updates

The study team worked with ATAC to acquire the most recent version of the Fargo-Moorhead TDM. Through coordination with ATAC, modifications were made to the model to minimize potential errors that could impact future Interstate forecasts. TDM updates are detailed in **Appendix B**.

Socioeconomic Data Updates

The study team worked with Metro COG to establish updated SE data for 2045. Recent SE data updates from Metro COG were formatted for import into the CUBE TDM for future year model runs.

Forecasting Methodology

The following steps were used to grow base year (2021) ADTs to 2045.

- Base Year (2015) and Future Year (2045) LRTP TDM daily flows were developed from CUBE model runs
- Daily Flows were balanced on freeway and ramp segments
- Daily model growth was calculated within the study area
- 24 years of the model growth was applied to the base year (2021) ADTs
  - This accounted for 6 years of SE data growth difference between the TDM (2015) and traffic data collection (2021)

Results

Base year (2021) and future year (2045) ADTs are detailed in the data collection memo in **Appendix B**. Most of the forecasted daily traffic growth is concentrated along I-29 between the potential interchanges at 64th Avenue S and 76th Avenue up to Main Avenue. This aligns with the large socioeconomic data growth south of I-94 and west of I-29. This growth was also reflected at the Tri-Level interchange ramps to/from the south including a 90% growth on the system interchange ramps between I-29 (to the south) and I-94 (to the east).

Full Build Out Travel Demand Modeling

Part of the perimeter road analysis included sensitivity model runs for a "Full Build Out" scenario. Metro COG staff worked with local jurisdictions to review current growth assumptions, modify new development areas that will be made available by the diversion, and develop land use assumptions for a full build out housing and employment scenario.

The study team took the land use assumptions and updated the socioeconomic TAZ inputs for full build out levels. The team worked with ATAC to incorporate and run the full build out sensitivity model runs. Additional details on this analysis are discussed in **Chapter 4** and **Appendix E**.

Simulation Modeling

The microsimulation model for the IOS was developed utilizing Caliper's TransModeler Traffic Simulation Software. The study area is shown in **Figure 2.1** and is defined by the following limits:

INTERSTATE 94

- **West Limit:** 165th Avenue / Cass County 15
- **East Limit:** Minnesota 336

INTERSTATE 29

- **North Limit:** Cass County 4 (Argusville)
- **South Limit:** 100th Avenue S / Cass County 14

The study area includes Interstate mainline segments, system ramps, service ramps, rest areas, and ramp terminal intersections along I-29 and I-94.

Simulation Development

Details on development and calibration results are included in **Appendix D**.

ROADWAY NETWORK

The roadway network of Interstates, ramps, and intersections were developed using Google satellite imagery. Acceleration, deceleration, and turn bay lengths were coded to match aerial imagery. Appropriate roadway classifications and speeds were coded onto the network.

TRAFFIC CONTROL

Traffic control was added at intersections where stop, yield, and signalized conditions are present. The study team reviewed available signal timing plans to establish planning level signal timing cycle lengths, clearance intervals, and minimum green times. Google Streetview was used to determine intersection phasing (i.e. permitted / protected lefts, overlaps, right-turn-on-red, etc.).

DEMAND

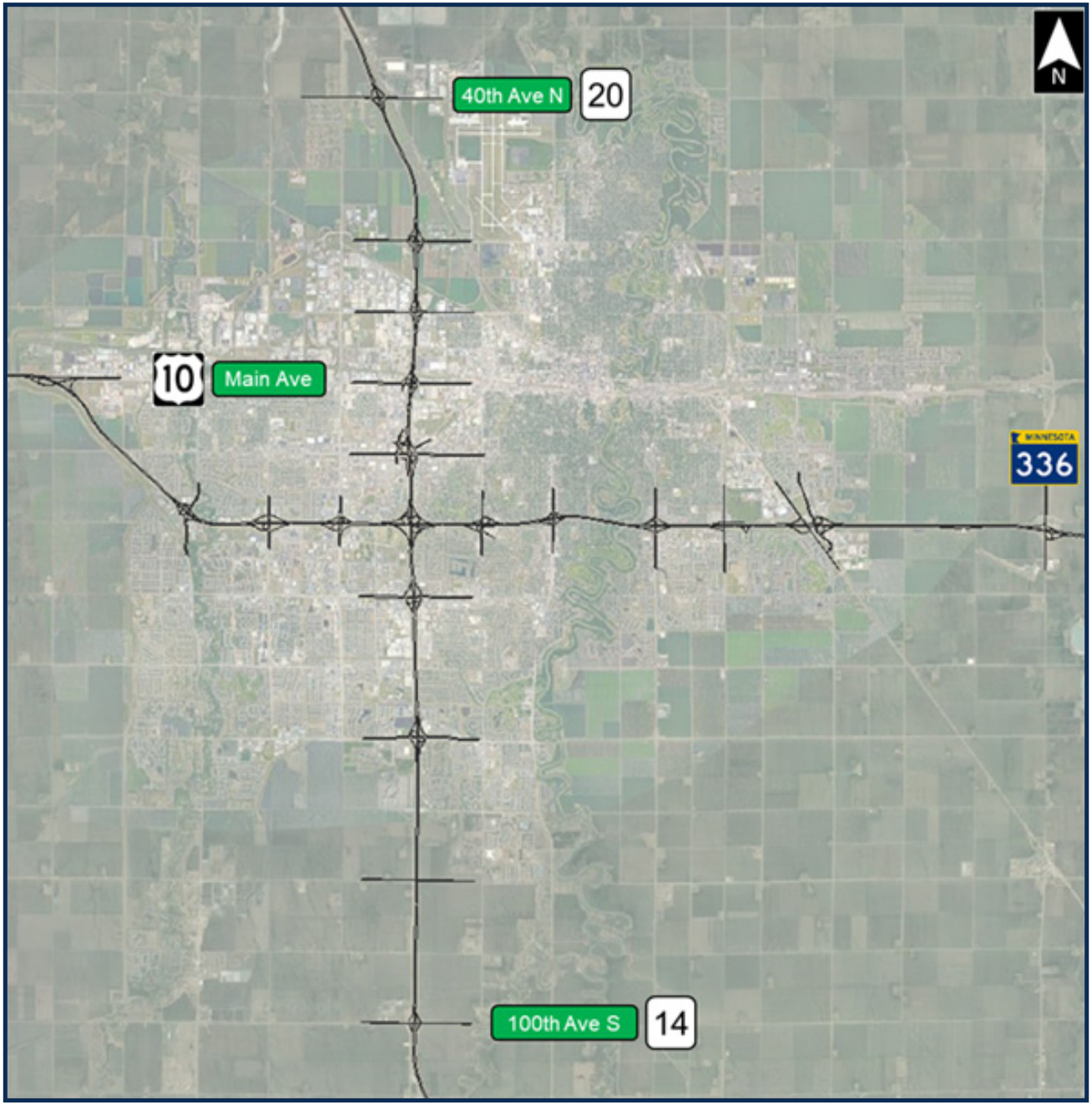
The study team utilized ODME to develop the base year and future year demand sets. ODME is a procedure that takes a seed matrix (i.e. StreetLight) and modifies the matrix to match measured traffic demand coded into the microsimulation network. Utilizing both Streetlight and existing traffic count data sources reduces the amount of error that can occur by using a single data source, resulting in a better calibrated demand set.

PARAMETER CHANGES

Microsimulation parameters were changed globally in TransModeler to reflect local conditions. The study team modified the following parameters to match local conditions and to calibrate to NPMRDS peak period speeds.

- Vehicle Fleet Mix
- Lane Changing Behaviors
- Headway Buffers
- Speed Distribution
- O-D Demand Curves
- Lane Connectivity

Figure 2.1. Simulation Model Network



3 | Traffic Operations / Safety

Existing Traffic Operations

Three tools were used to develop existing traffic operations summaries:

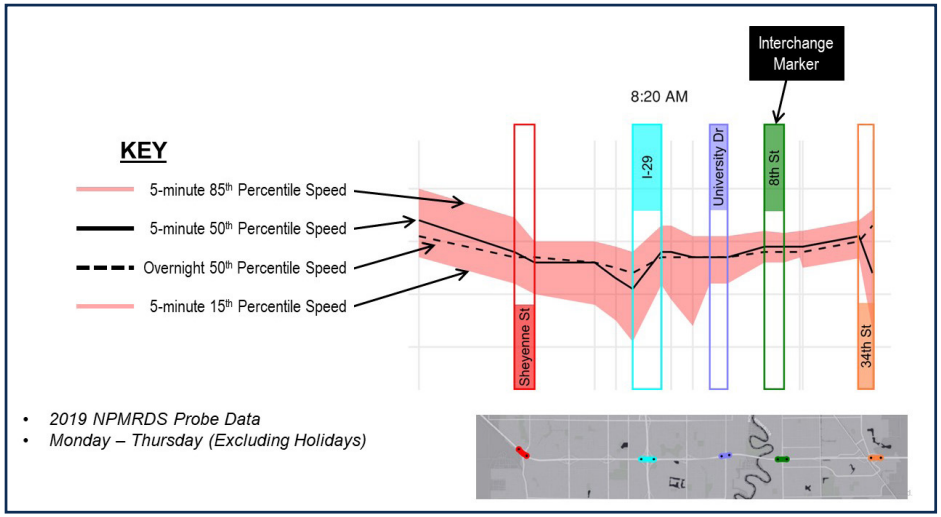
- NPMRDS percentile speed profiles
- Base Year Peak Hour Volume / Capacity Ratios
- Base Year Microsimulation Model Calibration

NPMRDS Speed Profiles

Historical NPMRDS speed data were collected along I-94 and I-29 to establish the limits and duration of recurring congestion within the Fargo-Moorhead Metropolitan Area. Detailed speed profile figures are included in **Appendix C**.

A key for the speed profile analysis is shown in **Figure 3.1**. Percentile speeds were established by taking the average speed for every weekday in 2019 (Monday through Thursday – excluding holidays) within a specific 5-minute time slice. Percentiles were calculated from these average speeds over 5 minutes. For reference, an overnight 50th percentile speed profile is shown on each figure to represent an average free flow speed.

Figure 3.1. Speed Profile Analysis Key



The study team used these 5-minute time slice speed profiles to create a summary of existing capacity issues on I-29 and I-94.

PEAK HOUR SLOWDOWNS

I-94

- **AM Peak Hour**
  - **EB:** Between Sheyenne Street through I-29
  - **WB:** Between 8th Street through 45th Street
- **PM Peak Hour**
  - **EB:** Between Sheyenne Street through 8th Street
  - **WB:** Between 25th Street and Sheyenne Street

Largest speed reduction (~16 mph) occurs during the WB PM peak hour between 25th Street through 45th Street. Note that this slowdown may have been impacted by various construction activities in 2019.

I-29

- **AM Peak Hour**
  - **NB:** Between 32nd Avenue S through Main Avenue
  - **SB:** Near 12th Ave N
- **PM Peak Hour**
  - N**B:** No Discernable Congestion
  - **SB**: Between 12th Ave N and I-94

Largest speed reduction (~11 mph) occurs during the SB PM peak hour near 13th Avenue S.

Base Year Peak Hour Volume / Capacity Ratios

Planning-level peak hour capacities were developed for all Interstate segments withing the study area. Existing peak hour volumes were compared to the planning level capacities and were organized from low congestion to severe congestion. Results from this analysis area shown in **Figure 3.2** & **Figure 3.3**.

Future Traffic Operations

Future Peak Hour Volume / Capacity Ratios

The same methodology was used to develop the future year peak hour congestion maps, shown in **Figure 3.4** & **Figure 3.5**. In the “No-Build” scenario, severe congestion is expected in the following locations:

- **I-29:** From Main Avenue to 52nd Avenue S
- **I-94:** From I-29 to 8th Street

Figure 3.2. 2021 AM Peak Hour Congestion

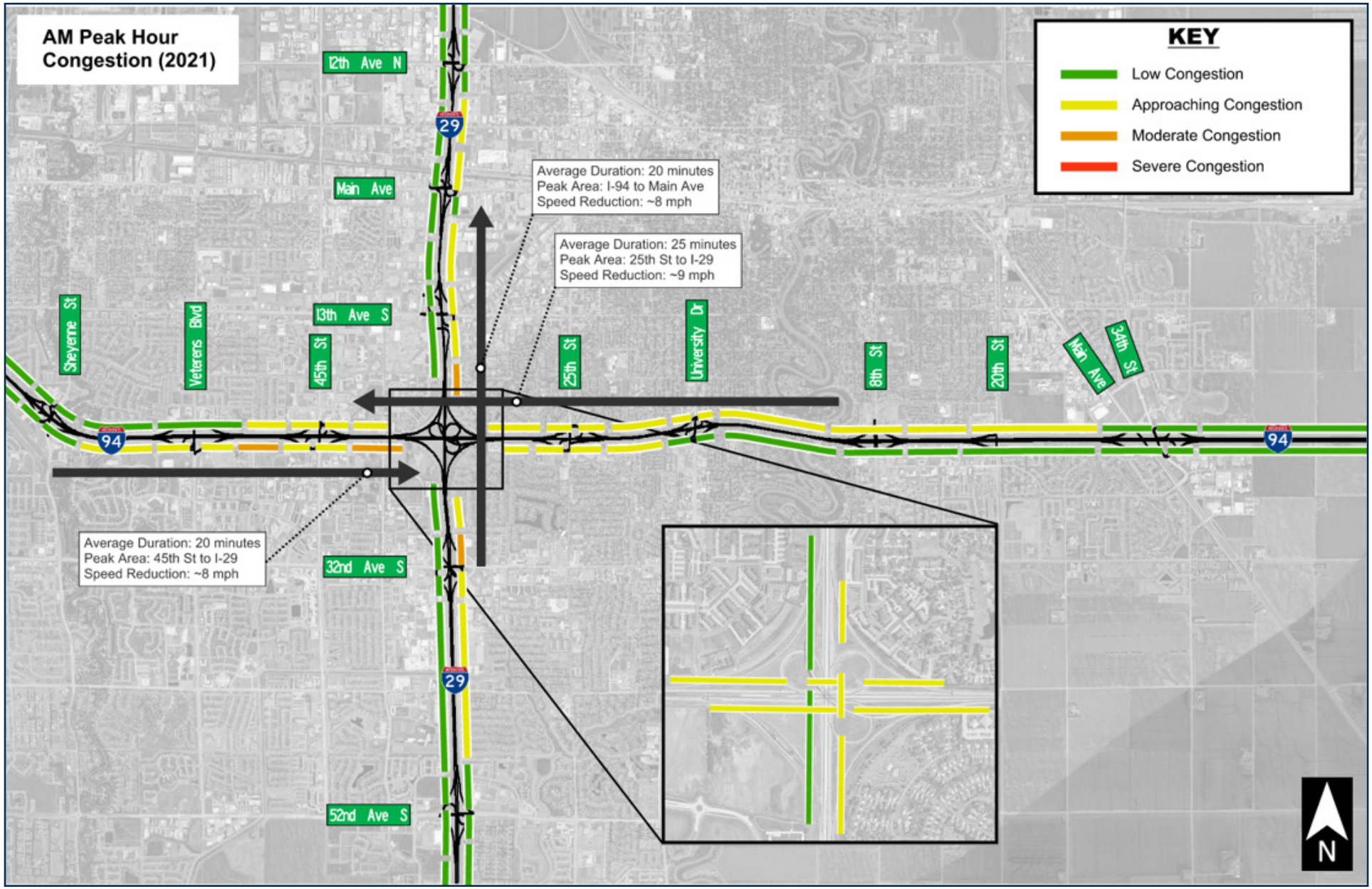


Figure 3.3. 2021 PM Peak Hour Congestion

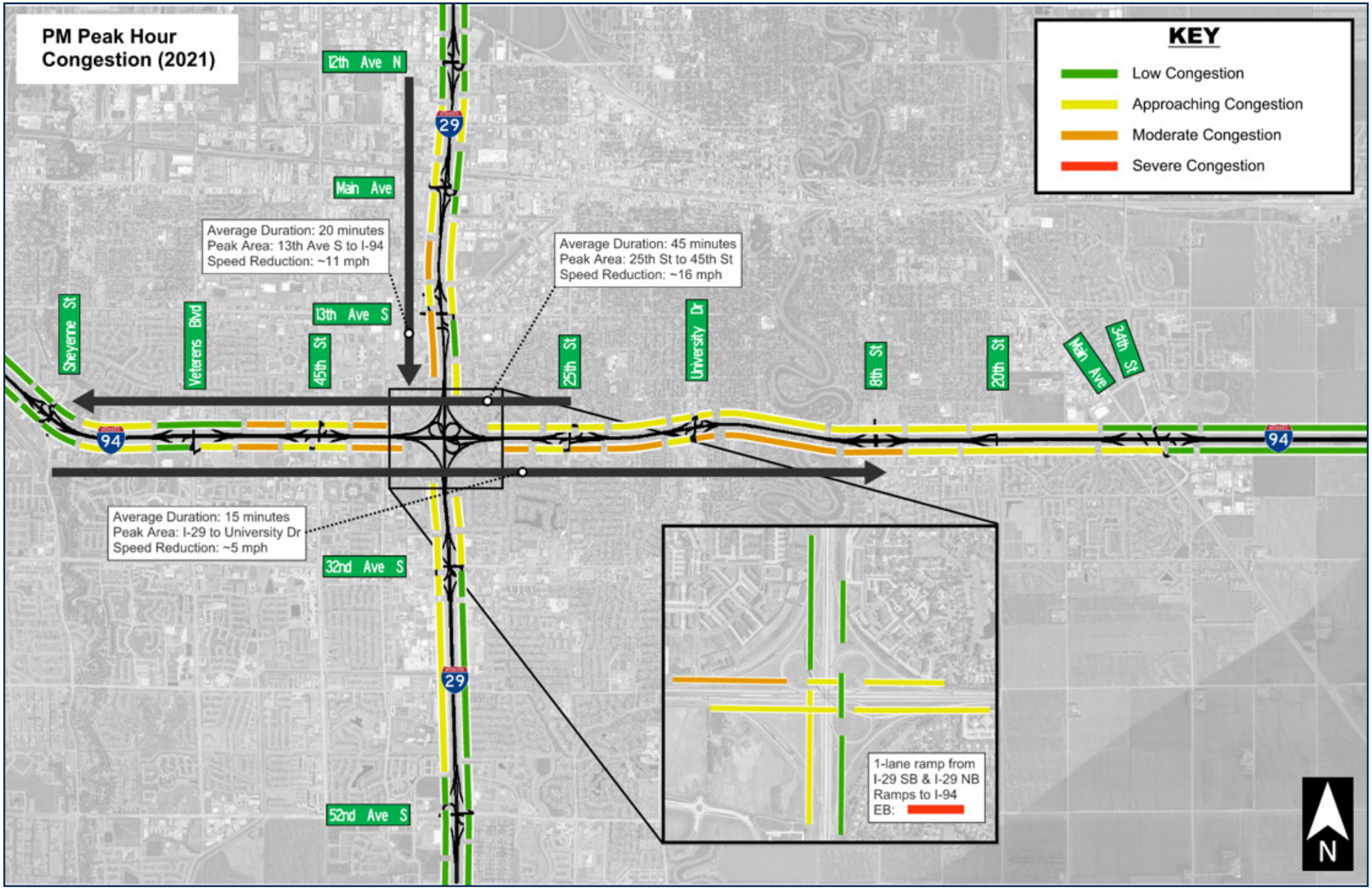


Figure 3.4. 2045 AM Peak Hour Congestion (No-Build)

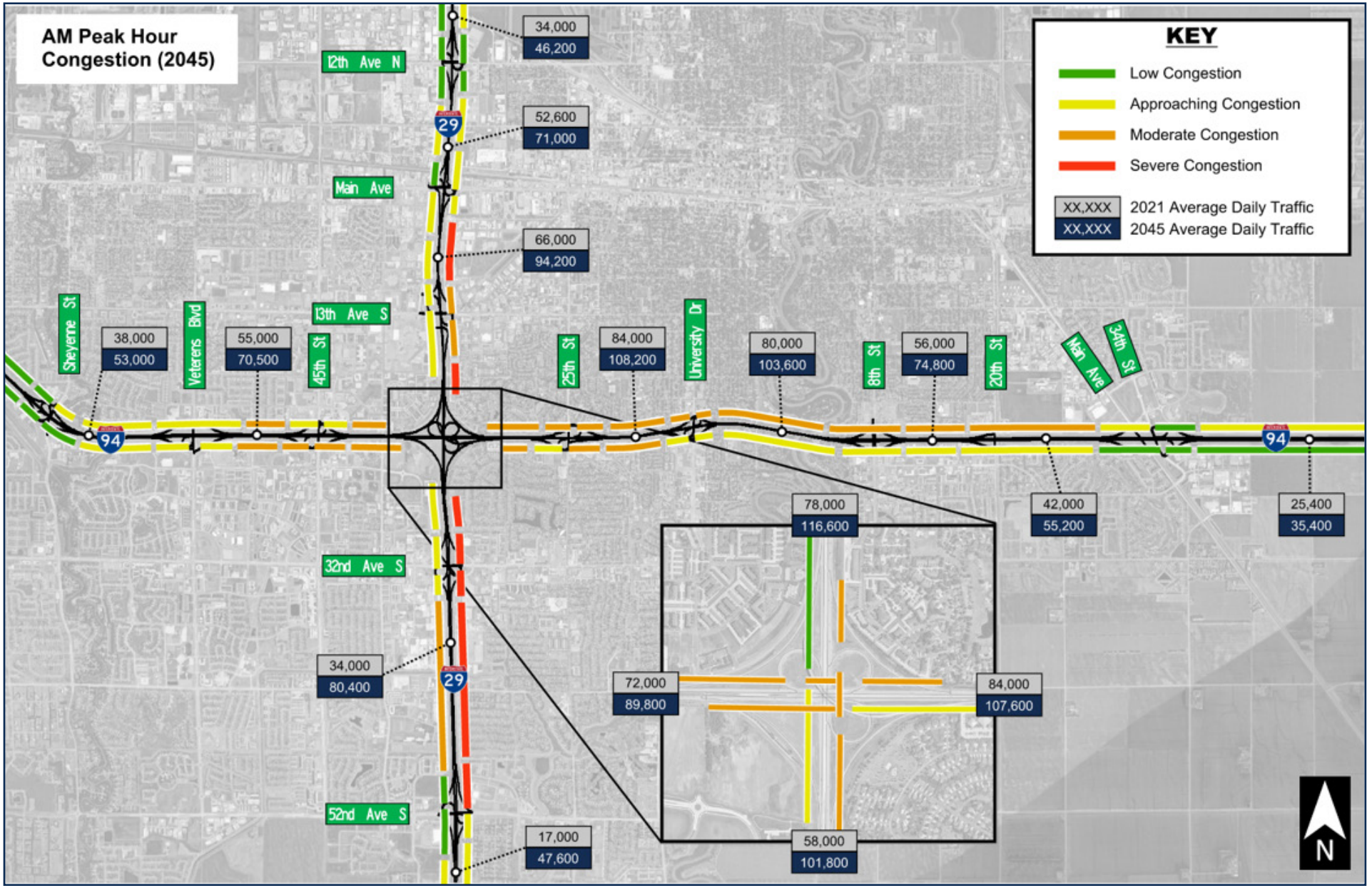
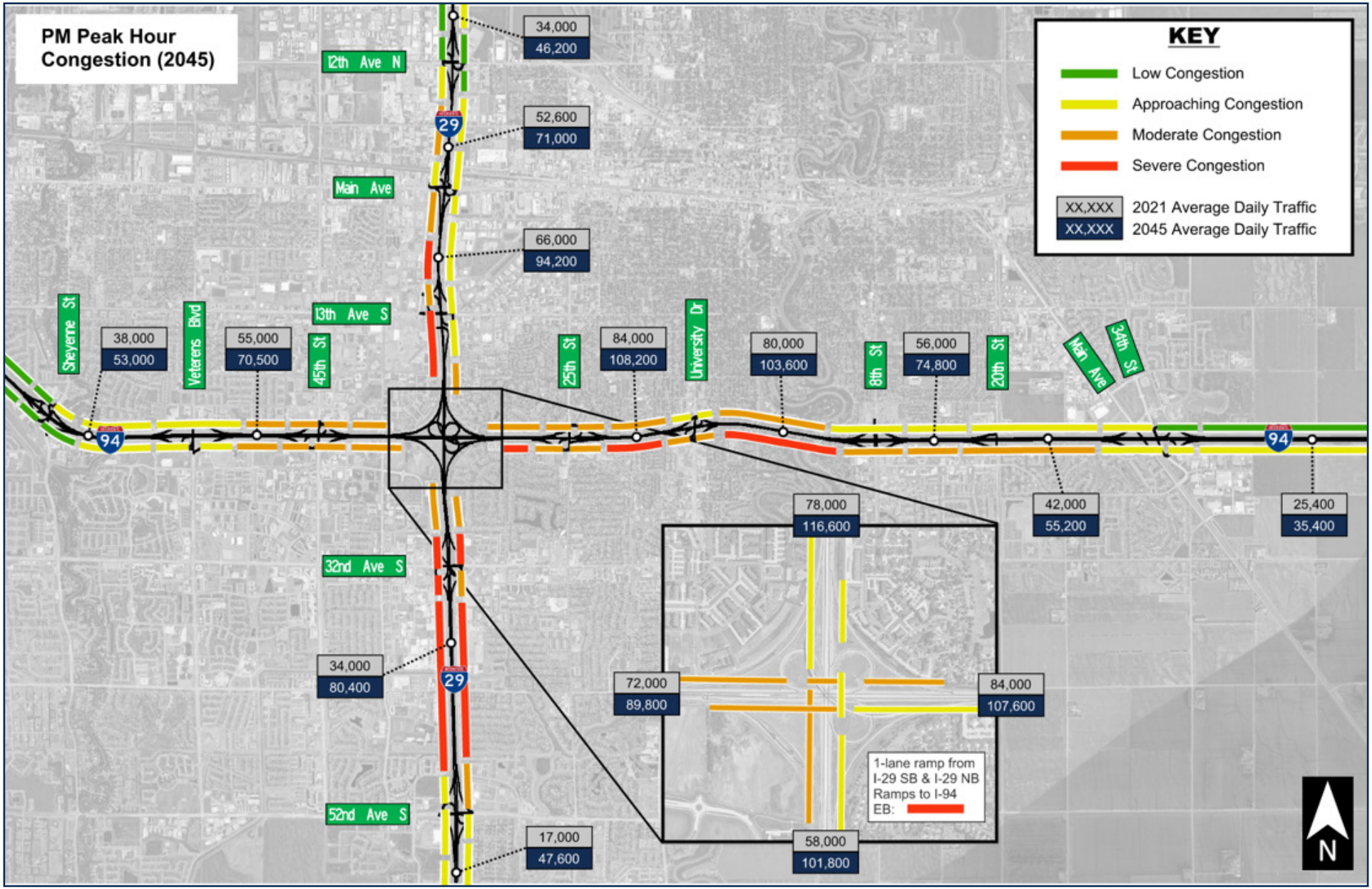


Figure 3.5. 2045 PM Peak Hour Congestion (No-Build)



Recurring vs Non-Recurring Congestion

As shown in the speed profiles section, 15th and 85th percentile speeds can vary considerably during the peak hour on I-29 and I-94. 15th percentile speeds are typically impacted by root causes of congestion that is not purely capacity. FHWA defines the seven root causes of congestion by the following:

- Physical Bottlenecks (Capacity)
- Traffic Incidents / Crashes
- Work Zones
- Weather
- Traffic Control Devices
- Special Events
- Fluctuations in Normal Traffic

FHWA's national estimates for recurring and non-recurring congestion in urban areas is shown on the bottom of **Figure 3.6**.

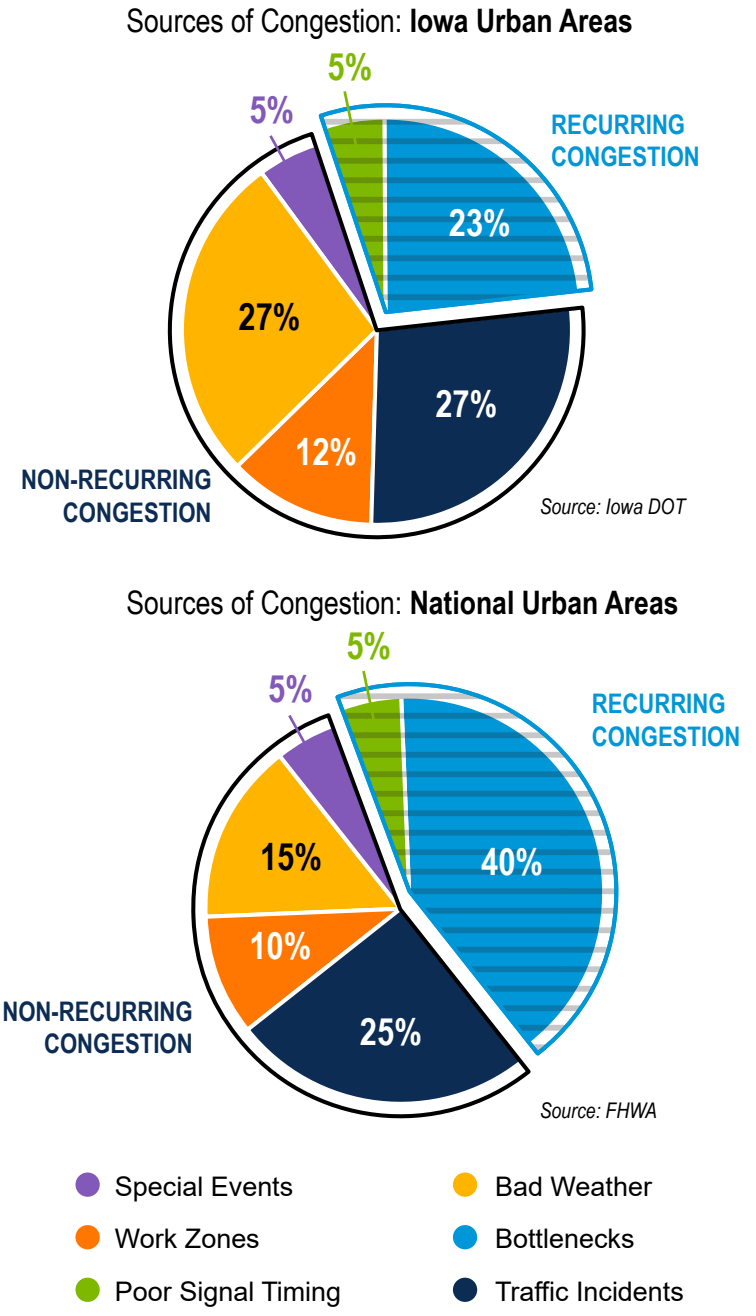
- 45% of congestion is recurring (Bottlenecks & Poor Signal Timing)
- 55% of congestion is non-recurring

Local sources of congestion for urban areas can vary substantially depending on a number of factors, with weather conditions playing a large role in the amount of non-recurring congestion. As discussed in the safety section, 43% of total crashes within the study area occur during December, January, and February. These crashes have residual effects on Interstate congestion depending on location, severity, and crash clearance times.

Iowa DOT developed their own analysis that breaks down recurring and non-recurring congestion, shown on the top of **Figure 3.7**. This data intensive process showed that less than 30% of congestion is recurring in Iowa Urban Areas, which are considered more similar to the Fargo-Moorhead metropolitan area than many other urban areas nationally.

The study team estimates that the percent recurring congestion in the Fargo-Moorhead metro area is 20%-30%.

Figure 3.6. Recurring and Non-Recurring Congestion Pie Charts

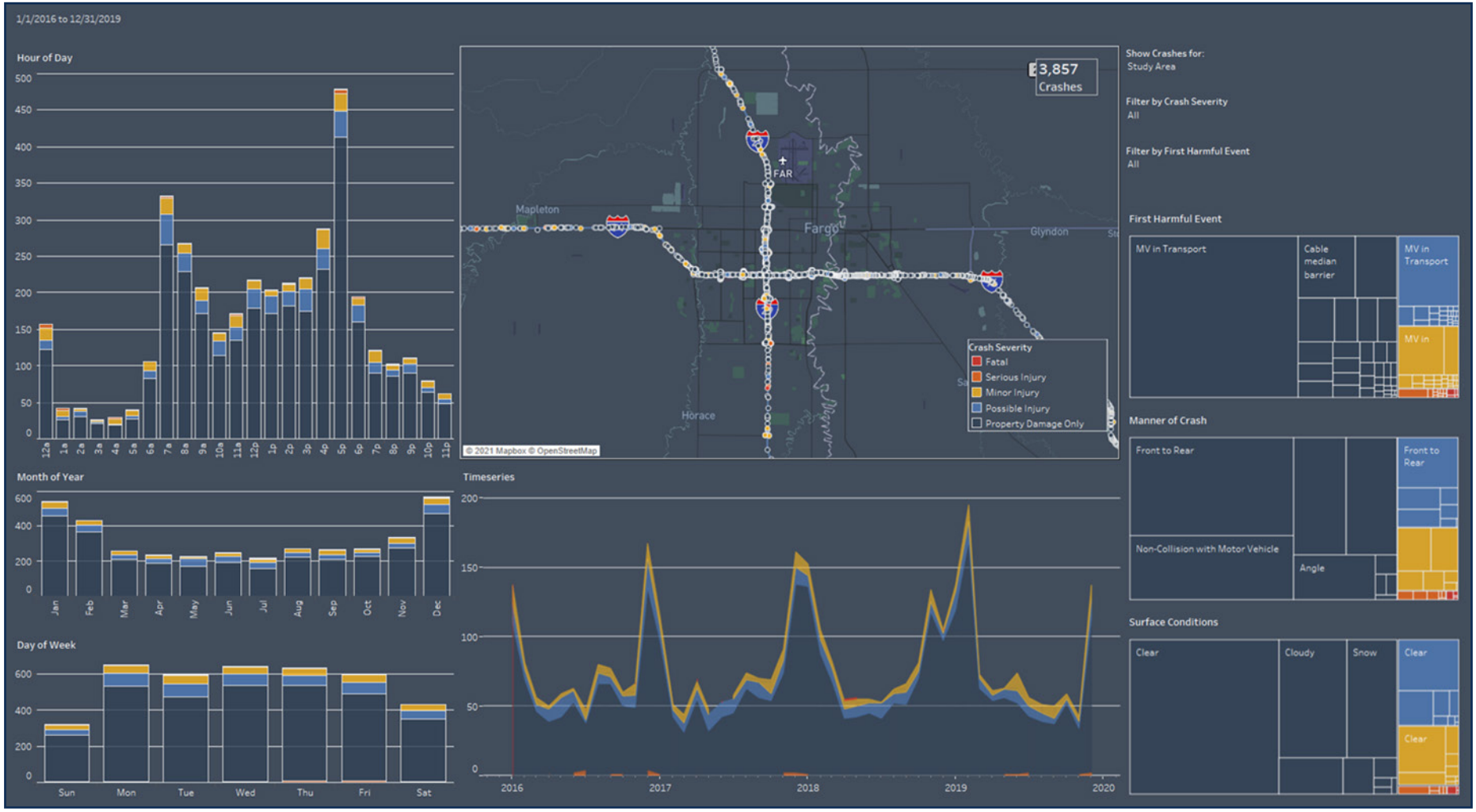


Safety

Safety Dashboard

The study team developed a Tableau dashboard to select, sort, and filter crashes by time of day, day of week, month of year, type, and location. This dashboard, shown in **Figure 3.7**, allowed the study team to investigate locations identified by the SRC. Additional details on the safety analysis are included in **Appendix C**.

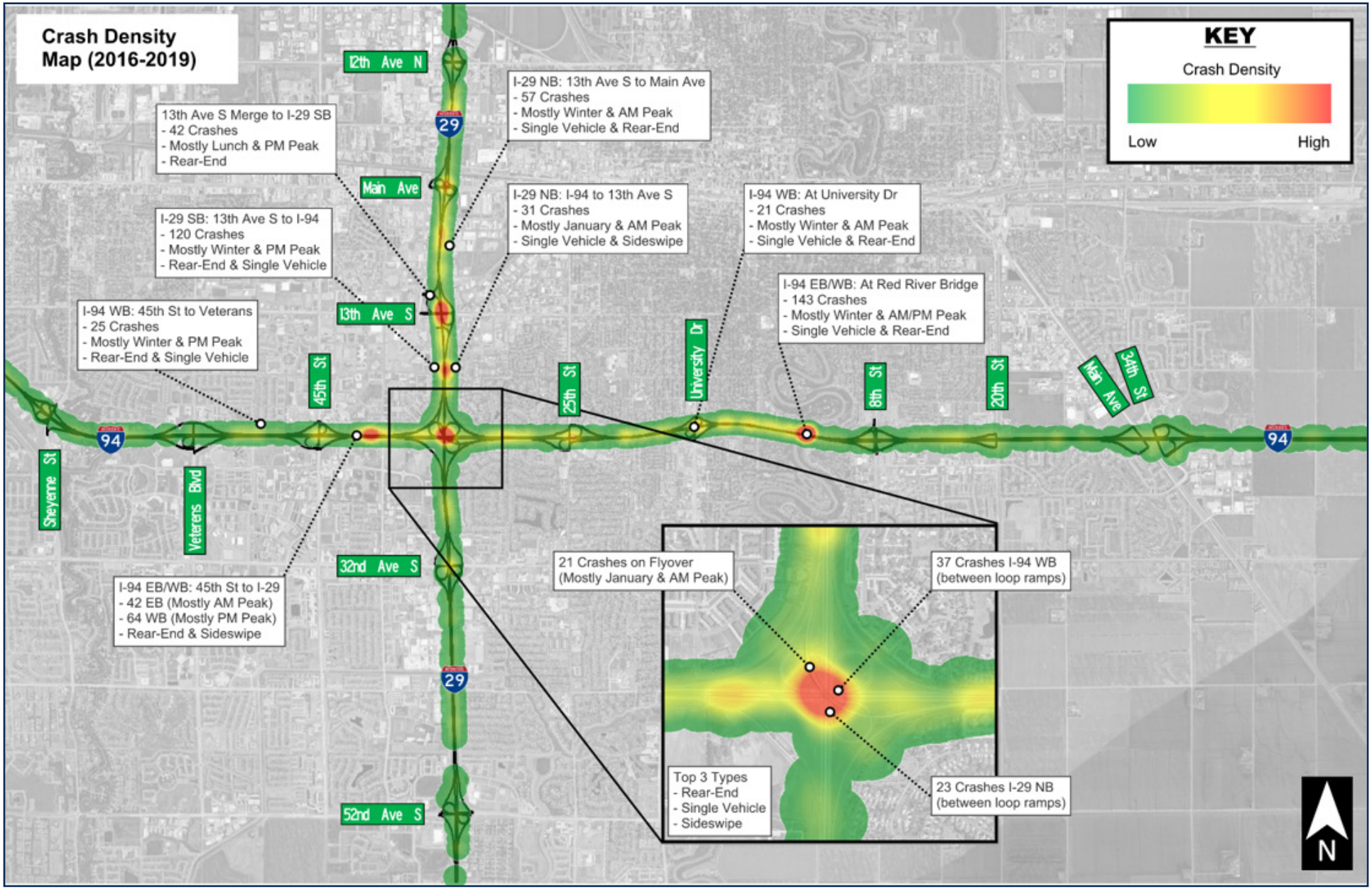
Figure 3.7. Safety Dashboard



Crash Density Map

The study team developed a crash density map to identify areas of high crash frequency along the Interstate system. The map, shown in **Figure 3.8**, was used in conjunction with the safety dashboard to highlight areas needed for further investigation. Crash investigation summaries from the safety dashboard are also included in **Figure 3.8**

Figure 3.8. Crash Density Map & Safety Dashboard Summary



TEMPORAL CRASH INVESTIGATION

The temporal nature of the study area crashes was reviewed to understand the potential impact of seasonality, time of day, and day of week on crash events.

Figure 3.9 plots the frequency of study area mainline and arterial crashes based on the month they occurred. There is substantial difference between the number of mainline crashes occurring during winter months (December, January, and February) compared to other months. Winter month mainline crashes account for 43% of total crashes throughout the year.

Figure 3.10 shows the distribution of crashes by the time of day that they occurred. As shown in the figure, study area crashes peaked during the 7 AM and 5 PM hours. These times reflect the AM and PM peak traffic hours, coinciding with higher traffic volumes on the Interstate system. **Figure 3.11** shows the distribution of crashes during winter months, with a majority of the crashes occurring during the AM peak period.

No unusual day-of-week trends were found. Crash trends followed the total daily traffic observations on the Interstate system, with more crashes occurring on workdays compared to weekends.

Figure 3.10. Study Area Crashes by Time-of-Day (Mainline & Arterial)

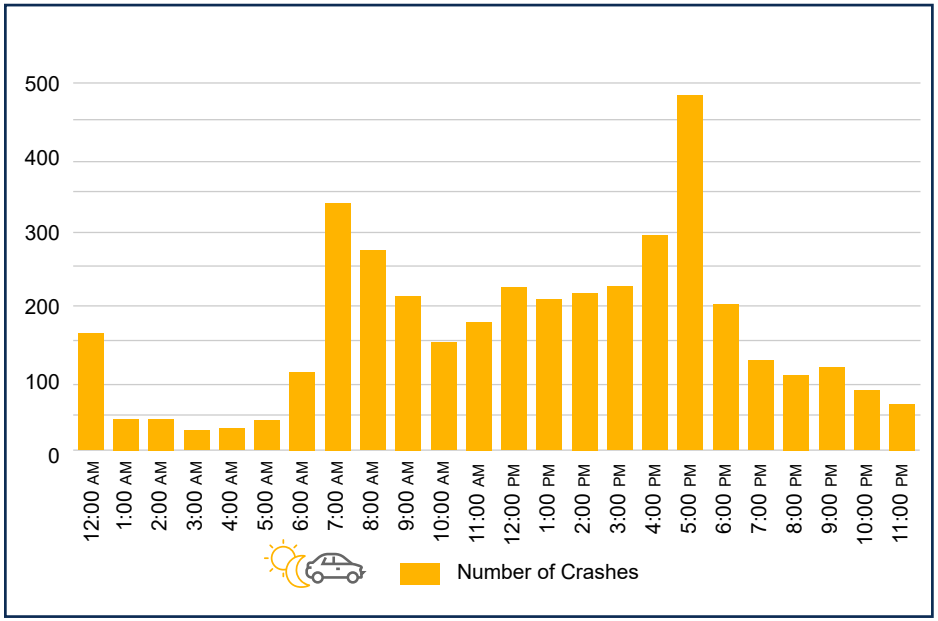


Figure 3.9. Study Area Crashes by Month

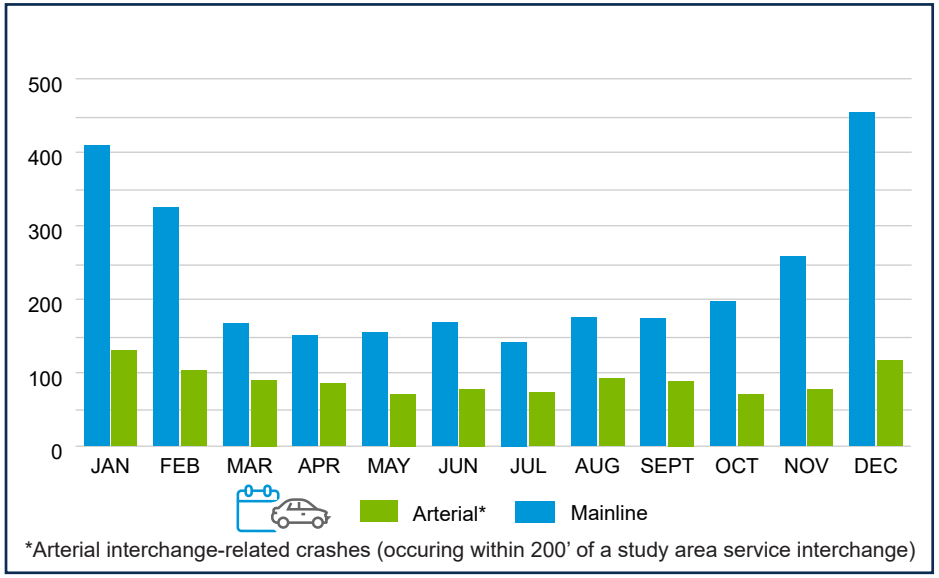
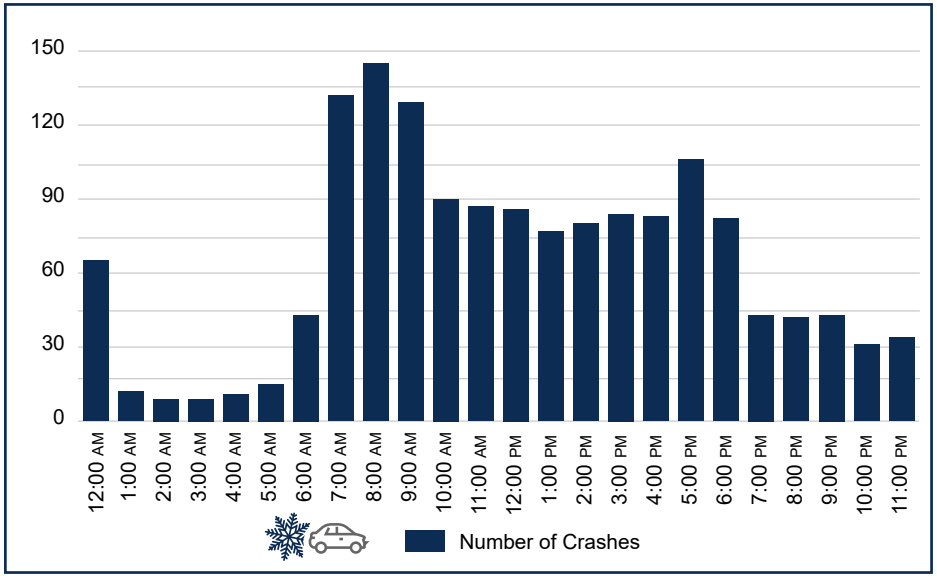


Figure 3.11. Winter Study Area Crashes by Time-of-Day (Mainline & Arterial)



4 | Strategy Development & Analysis

This chapter details the improvement strategies that were developed during the IOS. Many of these strategies were carried forward into the implementation plan in Chapter 5. Some strategies were not ultimately recommended as part of the IOS, but still should be considered during future project development phases.

Mainline Geometric Strategies

The study team assessed operational and safety deficiencies along I-29 and I-94 to develop geometric improvement strategies. The study team reviewed the following mainline geometric improvements:

- Traditional Interstate Widening
- Auxiliary Lanes
- Collector-Distributor Roads
- Braided Ramps

Traditional Interstate Widening

Traditional Interstate widening refers to the process of expanding an existing Interstate by adding travel lanes in each direction to reduce peak hour congestion. This strategy works well in areas where merge/diverge and/or weaving volumes don't cause significant mainline disruption. Areas considered for additional mainline lanes are listed in **Table 4.1**. Note that areas identified in **v** were not all carried forward into the implementation Plan.

Table 4.1. Traditional Interstate Widening Locations

INTERSTATE	FROM	TO	BASIC FREEWAY LANES	
			EXISTING	PROPOSED
I-94	Sheyenne St	I-29	4	6
I-94	I-29	8th Street	6	8
I-94	8th Street	MN 336	4	6
I-29	Main Avenue	I-94	6	8
I-29	32nd Ave S	52nd Ave S*	4	6

*Interstate widening may extend to C-D Roads between 52nd Ave S & 76th Ave S

Auxiliary Lanes

Auxiliary Lanes are additional lanes between an entrance ramp and exit ramp to provide additional space for traffic to merge / diverge / weave to stay on their intended route. They also provide additional space for vehicles and trucks to accelerate / decelerate and minimize disruption to the remaining through lanes. Auxiliary lanes were considered within the core of the study area where entry / exit ramp volumes are the highest. The study team considered the following locations for auxiliary lanes:

- I-94: Sheyenne Street to 8th Street (in Moorhead)
- I-29: 19th Avenue N to 52nd Avenue S

COLLECTOR-DISTRIBUTOR ROADS

C-D Roads are parallel roadway facilities that separate local traffic from through traffic to reduce merge/diverge disruptions to Interstate mainline segments. The study team reviewed the applicability of C-D roads for various lengths along I-29 and I-94. Two options were developed: a longer C-D road system through the core of the metro area and a shorter C-D road system around the system interchange. Due to origin-destination patterns and overall cost to construct, the longer C-D road system was removed from consideration.

The study team developed the shorter C-D road system strategy, shown in **Figure 4.1**. Key features of this strategy are detailed in the SRC slides and notes in **Appendix A** and are listed below.

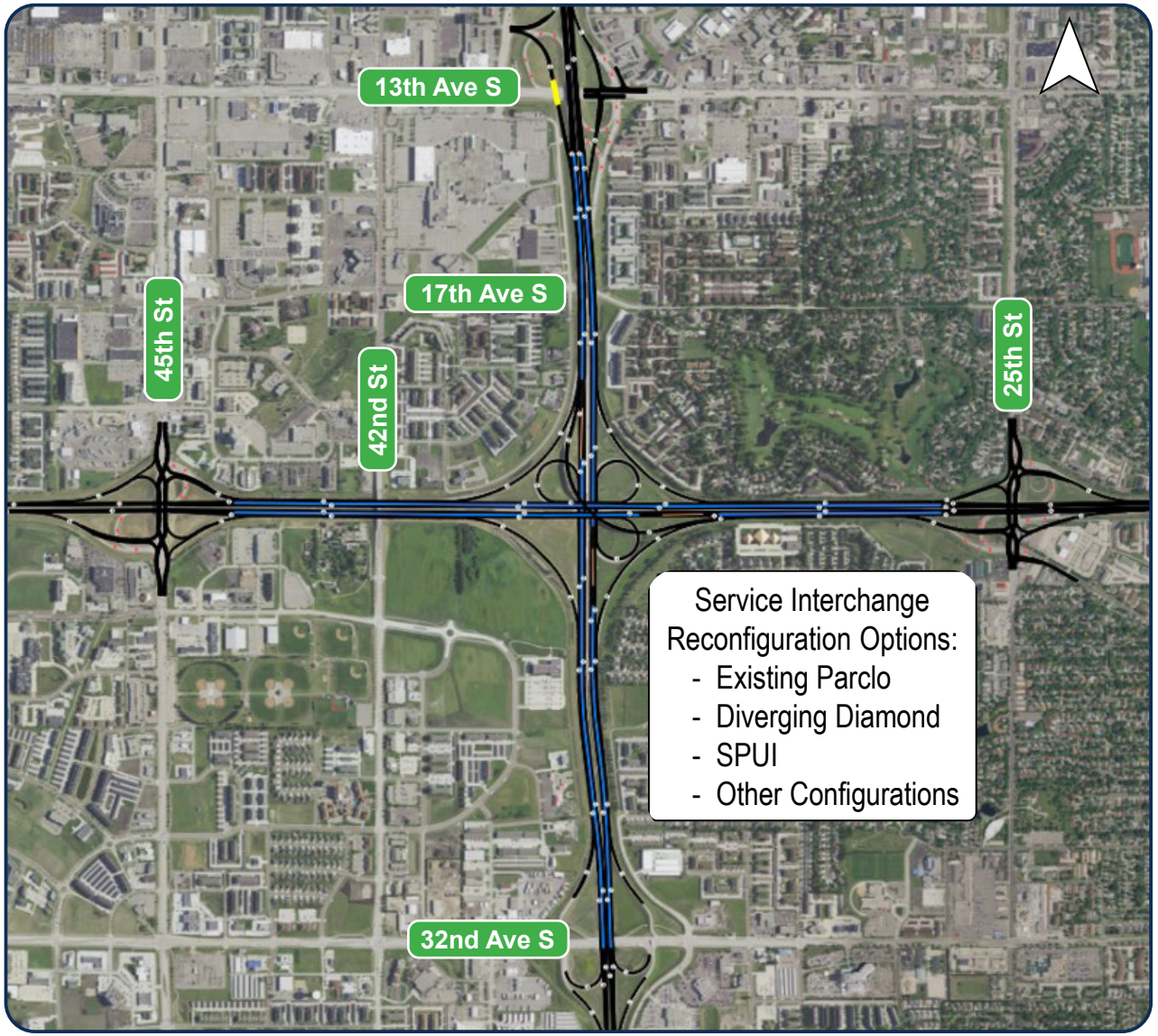
- **Start / End:** C-D Road develops / terminates under service interchange. Due to the closely spaced interchanges along I-29 & I-94, starting the C-D road under a service interchange helped meet AASHTO minimum lengths between successive ramps.
- **Interchange Modifications**: The study team determined (in most cases) that a single entrance ramp onto the C-D road system also helped meet AASHTO minimum ramp spacing to make the C-D road strategy potentially feasible. As shown in **Figure 4.1**, a mixture of existing configuration, DDIs, and other interchange modifications are shown. The study team did not determine a recommended interchange configuration, and a follow up study would need to be performed to determine this.

- **Number of Lanes:** The study team used Streetlight Origin-Destination patterns and Microsimulation to help determine the number of mainline and C-D road lanes. A large portion of Interstate users are destined for the system interchange to move between I-94 & I-29 to stay on their intended route. Because of this, 2 mainline lanes and 3 C-D road lanes were recommended for this concept.

Ultimately, the C-D road strategy was removed due to the reduced operational effectiveness compared to the cost of the project. Many of the existing and future operational issues relate to the closely-spaced interchange ramps and heavy weaving volumes. The C-D road strategy essentially shifts the heavy weaving volumes onto a C-D road. This improves the peak hour operations for the Interstate mainline segments, but the C-D road has poor LOS operations and slowdowns.

Additionally, there could be some wayfinding concerns for the end user. For example, WB I-94 traffic would need to exit to the C-D road under 25th Street to get to the 45th Street exit.

Figure 4.1. Collector-Distributor Road Strategy



Braided Ramps

Braided ramps are a strategy that separate entering and exiting traffic by shifting one of the movements onto a bridge. This removes the weaving traffic along the Interstate segment entirely. A braided ramp example is shown in **Figure 4.2**. In the figure, the entrance ramp bridge spans over the exiting traffic from the freeway. If traffic on the entrance ramp wants to exit at the downstream ramp, the user takes the slip ramp highlighted in green.

The study team developed a braided ramp strategy, shown in **Figure 4.3**. Key features of this strategy are detailed in the SRC slides and notes in **Appendix A** and are listed below.

- **Start / End & Interchange Modifications:** To meet AASHTO minimum ramp spacing, the braided ramp strategy followed the same approach as the C-D road concept.
- **Number of Lanes:** It was determined that 3 mainline lanes on I-29 & I-94 would be needed between the start and end of the C-D road system. Ramp traffic routed onto a parallel C-D road facility would need 1 or 2 lanes, depending on the location. The main reason the number of mainline lanes are different from the C-D road concept is due to the additional mainline demand from the braided ramps that enter directly onto the mainline instead of the C-D road.
- **Slip Ramps:** The study team included slip ramps on all 4 quadrants to maintain full access to the system interchange. Traditionally, braided ramps at service interchange do not have a slip ramp to discourage users from entering the Interstate and then leaving at the next downstream exit ramp. Since our project area includes a system interchange, we did not want to restrict the following movements:
  - Between 45th St & I-29
  - Between 25th St & I-29
  - Between 13th Ave S & I-94
  - Between 32nd Ave S & I-94

The full Braided Ramp concept was not carried forward due to overall project cost. The study team did carry forward the braided ramp strategy on I-29 between 13th Ave S and I-94 due to its operational benefits and existing safety concerns.

Figure 4.2. Braided Ramp Example

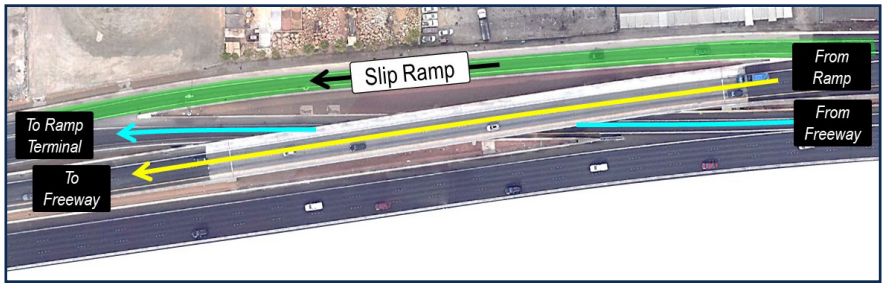
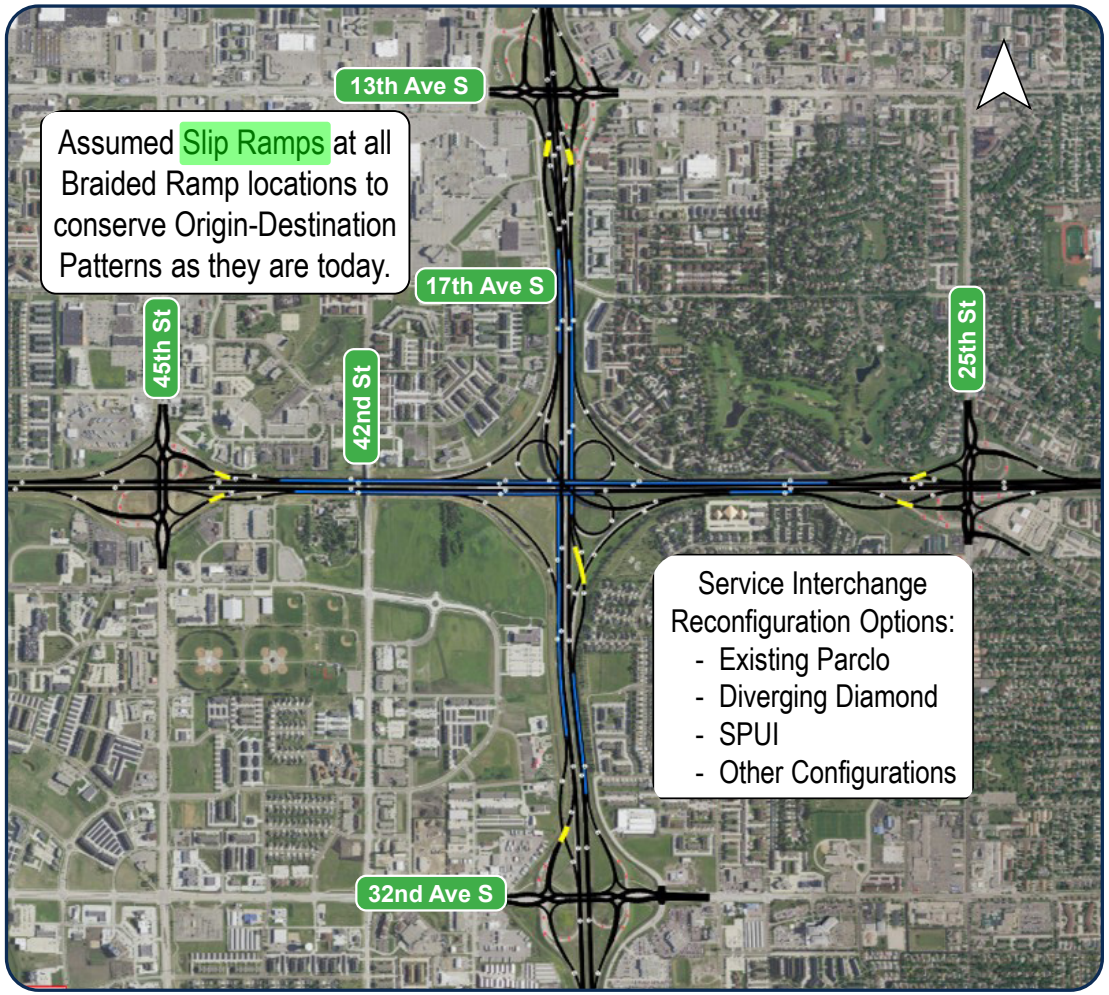


Figure 4.3. Braided Ramp Strategy



Interchange Strategies

Service Interchanges

The study team assessed operational and safety deficiencies at the service interchanges to develop recommended improvements. The following service interchanges are included within the IOS study area including a discussion on potential improvements.

I-94 INTERCHANGES

165TH AVENUE (KINDRED EXIT)

This interchange is a likely candidate for the connection point between the NW & SW perimeter road and I-94. The NW perimeter road is anticipated to carry:

- 4,000 - 6,000 ADT in 2045

The SW perimeter road is anticipated to carry:

- 4,000 - 7,000 ADT in 2045

This influx in 2045 volume at the 165th Avenue interchange would require ramp terminal modifications (signalization or roundabouts) and adjustments to the closely spaced intersections adjacent to the ramp terminal intersections.

38TH STREET (RAYMOND INTERCHANGE)

Future traffic demand at the 38th Street interchange is dependent on the following:

- West Fargo growth patterns once the Diversion is completed
- Potential improvements / connections at the Main Avenue interchange and 13th Avenue

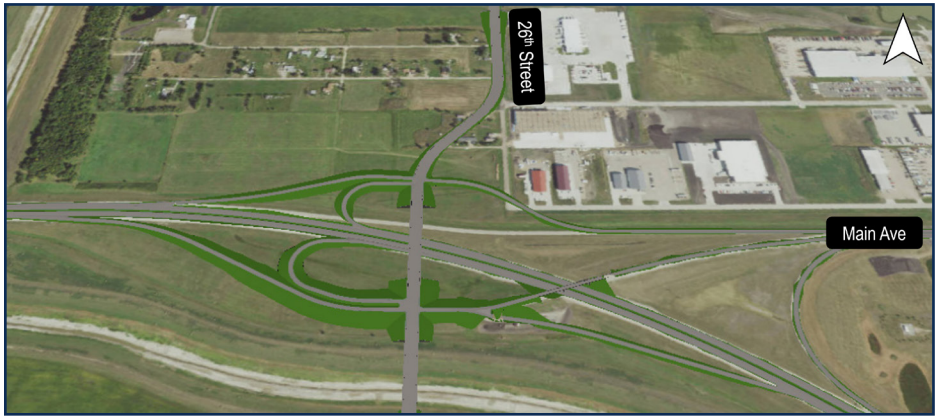
Based on current land use growth assumptions, no interchange modifications are identified at this location. The interchange should continue to be monitored as growth patterns change as more developable land becomes available north and south of I-94.

NDDOT designed the existing diamond interchange to allow a SB to EB loop ramp to be constructed with little impact to existing ramps.

MAIN AVENUE [US 10]

This interchange was reviewed as part of Metro COG's Northwest Metro Transportation Plan. The plan looked at potential build out scenarios including growth assumptions and added connectivity over transportation barriers. Although this study did not identify operational deficiencies at the Main Avenue interchange, local access needs and connectivity to/from I-94 would be improved considerably with an interchange reconfiguration. The concept from the Northwest Metro Transportation is shown in **Figure 4.4**.

Figure 4.4. Main Avenue & 26th Street Interchange Concept



The City of West Fargo is looking at additional concepts in an effort to preserve future right of way north of I-94 and west of 26th Street to ensure that a future interchange remains feasible once the surrounding area is developed.

SHEYENNE STREET [CR 17]

Construction for this interchange reconfiguration was completed in 2020. The modified single-point urban interchange (SPUI) will provide long-term capacity needs for users to/from West Fargo.

VETERANS BOULEVARD

Future year forecasts show a moderate increase in daily traffic at the Veterans Boulevard interchange. No major improvements were identified at Veterans Boulevard, but the following modifications would improve the operational efficiency at the interchange as traffic grows in the area:

- Additional SB through lane at the westbound ramp terminal – dropping at the SB to EB loop ramp.
- NB dual lefts at the westbound ramp terminal (intersection currently has available pavement for NB dual lefts)

45TH STREET

This interchange was modified in 2010. This improvement added a loop ramp in the NE quadrant of the interchange and provided additional through capacity along 45th Street. This improvement will provide long-term capacity needs along 45th Street. Arterial operations may be improved by dropping the right-most lane similar to the example shown in **Figure 4.5** at University Drive.

Long-term capacity needs along I-94 may require a modified interchange configuration at 45th Street. Collector-Distributor roads and braided ramp options would likely require ramp modifications at a minimum. Additional discussion on these needs is discussed previously in the mainline strategies section.

25TH STREET

This interchange was modified in 2015. This improvement added a directional ramp in the SE quadrant of the interchange which improved the EB ramp terminal intersection operations. This improvement will provide long-term capacity needs along 25th Street.

Long-term capacity needs along I-94 may require a modified interchange configuration at 25th Street. Collector-Distributor roads and braided ramp options would likely require ramp modifications at a minimum. Additional discussion on these needs is discussed previously in the mainline strategies section.

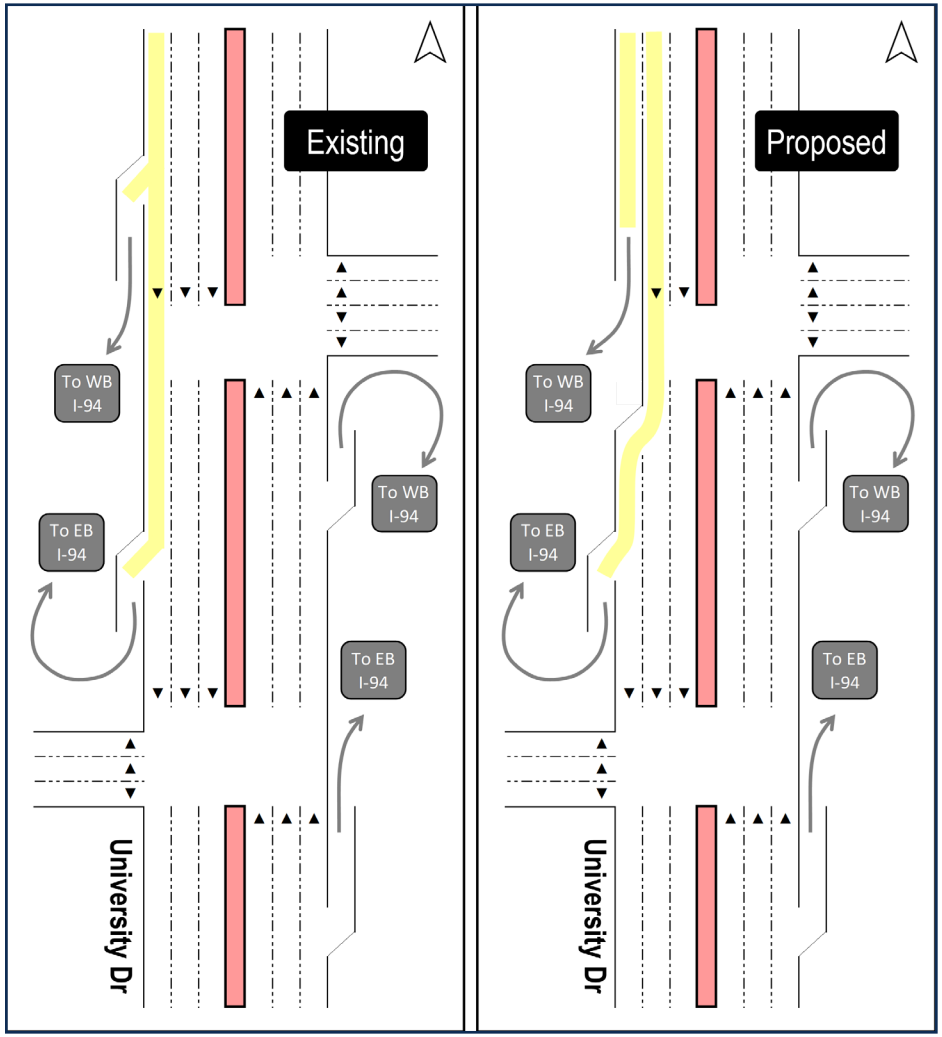
UNIVERSITY DRIVE

Future year forecasts show a moderate increase in daily traffic at the University Drive interchange. The parclo configuration is anticipated to operate at acceptable operations through the planning horizon. Parlco configurations can cause poor lane utilization at closely spaced intersections since both entrance ramps from the arterial to the Interstate are from the right-most lane.

At University Drive, the SB lane utilization may be improved by dropping the right-most lane at the SB to WB entrance ramp as shown in the proposed configuration in **Figure 4.5**. This lane drop would allow the SB to EB traffic to utilize the middle SB lane thereby improving SB arterial lane utilization. This strategy aims to balance traffic across all lanes to improve ramp terminal and adjacent intersection signal operations.

As Interstate and ramp volumes increase at parclo interchanges, this lane reconfiguration strategy may be applicable at multiple interchange locations throughout the metro.

Figure 4.5. Parclo Modification Example at University Drive



8TH STREET (IN MOORHEAD)

This diverging diamond interchange reconfiguration was completed in 2017. The DDI will provide long-term capacity needs at 8th Street. When constructed, the interchange included fiber connections for potential future ramp metering deployment in the region.

20TH STREET (IN MOORHEAD)

The 20th Street interchange is a half interchange within Moorhead. Although this study did not identify operational deficiencies at the 20th Street, there may be local access and connectivity needs that a full access interchange may provide. There are several barriers to providing a full interchange at this location including:

- Right-of-Way Constraints (Church, Community College, Industrial Buildings)
- Railroad Conflicts (to the east)
- Existing Trail Crossing
- Rest Area Exit Ramp Spacing
- Bridge Lateral Clearance (Roadway and Railroad)

The City of Moorhead & Metro COG will look at potential build alternatives in detail in a follow-up study in 2023 / 2024.

MAIN AVENUE / 34TH STREET (IN MOORHEAD)

The Main Avenue interchange and 34th Street interchange act as a single interchange. This interchange was reconfigured in 2011. As volumes continue to grow at the Main Avenue interchange, minor ramp terminal improvements may be required including signalization or roundabouts on Main Avenue.

MN 336 (IN MOORHEAD)

Future year forecasts show a moderate increase in daily traffic at the MN 336 interchange – mostly driven by external traffic. Note that future forecasts are based on typical weekday traffic and do not include “lake traffic” influxes during summer months.

This interchange is a likely candidate for the connection point between the NE perimeter road and I-94. The NE perimeter road is anticipated to carry:

- 5,000 - 8,000 ADT in 2045

The current interchange configuration has capacity for additional 2045 volume growth anticipated by the perimeter roadway. Unsignalized ramp terminal intersections and closely spaced intersections should continue to be monitored for safety issues along MN 336.

I-29 INTERCHANGES

100TH AVENUE S [CR 14]

This interchange is currently rural but expected to be on the fringe of the urban area by 2045. It is anticipated that the existing interchange will be reconfigured and/or updated to urban design standards by 2045. Improvements will also include adjustments to the closely spaced intersections at the ramp terminal intersections.

The 100th Avenue S interchange is a likely candidate for the connection point between the SW perimeter road and I-29. The SW perimeter road is anticipated to carry:

- 4,000 - 7,000 ADT in 2045 with ADTs near I-29 at 11,000

The 100th Avenue S reconfiguration needs to consider 2045 volume growth from the potential SW perimeter road connection.

64TH AVENUE S / 76TH AVENUE S

The City of Fargo will look at new interchange configurations at both 64th Avenue S and 76th Ave S through a separate study. The goal of this study is to complete an Interstate Justification Report, environmental documentation, and design plans at the 64th Avenue Interchange. At 76th Avenue S, the city plans to secure future ROW for a future interchange post-2025.

- The city intends for the 64th Avenue S corridor to be more pedestrian, bicycle, and transit focused with traffic calming enhancements along 64th Avenue S.
- The ultimate future design for 76th Avenue S has not been determined yet, but it is currently anticipated that the corridor will have more roadway capacity and higher levels of vehicular mobility with more limited access compared to 64th Avenue S.

The 76th Avenue S interchange is a likely candidate for the connection point between the SE perimeter road and I-29. The SE perimeter road is anticipated to carry:

- 8,000 - 17,000 ADT in 2045

The 76th Avenue S configuration needs to consider 2045 volume growth from the potential perimeter road and new Red River crossing.

52ND AVENUE S

The 52nd Avenue S interchange is expected to experience significant growth by 2045. Future growth at the interchange will be dependent on development patterns and the ultimate configuration of the 64th Avenue S and 76th Avenue S interchanges.

The arterial parclo lane utilization issues discussed previously at the I-94 & University Drive apply to 52nd Avenue, with the heavy volumes utilizing the WB to NB directional ramp results in poor WB lane utilization along 52nd Avenue S. This is a similar improvement as the University Drive lane reconfiguration shown in **Figure 4.5**.

32ND AVENUE S

This interchange was reconfigured as a parclo in 2017. This improvement added a loop ramp in the SW quadrant of the interchange which improved the SB ramp terminal intersection operations and SB I-29 weaving operations (lengthening the SB weave distance). This improvement will provide long-term capacity needs along 32nd Avenue S.

Long-term capacity needs along I-29 may require a modified interchange configuration at 32nd Avenue S. Collector-Distributor roads and braided ramp options would likely require ramp modifications at a minimum. Additional discussion on these needs is discussed previously in the mainline strategies section.

13TH AVENUE S

The 13th Avenue S interchange is one of the most unique interchanges within the metro area. Existing unique features include:

- NB directional exit ramp to West Acres Mall
- Access point to businesses on NB entrance ramp
- Modified loop ramp to SB I-29

The current interchange configuration results in a short weaving section on NB I-29. The weaving section on SB I-29 is longer due to the entrance ramp location on the NW quadrant of the interchange.

Long-term capacity needs along I-29 may require a modified interchange configuration at 13th Avenue S. Collector-Distributor roads and braided ramp options would likely require ramp modifications at a minimum. Additional discussion on these needs is discussed previously in the mainline strategies section.

Note that most interchange reconfiguration options would likely include reconstruction of adjacent intersections to the west of I-29.

MAIN AVENUE [US 10]

The Main Avenue interchange is expected to experience moderate growth by 2045. The study team identified future operational deficiencies at the 36th Street SB Approach at the NB ramp terminal. The SB traffic queues along the 36th Street frontage road and does not impact the rest of the interchange or cause a safety concern to I-29 or Main Avenue traffic. This approach should continue to be monitored and approach lanes should be adjusted if necessary (i.e. two SB Right turns).

12TH AVENUE N

The 12th Avenue N interchange is expected to experience moderate growth by 2045. The study team did not identify existing or future operational deficiencies at the 12th Avenue N ramp terminal intersections, resulting in no specific interchange modification recommendations.

19TH AVENUE N

The 19th Avenue N interchange is expected to experience moderate growth by 2045. The study team did not identify existing or future operational deficiencies at the 19th Avenue N ramp terminal intersections, resulting in no specific interchange modification recommendations.

40TH AVENUE N [CR 20]

The 40th Avenue N interchange is expected to experience moderate vehicular growth and significant freight growth by 2045. NDDOT is currently working on a separate study to develop interchange modification recommendations and plans to improve operations and safety at 40th Avenue N.

This location has experienced several wrong-way driving crashes, so the study team looked at potential solutions to reduce wrong-way drivers through innovative interchange configurations. One solution recommended by the study team was a single lane Diverging Diamond Interchange – similar to the example shown in **Figure 4.6**. DDI ramp terminal geometry combined with a raised medians along 40th Avenue N would reduce the potential for a user to turn from 40th Avenue N locations into oncoming traffic.

Additional options, including traditional interchange configurations and roundabouts, have been evaluated by NDDOT and will be developed through an independent study.

Figure 4.6. College Drive & I-25 Single Lane DDI

76TH AVENUE N [CR 22]

This interchange is a likely candidate for a I-29 connection point for a portion of the NW and NE perimeter roads. The NW perimeter road is anticipated to carry:

- 4,000 - 6,000 ADT in 2045

The NE perimeter road is anticipated to carry:

- 5,000 - 8,000 ADT in 2045

This influx in volume at the CR 22 interchange may require ramp terminal modifications (signalization or roundabouts) and adjustments to the closely spaced intersections adjacent to the ramp terminal intersections.

25TH STREET [CR 4]

This interchange is a likely candidate for a I-29 connection point between the NW perimeter road and I-29. The NW perimeter road is anticipated to carry:

- 4,000 - 6,000 ADT in 2045

The influx in volume at the CR 4 interchange may require ramp terminal modifications (signalization or roundabouts).

System Interchange Strategies

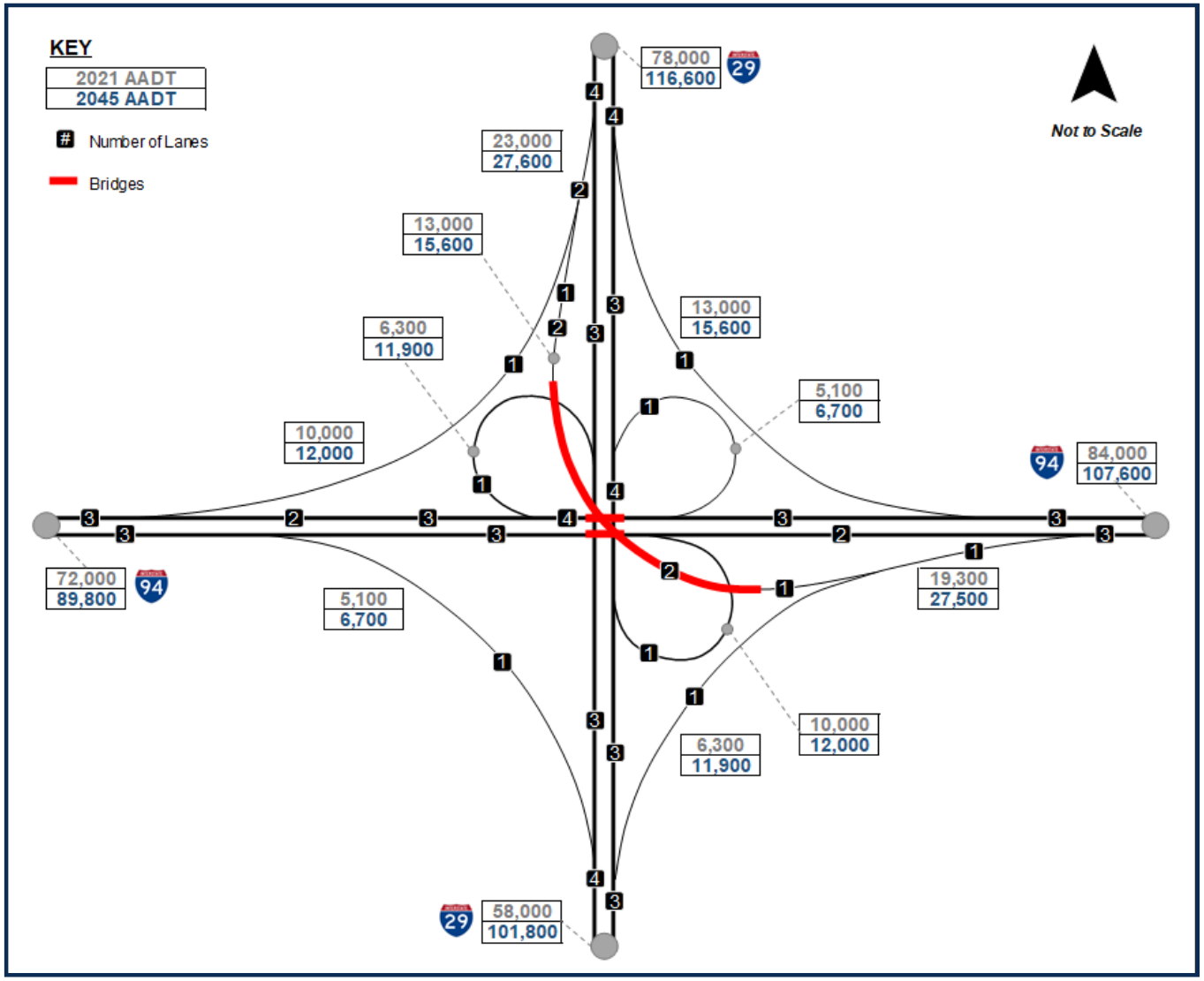
The I-29 / I-94 system interchange is expected to experience significant growth by 2045, shown in **Figure 4.7**. Most of the Interstate growth is driven by I-29 growth south of I-94, which results in significant future growth on ramps listed below.

- WB I-94 to SB I-29
- NB I-29 to EB I-94
- NB / SB I-29 through

Many of the mainline improvement options discussed previously impact operations around the system interchange. System interchange modifications were reviewed to determine if safety or operations could be improved within the system interchange or on adjacent Interstate segments. The study team reviewed the viability of the following improvements:

- SB I-29 to EB I-94 expansion to 25th Street
- SB I-29 to I-94 exit lane reconfiguration
- NB I-29 to WB I-94 Flyover
- Braided Loop Ramps
- Collector-Distributor Roads
- Dynamic Lane Assignment

Figure 4.7. System Interchange AADT

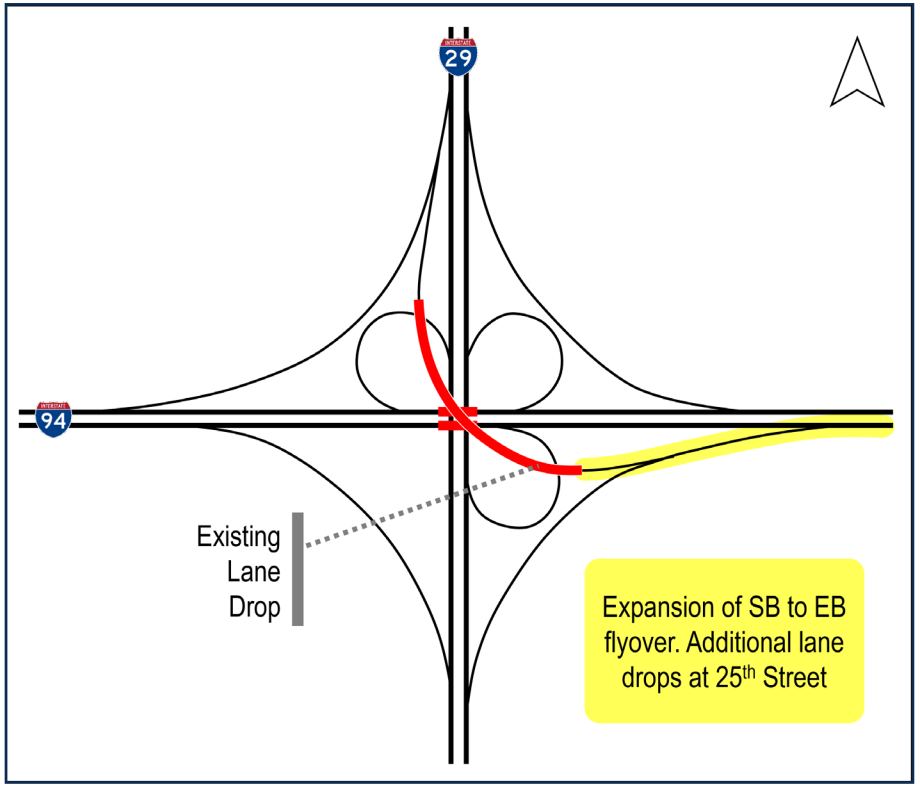


SB I-29 to EB I-94 Expansion to 25th Street

Existing Configuration: The SB to EB flyover currently drops a lane (from 2 → 1) near the "Existing Lane Drop" note shown in **Figure 4.8**. This lane drop causes significant slowdowns and capacity issues during the PM peak hour.

Proposed Configuration: This project will add an additional lane from the SB to EB flyover dropping the lane at 25th Street, shown in **Figure 4.8**. Construction for this project is anticipated in 2023 and is included in Metro COG's 2023 TIP.

Figure 4.8. SB I-29 to EB I-94 Expansion to 25th Street Schematic

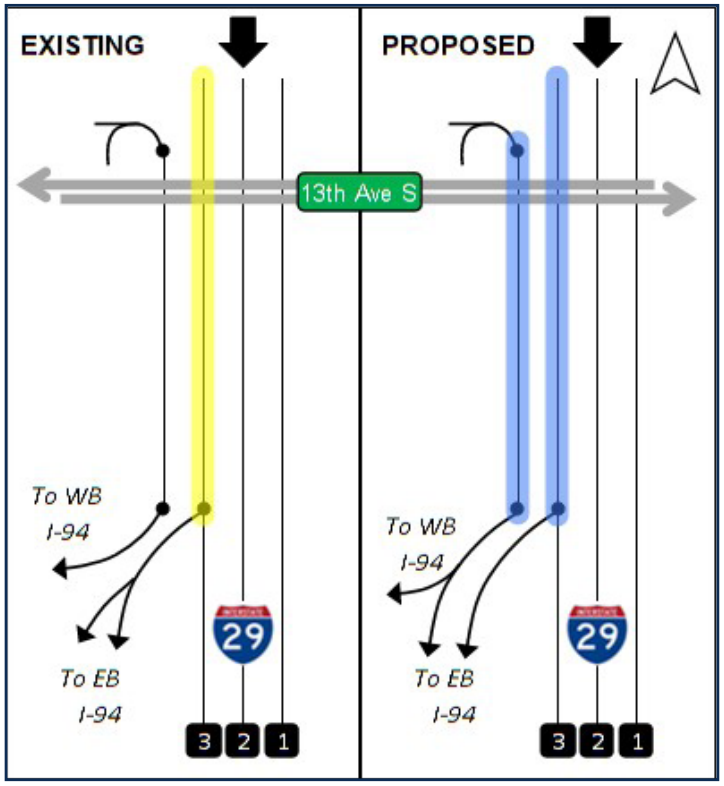


SB I-29 to I-94 Exit Lane Reconfiguration

Existing Configuration: The SB I-29 exit to I-94 currently drops the outside lane to WB I-94 and provides a single lane to EB I-94 at the exit gore. As shown in **Figure 4.8**, traffic destined for EB I-94 is confined to lane 3 (highlighted in yellow) resulting in poor SB lane utilization and congestion during the PM peak hour.

Proposed Configuration: This potential project would modify the exit ramp to provide 2 continuous lanes from SB I-29 to EB I-94. As shown in **Figure 4.9**, this lane modification would spread traffic destined for EB I-94 over two lanes (shown in blue).

Figure 4.9. SB I-29 to I-94 Exit Lane Reconfiguration Schematic



NB I-29 to WB I-94 Flyover

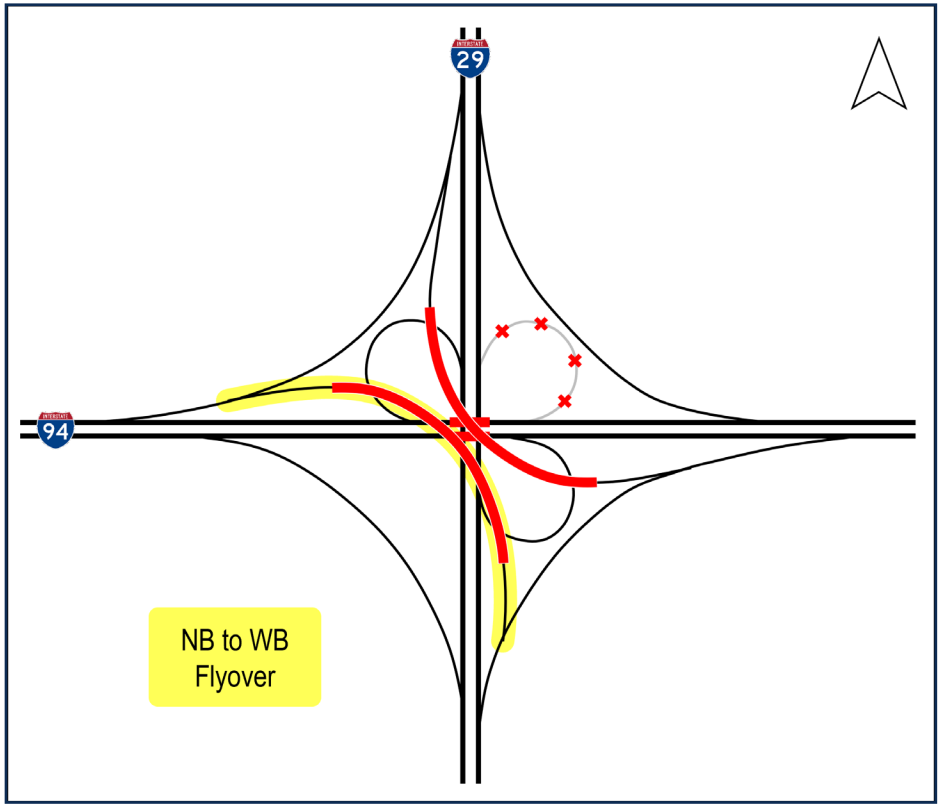
Existing Configuration: Shown previously in **Figure 4.8**, successive loop ramps along NB I-29 and WB I-94 require users to weave with entering and existing loop ramp traffic within the system interchange.

Proposed Configuration: This potential project would add a direct connector, shown in **Figure 4.10** from NB I-29 to WB I-94 (similar to the SB I-29 to EB I-94 flyover). This project would remove the existing weaving sections between successive loop ramps.

This configuration was not carried forward into the implementation plan due to the following factors.

- **High Project Costs:** NDDOT estimated the interchange reconfiguration would cost around $70 Million. There are other areas within the Metro Area that could provide a larger overall operational and safety benefit for the same amount of capital.
- **Limited Operational Benefit:** Although a NB to WB flyover would remove the existing weaving sections between loop ramps, it would reduce the effective weaving lengths for adjacent Interstate segments while increasing the weaving volumes. This results in an alternative that would perform better operationally within the core of the interchange but would operate worse at the following locations:
  - WB I-94 between I-29 & 45th Street
  - NB I-29 between 32nd Avenue S & I-94

Figure 4.10. NB I-29 to WB I-94 Flyover Schematic

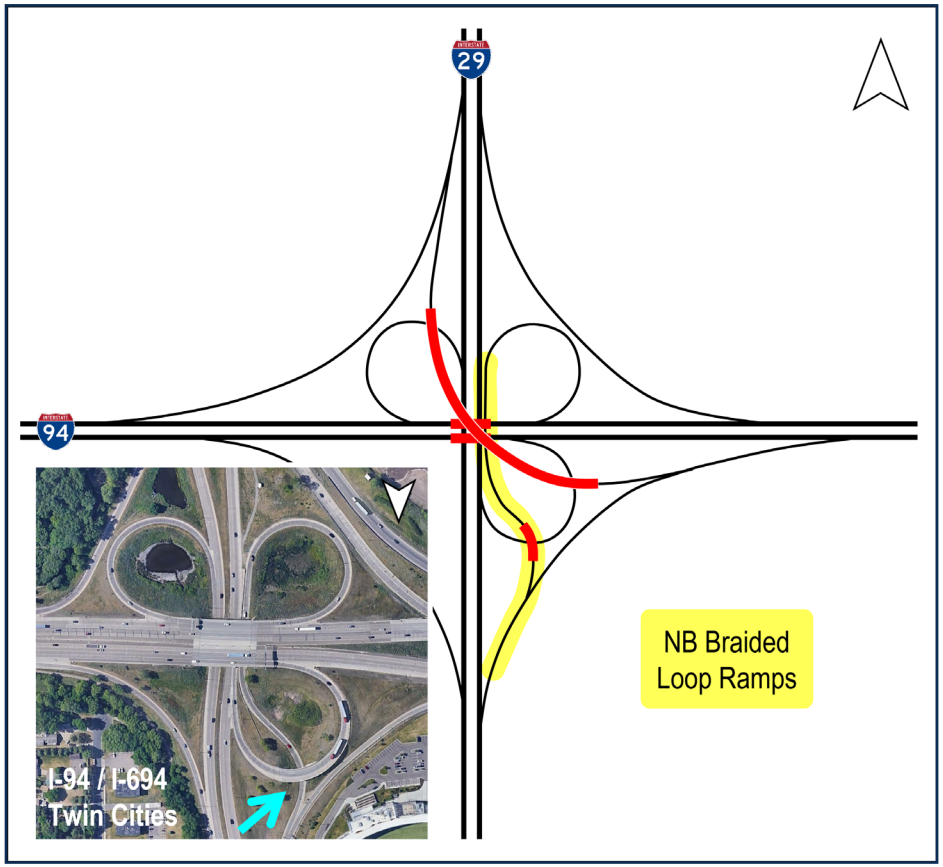


Braided Loop Ramps

Existing Configuration: Shown previously in **Figure 4.8**, successive loop ramps along NB I-29 and WB I-94 require users to weave with entering and existing loop ramp traffic within the system interchange.

Proposed Configuration: This potential project would remove the NB I-29 weaving section by adding a bridge over the EB I-94 to NB I-29 loop ramp, shown in **Figure 4.11**. MnDOT has incorporated this strategy at the I-94 / I-694 system interchange as a lower cost solution compared to a flyover while realizing the operational and safety benefits of eliminating a weave.

Figure 4.11. Braided Loop Ramps Schematic



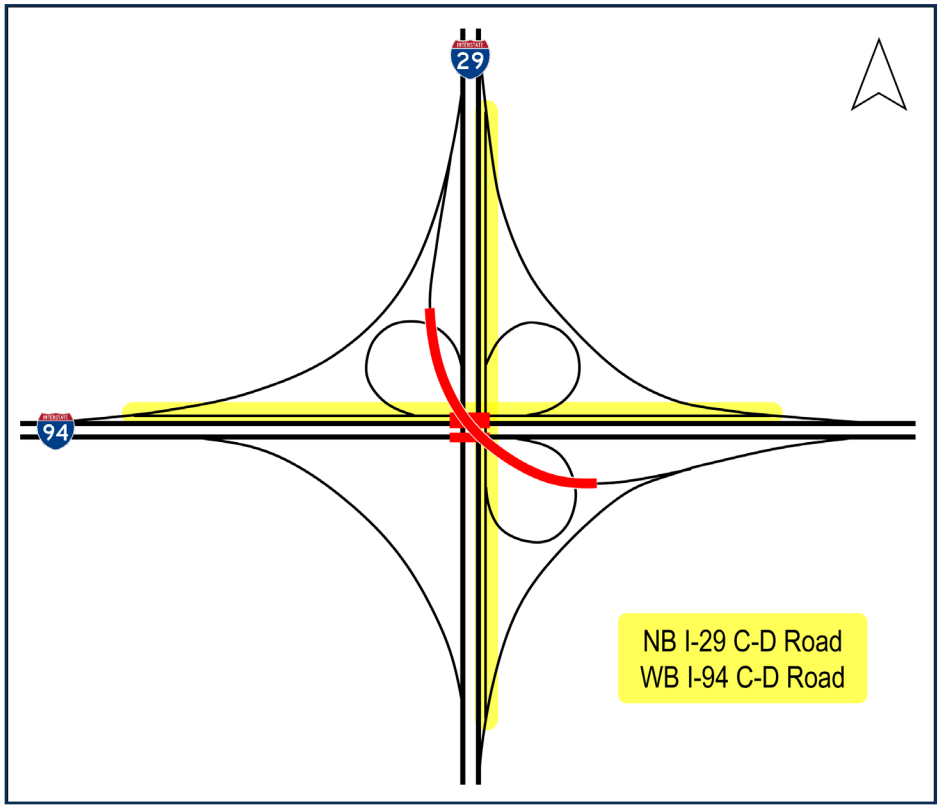
Collector-Distributor Roads

Existing Configuration: Shown previously in **Figure 4.9**, successive loop ramps along NB I-29 and WB I-94 require users to weave with entering and existing loop ramp traffic within the system interchange.

Proposed Configuration: This potential project would shift traffic all loop ramp traffic at the system interchange onto a parallel C-D Road system, reducing disruptions to the Interstate mainline segments within the interchange, shown in **Figure 4.12**.

This configuration was not carried forward into the implementation plan. Similar to the NB I-29 to WB I-94 flyover concept, C-D roads would reduce the effective weaving lengths for adjacent Interstate segments while increasing the weaving volumes.

Figure 4.12. Collector-Distributor Roads Schematic



Dynamic Lane Assignment

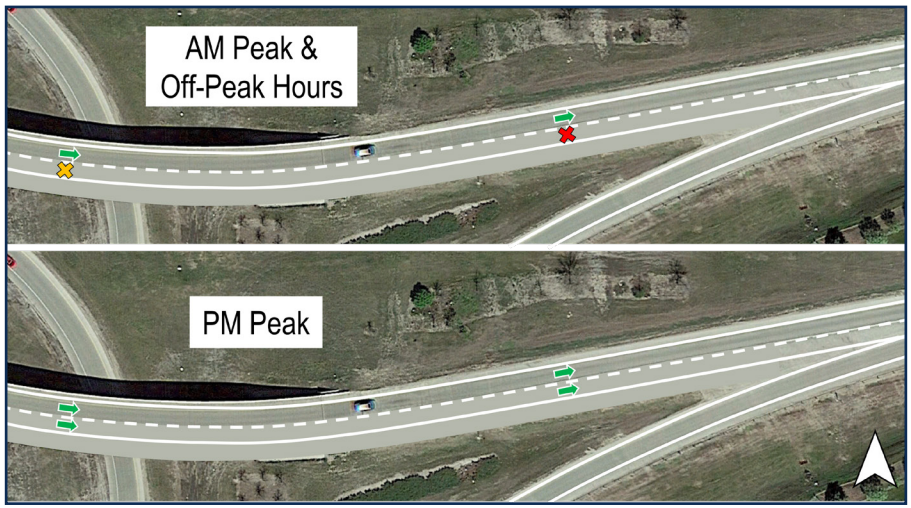
Near-Term Build Configuration: Once the SB I-29 to EB I-94 expansion to 25th Street is complete, the NB I-29 to EB I-94 ramp will need to make the following movements to continue east on I-94.

- Merge with the outside flyover lane
- Lane-change out of the auxiliary lane to continue east on I-94

Proposed Configuration: As shown previously in **Figure 4.9**, the NB I-29 to EB I-94 directional ramps are expected to grow significantly from 6,300 AADT in 2021 to 11,900 AADT in 2045. During the AM peak hour and off-peak times, the 2-lane capacity of the SB I-29 to EB I-94 flyover is not needed from a capacity standpoint. Using dynamic lane use signs, the merge condition for the NB I-29 to EB I 94 could be improved during the AM peak hour and off-peak times be "closing" one lane on the flyover.

One concern with dynamic lane assignment is non-compliance of road users. In this concept, the NB I-29 to EB I-94 ramp would not be aware of the dynamic lane assignments for the flyover movement, shown in **Figure 4.13**. This would create acceptable gaps for the NB I-29 to EB I-94 ramp traffic even if a portion of the flyover traffic do not comply with dynamic lane assignment.

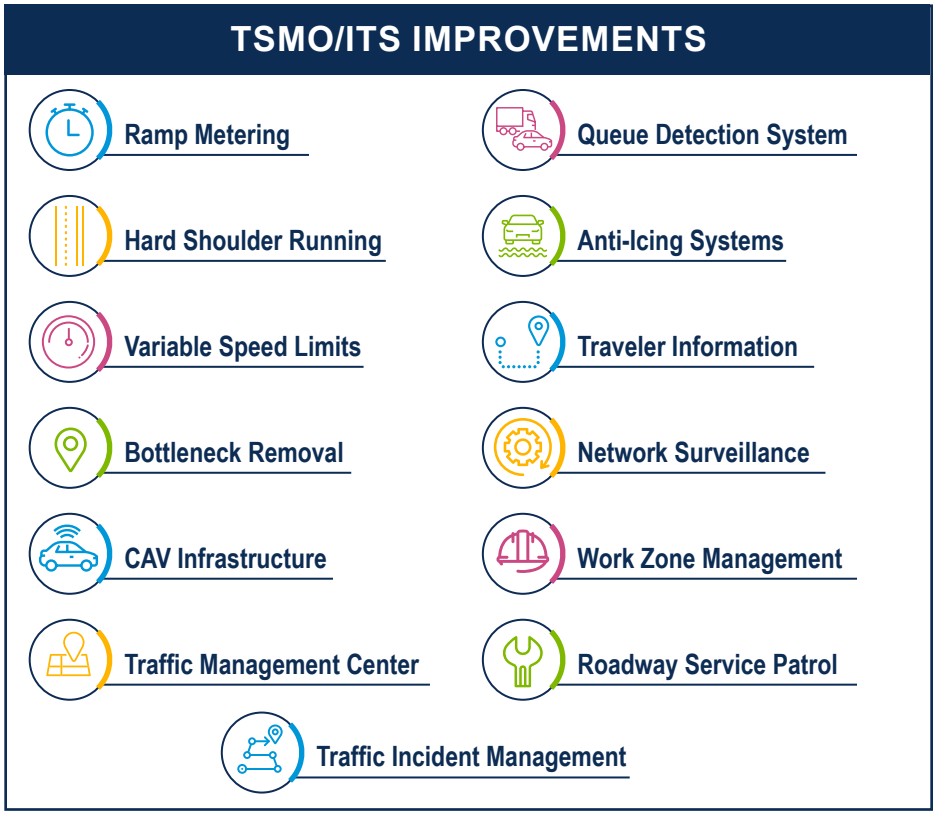
Figure 4.13. Dynamic Lane Assignment



System-Wide TSMO Strategies

Transportation Systems Management and Operations is an approach to manage and optimize the current transportation systems to improve safety, reduce congestion, and enhance mobility. TSMO typically involves the integration of various transportation technologies, strategies, and services to improve the performance of the transportation system.

The study team reviewed the following TSMO Strategies to determine their effectiveness within the metro area.



The study team advanced TSMO strategies that were applicable to the metro area and grouped some strategies into a combined strategy.

- Ramp Metering
- Queue Detection
- TIM / Work Zone Management / Roadway Service Patrol

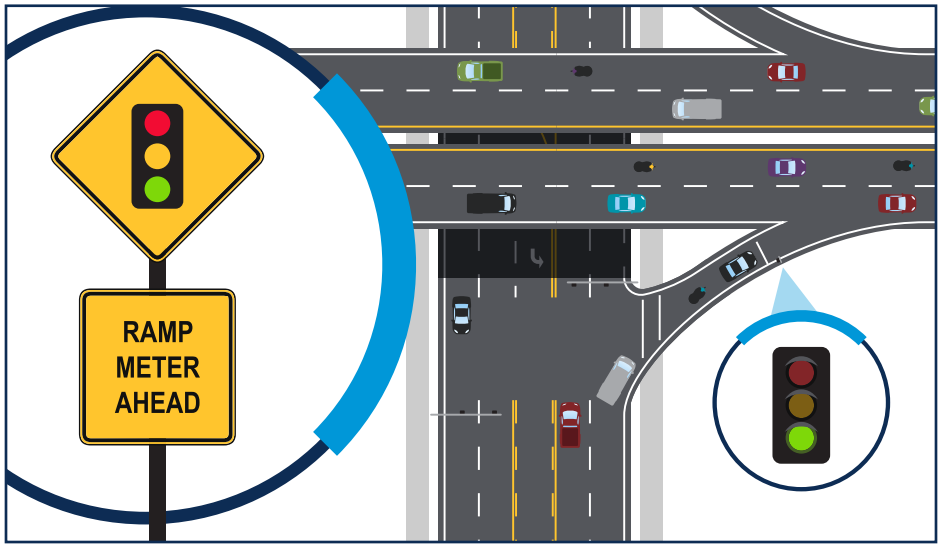
Ramp Metering

The implementation of ramp metering has been discussed for a while in the Fargo-Moorhead metro area. In the previous IOS completed in 2011, it was recommended to establish a Traffic Operations Center (or Traffic Management Center) and to perform a detailed study on ramp metering implementation.

One of the main hurdles for implementation is the development of a TMC. With recent traction on the advancement of an NDDOT statewide TMC, the next step in the process aligns with the 2011 IOS recommendation of performing a detailed study of ramp meter implementation. The detailed study should include the following components:

- Peer Review / Exchange or Best Practices: Agencies new to ramp metering struggle to work through the system engineering process because they don't understand the value and operations of the system – Metro COG & NDDOT could easily draw on many of these best practices from MnDOT Metro District.
- Concept of Operations: Establishes users, current operations, needs, and proposed future operations at a planning level where the specific technology is not prescribed
- Engineering Feasibility Analysis: Utilize a queuing model, assess the ability to restripe or widen ramps, and assess the benefit-cost of a metering system. An emphasis on entrance ramps with a high heavy truck percentage will be assessed.
- System Requirement Development: Includes the ramp meter software, firmware on the controller, design characteristics of the relationship of detection, signal indication, monitoring equipment, communication, and TMC users/operators.
- Operational (Business) Plan: Establishes how the system will continue to be monitored daily and funded. This step is often developed in house by the lead agency and then supported by a memorandum of understanding

Through a review of the CMF Clearinghouse and case study research, ramp metering may reduce the number of total crashes up to 40% in areas of the Interstate where metering occurs.



Queue Detection System

As traffic congestion continues to grow along I-29 & I-94, recurring slowdowns and bottlenecks may occur in various areas within the metro area. A queue detection system includes strategically places DMS with sensors and/or cameras to automatically detect the presence of slow-moving or stopped vehicles.

Through a review of the CMF Clearinghouse and case study research, a queue detection system may reduce the number of total crashes up to 16% in areas of the Interstate where queue detection occurs. Research notes signs will be ignored if the information is not designed to be timely, accurate, and relevant.

TIM / Work Zone Management / Roadway Service Patrol

Three TSMO strategies were combined to convey how they are all linked together.

- **Traffic Incident Management:** Traffic incident management is becoming critical for metro areas given increased traffic growth over the last 10+ years. An emphasis on quick clearance, alternative route planning, training, and incentives can lessen the overall impact (operationally and safety implications) of an incident.
- **Work Zone Management / Smart Work Zones:** Smart work zones continuously monitor areas impacted by road work to protect workers and drivers through increased awareness to conditions. The use of a smart work zone typically involve portable detection and / or monitoring equipment, portable DMS, and wireless communication. A smart work zone as a temporary strategy can often be factored into the budgets for traffic control of individual projects – though areawide standards and specifications should be utilized for consistency and interoperability with permanent management strategies. More broadly, work zone management can include both dynamic smart work zones and static or pre-planned strategies like early work zone stage planning to shorten the impact of the work zone and public awareness campaigns to decrease travel through the work zone among other strategies.
- **Roadway Service Patrol:** This program would add DOT staff driving the I-29 / I-94 Interstate system in trucks equipped with portable message boards and supplies to support disabled vehicles, state patrol, or first responders during an incident. This program would be similar to MnDOT's Freeway Incident Response Safety Team or other Highway Helper programs throughout the country.

Through a review of the CMF Clearinghouse and case study research, a combination of TIM, Work Zone Management, and Roadway Service Patrol may reduce the number of total crashes up to 20%. A majority of these crashes prevented potential secondary crashes which are generally more severe than primary crashes.

Perimeter Roads & Off-System Improvements

A significant component to a resilient and reliable Interstate system is the non-Interstate system. The study team identified perimeter road alignments and other off-system improvements to act as a relief valve during Interstate slowdowns due to an incident, weather event, peak congestion, or construction.

Perimeter Roads

The study team reviewed potential route alignments, forecasted future traffic volumes along perimeter roads, determined potential Interstate traffic reduction, and developed planning level costs.

The study team developed a series of scenarios adjusting the alignment, speed limit, roadway capacity, and Interstate connections. The study team worked with Metro COG to develop a "full build out" analysis to gauge the effectiveness of the perimeter roads once all developable land has filled in within the metro area. Full build out analysis results can be found in **Appendix E**.

Although freeway-level speed limits (70 mph) increased the draw of traffic to the perimeter roads in the TDM, the overall cost of grade-separating arterial connections outweigh regional travel benefits of a freeway-type perimeter road facility. Because of this, the perimeter roads were modeled at 55 - 65 mph in rural areas. Due to existing constraints, speeds near Interstate connection points and through urban areas were reduced to current speed limits. Speeds, roadway capacity, and forecasted volumes are detailed in **Table 4.2**.

Table 4.2. Perimeter Road Forecast Summary

Quadrant	Facility	Speeds (mph)	2045 AADT (in 1000s)
NW	2-Lane	55 - 65	4 - 6
NE	2-Lane[A]	35 - 55	5 - 8
SE	2-Lane[A]	35 - 55	8 - 17
SW	2-Lane	55 - 65	4 - 7[B]

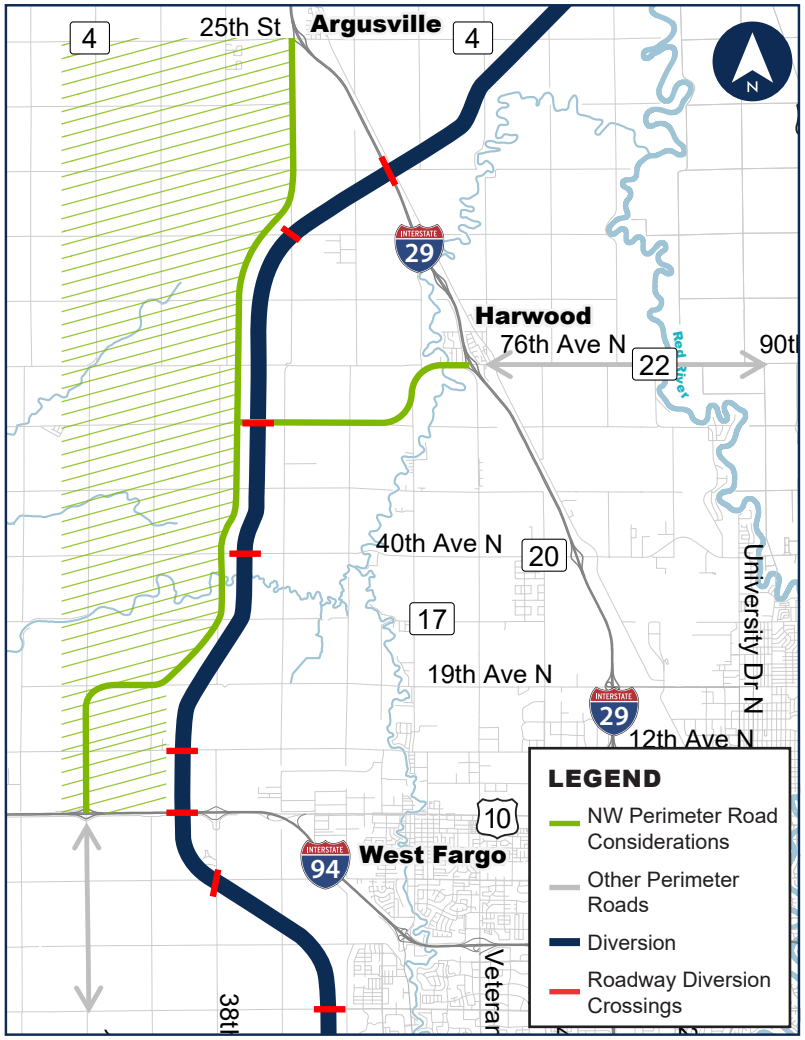
[A] NE and SE ring routes will have portions of 4-Lane roadways (i.e. existing MN 336 alignment)

[B] Daily forecasts just west of I-29: 10,000 - 12,000

NW PERIMETER ROAD

This project would either utilize existing county road alignments, ROW purchased for the Diversion, or a combination of both in the NW quadrant of the metro area, shown in **Figure 4.14**.

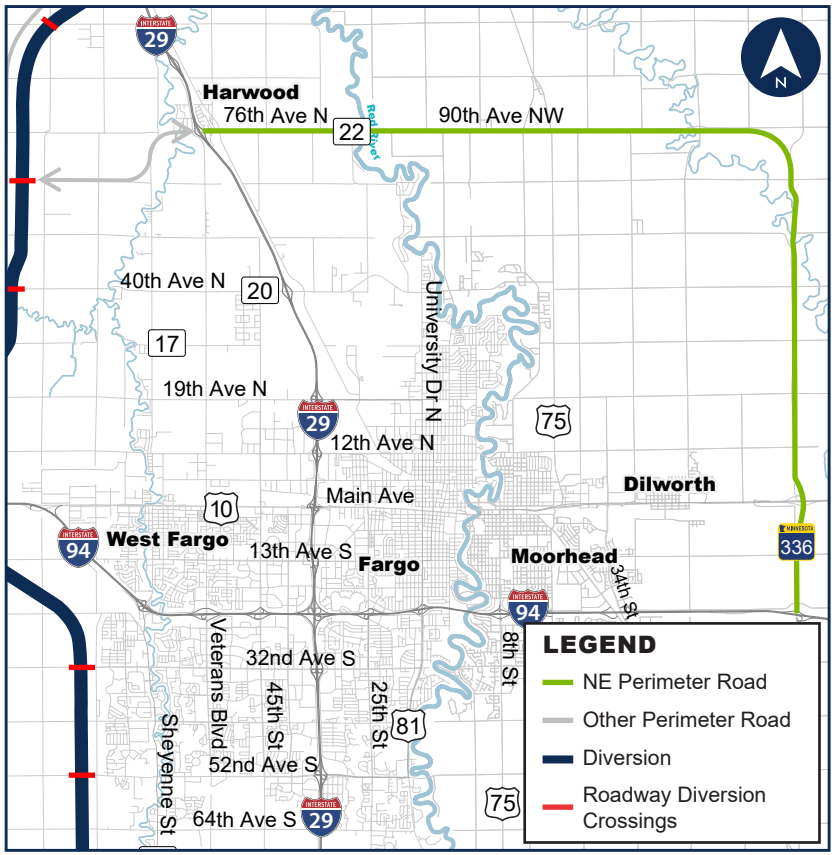
Figure 4.14. NW Perimeter Road Alignment



NE PERIMETER ROAD

The NE perimeter road is shown in **Figure 4.15**. This project would extend north from MN 336 then utilize 90th Avenue NW / CR 26 in Minnesota and 76th Avenue N / CR 22 in North Dakota. This project would utilize the existing CR 26 / CR 22 Red River bridge. Through Harwood, the perimeter road alignment will intersect an at-grade crossing, pass by an elementary school, and cross multiple closely spaced intersections. These locations need to be considered from an operational and safety standpoint as the perimeter road advances to further development phases.

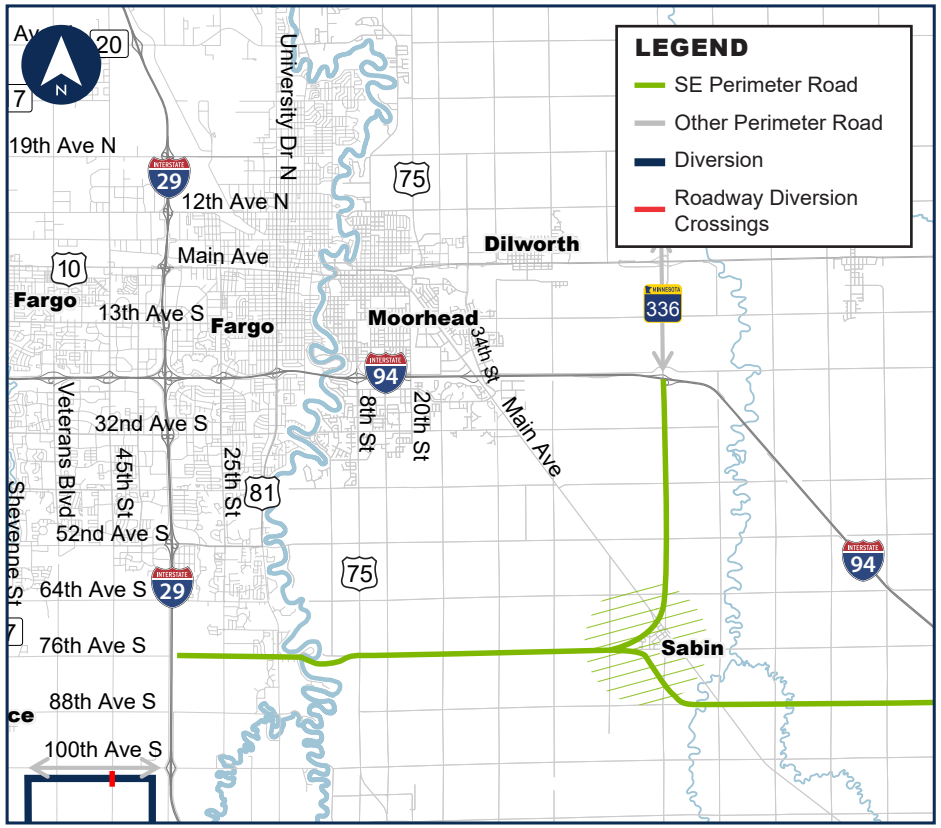
Figure 4.15. NE Perimeter Road Alignment



SE PERIMETER ROAD

This project, shown in **Figure 4.16**, would extend east from a new interchange at 76th Avenue S, cross the Red River at a new river crossing, and connect to I-94 via County 10 (Exit 15) and MN 336. Due to the new river crossing and more direct route from I-94 to southern Fargo and Horace, traffic volumes on the SE perimeter road are expected to carry 8,000 – 17,000 daily trips in 2045.

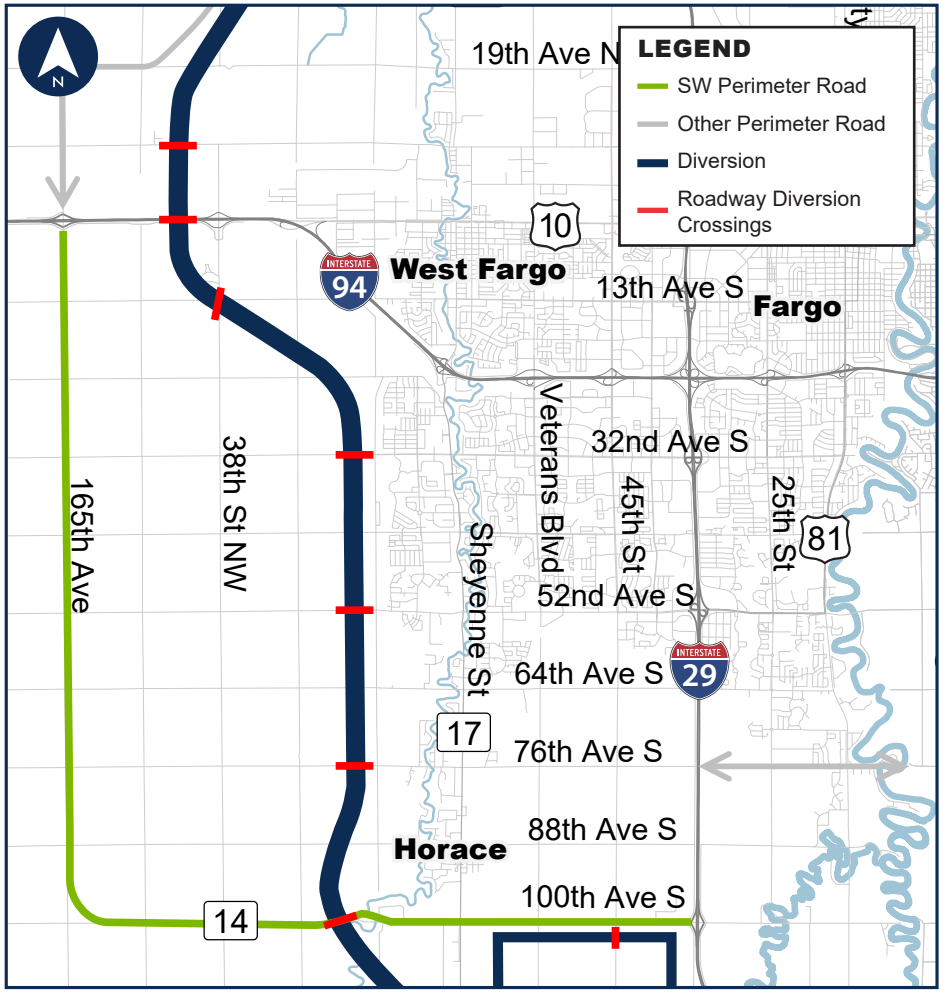
Figure 4.16. SE Perimeter Road Alignment



SW PERIMETER ROAD

This project, shown in **Figure 4.17**, would extend south from the NW perimeter road & I-94 connection at 165th Avenue (Kindred Exit), then east via 100th Avenue S / CR 14 to I-29.

Figure 4.17. SW Perimeter Road Alignment



Off-System Improvements

ENHANCED SIGNAL TIMING IMPROVEMENTS

Signal timing improvements along continuous major arterials can provide an outlet for Interstate traffic during an incident, weather event, construction, or during peak travel times. The following strategies were developed:

- **Improved Coordination Between Agencies:** Improved local agency coordination between Fargo, West Fargo, and Moorhead can provide better signal timing progression across dividing lines between agencies, resulting in improved east-west arterial coordination. Improved agency coordination combined with ramp metering implementation would likely reduce the amount of short Interstate trips that currently occur in the metro area.
- **Adaptive Signals / Enhanced TOD Timing Plans:** Adaptive signals can improve the capacity, safety, and reliability of arterial corridors. Corridors that experience significant demand fluctuations that vary day-by-day could be a good candidate for adaptive signal control consideration. On corridors that have more consistent demand throughout the day / week, updating signal timings and coordination on a regular basis can help get the most out of the arterial system. Data providers, such as INRIX and Streetlight, can help identify problem areas and whether or not timing plans should be split into more or less unique TOD plans.

PARALLEL CORRIDOR IMPROVEMENTS

Similar to the perimeter road discussion, there are several roads on the fringes of the metro area that are used to avoid Interstate congestion, construction, or as a detour route during an incident. During construction activities along I-94 in 2022, SRC and focus group members highlighted use of 52nd Avenue S / 60th Avenue S from University Drive to 8th Street (US 75). As development continues to occur in south Fargo, this corridor will become a relief valve for traffic to/from I-94 & US 10 to the east.

Agencies should continue to monitor rural corridors during construction activities to ensure detour routes (official or unofficial) are providing a safe and reliable outlet for Interstate traffic.

BICYCLE / PEDESTRIAN CONSIDERATIONS

Service interchanges in the Fargo-Moorhead area include enhanced bicycle and pedestrian crossings at entrance and exit ramps. At many locations throughout the metro area, box culverts are used to provide grade separation between vehicles / trucks and vulnerable road users. This reduces conflict points, provides lower levels of traffic stress for bicyclists and pedestrians, and ultimately improves safety at these locations. Grade-separated trail crossings currently exist at the following interchange locations:

Table 4.3. Grade Separated Interchange Trail Crossings

Interstate	Cross Street	Number of Separations
I-94	Sheyenne Street	Both Ramps
I-94	Veterans Boulevard	1 Ramp
I-94	25th Street	1 Ramp
I-94	University Drive	1 Ramp
I-94	8th Street	Both Ramps
I-29	52nd Avenue S	Both Ramps
I-29	32nd Avenue S	Both Ramps

As interchanges are reconfigured and reconstructed in the metro area, grade separated trail crossings are recommended. Additionally, the metro area trail system can also be connected through grade separated crossings at half mile locations (i.e. 17th Avenue S crossing under I-29 and pedestrian bridge near 16th Street crossing I-94).

At-grade pedestrian crossing locations throughout the metro can be improved through strategies other than grade separation including:

- Restricting right-turn-on-red
- Enhanced marked crosswalks and signage
- Rectangular Rapid Flashing Beacons at uncontrolled locations
- Additional roadway lighting
- Reducing long crossing distances
- Leading Pedestrian Interval

Many of these improvements can be made system-wide. For purposes of this study, the team reviewed RTOR restrictions and RRFBs.

RESTRICTING RIGHT-TURN-ON-RED

Many of the interchange configurations in the metro area currently allow RTOR movements. Many of the service interchange locations have the reserve capacity to restrict RTOR movements and still operate at an acceptable LOS. Ramp terminal locations with at-grade pedestrian crossings should continue to be monitored and right-on-red restrictions should be installed on an as-needed basis. Restricting RTOR would improve overall safety at ramp terminal intersections for vehicles and pedestrians.

RECTANGULAR RAPID FLASHING BEACONS

Six entrance ramp locations in the metro area currently have uncontrolled pedestrian crossings. Some of these crossing locations currently have actuated pedestrian flash indicators. The study team recommends installing or upgrading the following locations to a RRFBs.

- I-94 & 45th Street (NB to WB)
- I-94 & University (SB to EB)
- I-29 & Main Avenue (EB to SB)
- I-29 & Main Avenue (EB to NB)
- I-29 & 12th Avenue N (EB to NB)
- I-29 & 19th Avenue N (EB to NB)

Additionally, signalization of the entrance ramps (similar to 25th Street NB to WB loop ramp) could help mitigate safety issues at pedestrian crossings.

5 | Implementation Plan

This chapter details the improvement strategies from Chapter 4 that were carried forward into the implementation plan. The study team used the following guidelines to develop the implementation plan.

COMBINING SYSTEM PRESERVATION & EXPANSION PROJECTS

The plan should consider combining system preservation projects with expansion projects where it makes sense. This could be achieved by delaying or by advancing either type of project within any given Interstate segment.

OPERATIONAL & SAFETY CONSIDERATIONS

The plan should consider the severity of operational and safety needs and the impact of delaying the recommended improvement strategies.

LIMITING DISRUPTIONS TO THE TRAVELING PUBLIC

The plan should consider the impacts of project construction on the users of the system (for example, should there be a minimum number of years between major projects within a specific section of Interstate). Additionally, off-system or TSMO improvements that would improve operations during construction should be considered.

INPUT FROM STAKEHOLDERS

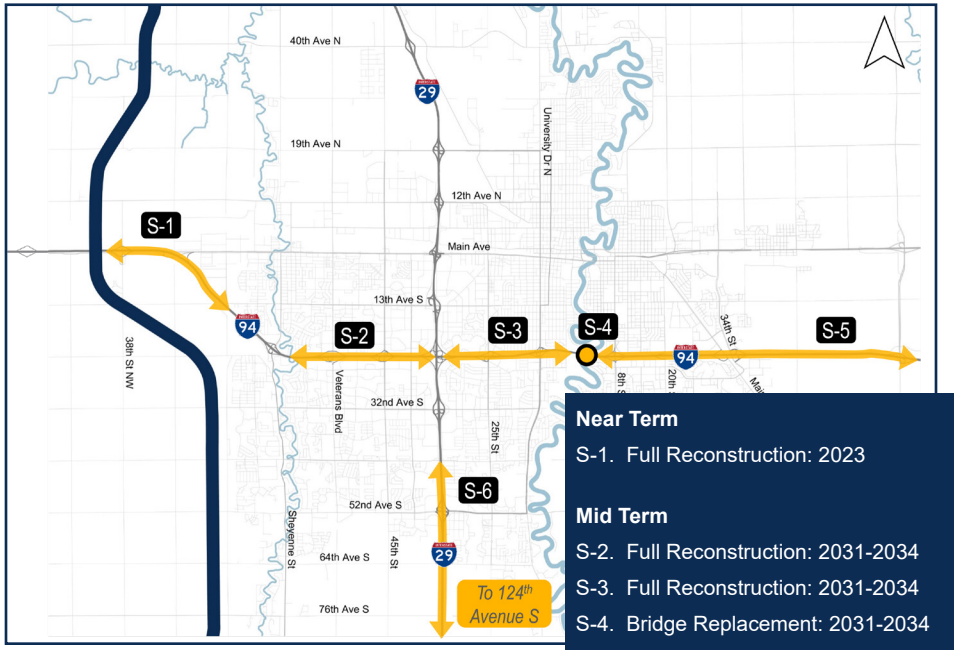
The plan should consider a balance of state DOT and local agency needs. The impact of development growth opened up by the diversion may shift local agency needs at various service interchanges. The timeline of these improvements were determined with SRC members.

System Preservation

This study focused on anticipated Interstate reconstruction projects within the study area over the next 20 years. The study team worked with NDDOT and MnDOT to determine the timeline and location of full reconstruction projects. Note that minor rehabilitation (concrete pavement repair, bridge deck overlays, etc.) were not included in the implementation plan. A complete list of Interstate system preservation projects can be found in **Appendix F**.

As shown in **Figure 5.1**, 6 major system preservation projects are anticipated within the study area over the next 20 years.

Figure 5.1. System Preservation (Reconstruction) Projects



Implementation Plan Overview

The recommended implementation plan is shown in **Figure 5.2**. Projects are clustered by near, mid-, and long-term projects. Interstate reconstruction projects are included at the bottom of Figure I.I. IDs for these projects start with the following letters:

- "N" – for Near-Term (2023-2030)
- "M" – for Mid-Term (2031-2040)
- "L" – for Long-Term (2041+)
- "S" – for System Preservation (Reconstruction)

Figure 5.2. Implementation Plan

TYPE	ID	PROJECT	NEAR TERM								MID TERM										LONG TERM									
			23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Interstate	N-1	I-94 EB Exit to 8th Street																												
Interstate	N-2	Flyover Expansion to 25th Street																												
Interstate / Interchange	N-3	New Interchange at 64th Ave S (May Include C-D Roads)																												
Interstate	N-4	I-29 Expansion (Between I-94 & 52nd Ave S)																												
Interstate	N-5	I-94 EB Aux Lanes (Between 34th Street, Weigh Station, & MN 336)																												
Interchange	N-6	40th Ave N Interchange Reconfiguration																												
Off-System	N-7	52nd Ave S / 60th Ave S Widening (Between University & US 75)																												
TSMO	N-8	Re-Start TIM Group																									No Years Identified			
TSMO	N-9	Development of TMC																												
TSMO	N-10	DMS / CCTV Expansion																									No Years Identified			
Interstate	M-1	I-94 Expansion to 6 Basic Lanes (Between Sheyenne & I-29)																												
Interstate	M-2	I-94 Expansion to 8 Basic Lanes (Between I-29 & 8th Street)																												
Interstate	M-3	I-94 Mobility Improvements (Between 8th Street & MN 336)																												
Interchange	M-4	20th Street Reconfiguration																												
Interstate / Interchange	M-5	I-29 Braided Ramps between 13th Ave S & I-94																												
Interchange	M-6	I-94 & Main Ave Improvements (Including 13th Ave S I-94 Overpass)																												
Off-System	M-7	NW Perimeter Road																												
TSMO	M-8	Ramp Metering (Ring 1)																												
TSMO	M-9	Service Patrol																												
TSMO	M-10	Smart Work Zones																									No Years Identified			
Interstate	L-1	I-29 Aux Lanes (Between 12th Ave N & Main Ave)																									No Years Identified			
Interstate	L-2	Braided NB Loop Ramp (At I-29 / I-94 System Interchange)																									No Years Identified			
Interchange	L-3	New Interchange at 76th Ave S (May Include C-D Roads)																									No Years Identified			
Interchange	L-4	100th Ave S Improvements																									No Years Identified			
Off-System	L-5	Perimeter Road(s)																									No Years Identified			
TSMO	L-6	Ramp Metering (Ring 2)																												
System Preservation	S-1	I-94 Construction (Between 38th Street NW to 13th Ave S)																												
System Preservation	S-2	I-94 Reconstruction (Between Sheyenne & I-29)																												
System Preservation	S-3	I-94 Reconstruction (Between I-29 & Red River)																												
System Preservation	S-4	I-94 Red River Bridge Replacement																												
System Preservation	S-5	I-94 Reconstruction (Between Red River & MN 336)																												
System Preservation	S-6	I-29 Reconstruction (Between 40th Ave S & 124th Ave S)																												

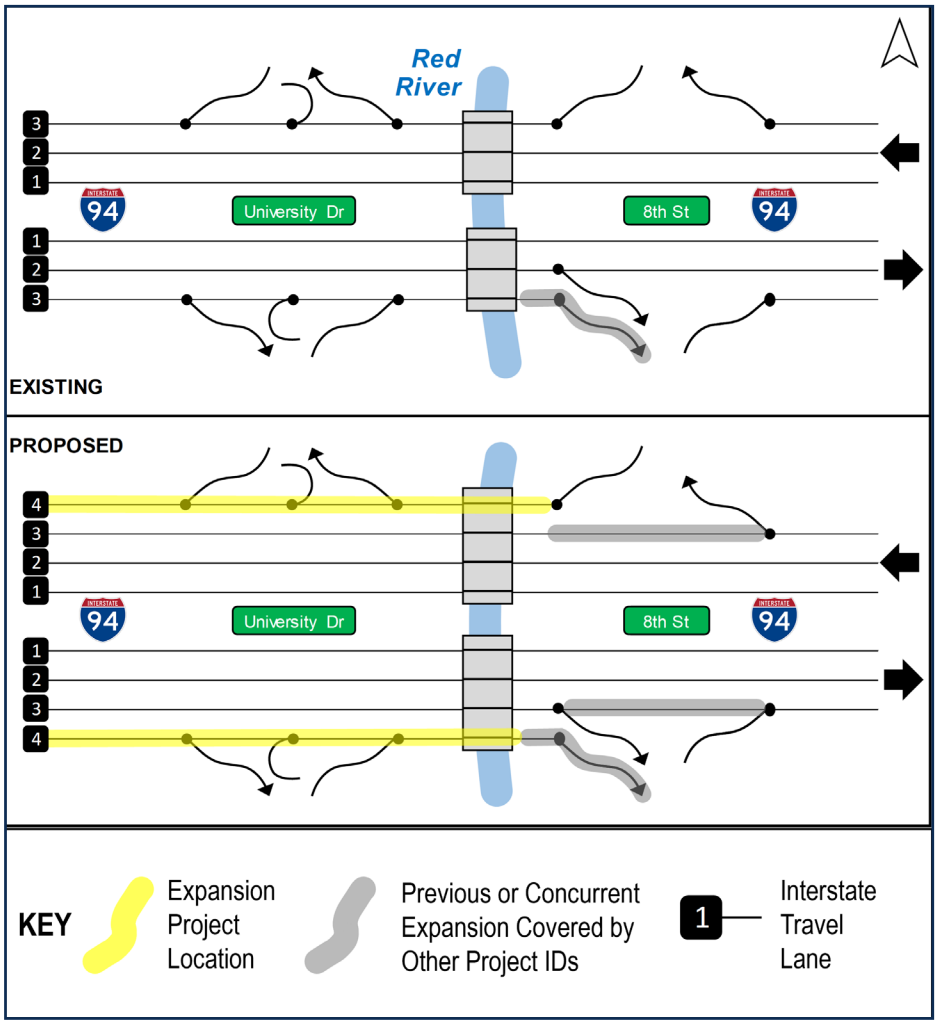
Legend

- Near Term
- Mid Term
- Long Term
- System Preservation
- Mainline / Off-System
- Interchange
- TSMO

Project Schematics Overview

The following sections include schematics detailing the Interstate expansion projects recommended in the near-, mid-, and long-term. **Figure 5.3** includes a key for interpreting the project schematics.

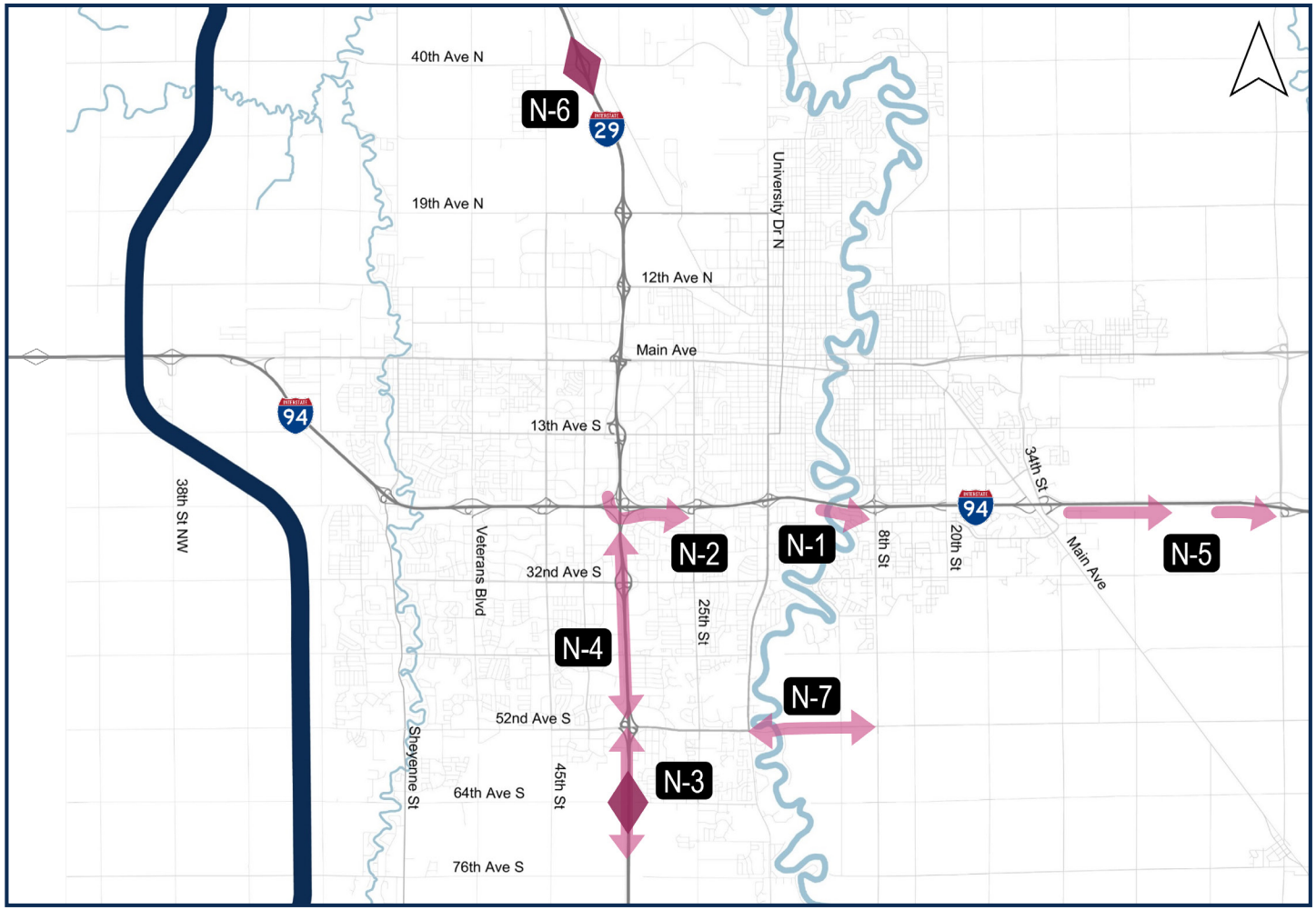
Figure 5.3. Project Schematic Key



Near-Term Projects

Near-Term project locations are shown in **Figure 5.4**. IDs shown on the map correspond with the near-term Interstate, interchange, and off-system improvements identified in the implementation plan shown previously in **Figure 5.2**. Near-Term TSMO projects are not shown on the map, but detailed project descriptions are included later in this section.

Figure 5.4. Near Term Project Locations



- **N-1. I-94 EB Exit to 8th Street**
- **N-2. Flyover Expansion to 25th Street**
- **N-3. New Interchange at 64th Ave S (may include C-D Roads)**
- **N-4. I-29 Expansion**
- **N-5. I-94 Aux Lane (East of Weigh Station)**
- **N-6. 40th Ave N Interchange Reconfiguration**
- **N-7. 52nd Ave S / 60th Ave S Widening**

TSMO Improvements

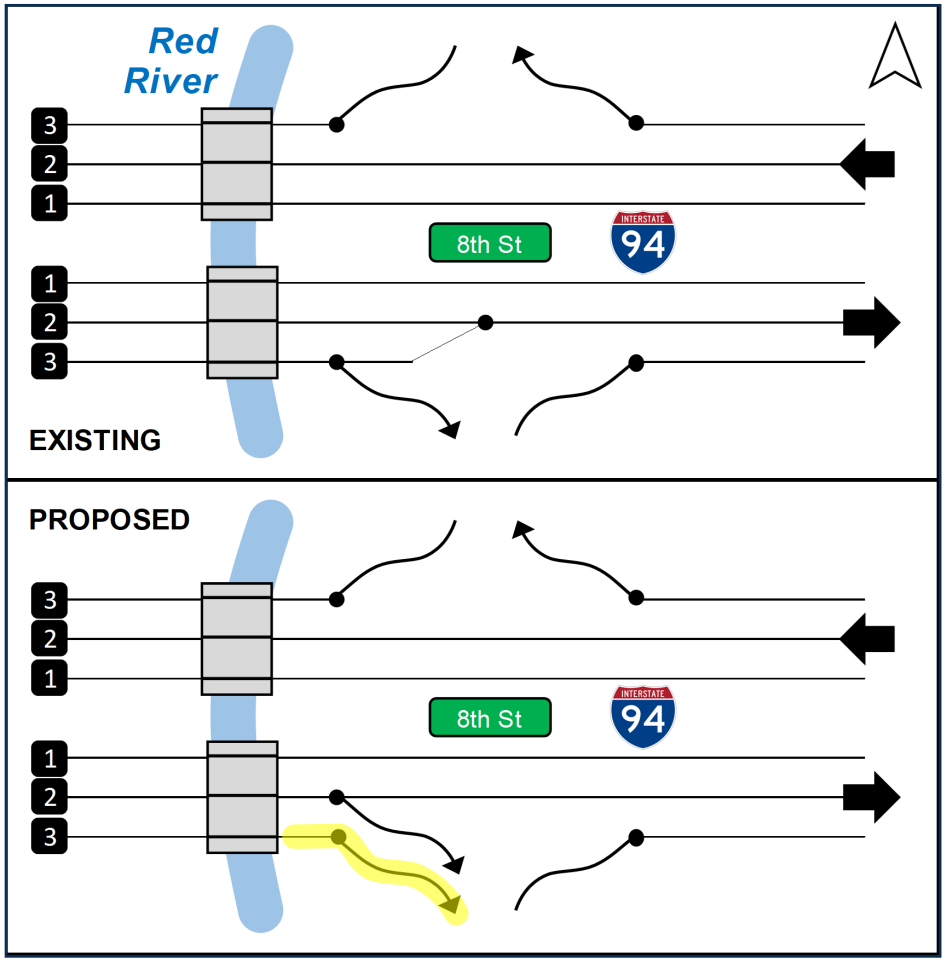
- **TIM Group**
- **TMC**
- **DMS / CCTV**

Note that all project identified in Metro COG's TIP are assumed to be completed / included in the Near-Term project list.

N-1: I-94 EB Exit to 8th Street

This project modifies the EB exit ramp lane from a single lane to two lanes at 8th Street. This project is intended to improve EB I-94 lane utilization by allowing traffic destined for the 8th Street exit to use lane 2 or 3.

Figure 5.5. I-94 EB Exit to 8th Street Schematic

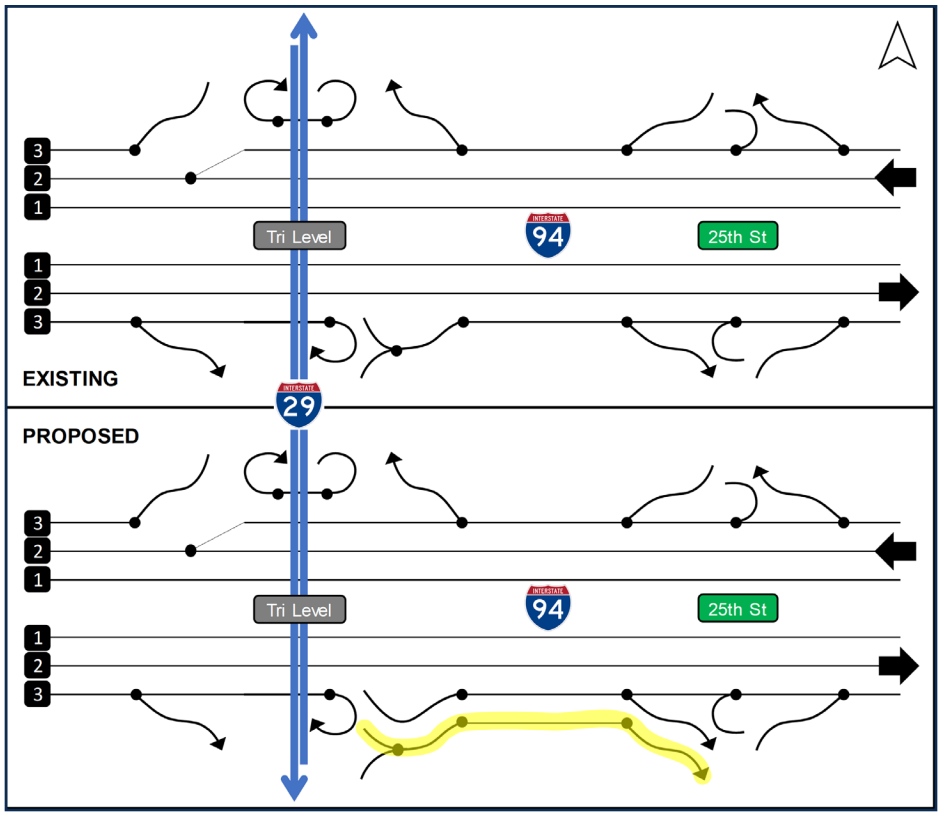


Project Cost: $0.5 - 0.6 Million

N-2: Flyover Expansion to 25th Street

This project extends the 2-lane flyover from SB I-29 to EB I-94 to 25th Street by widening the existing ramp and adding an auxiliary lane between I-29 & 25th Street. This project is intended to reduce congestion and improve reliability along SB I-29 and at the I-29 to EB I-94 connection within the system interchange during the PM peak period. This project is planned for construction in 2023.

Figure 5.6. Flyover Expansion to 25th Street Schematic



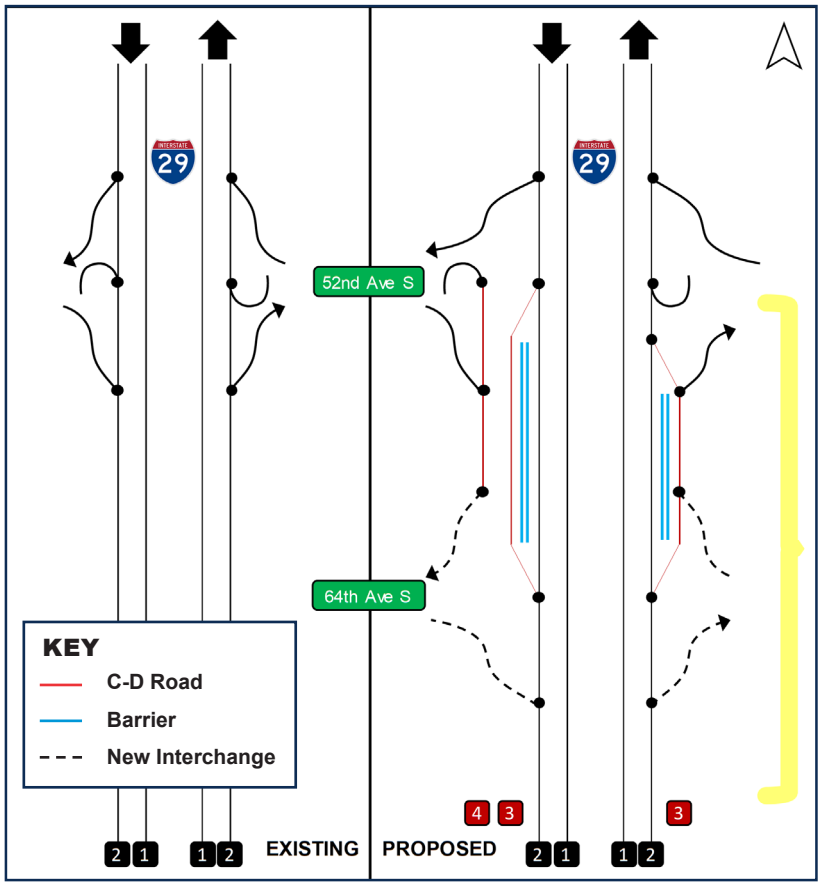
Project Cost: $4.6 Million

Cost provided by NDDOT (Fargo District)

N-3: New Interchange at 64th Avenue S

This project adds a new interchange at I-29 & 64th Avenue S. Due to proximity of the 64th Avenue S interchange to 52nd Avenue S, the study team recommends the consideration of C-D Roads that tie in with the 52nd Avenue S ramps to the south. Short C-D Roads would shift all weaving movements off of I-29 mainline lanes, improving the longevity of the improvement before operational issues arise from short weave segments. This project is being studied independently by City of Fargo and is planned for construction in 2025.

Figure 5.7. New Interchange at 64th Avenue S Schematic



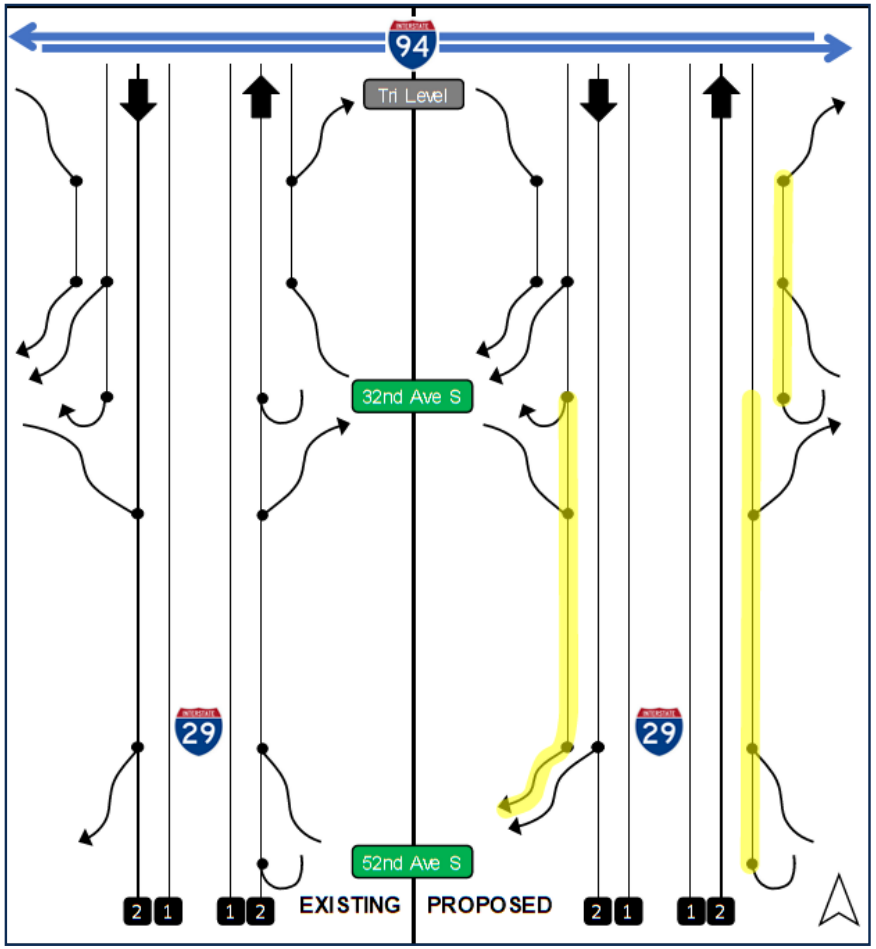
Project Cost: $18.2 Million

Cost provided by NDDOT (Fargo District). Planning level costs will be impacted by the absence and/or inclusion of C-D roads.

N-4: I-29 Expansion (Between I-94 & 52nd Ave S)

This project adds I-29 mainline capacity from I-29 to 52nd Avenue S. This project is needed in the near-term due to the current and expected growth in south Fargo. This project is also needed to connect to future C-D roads associated with the 64th & 76th Avenue S interchange alternatives.

Figure 5.8. I-29 Expansion (Between I-94 & 52nd Ave S) Schematic

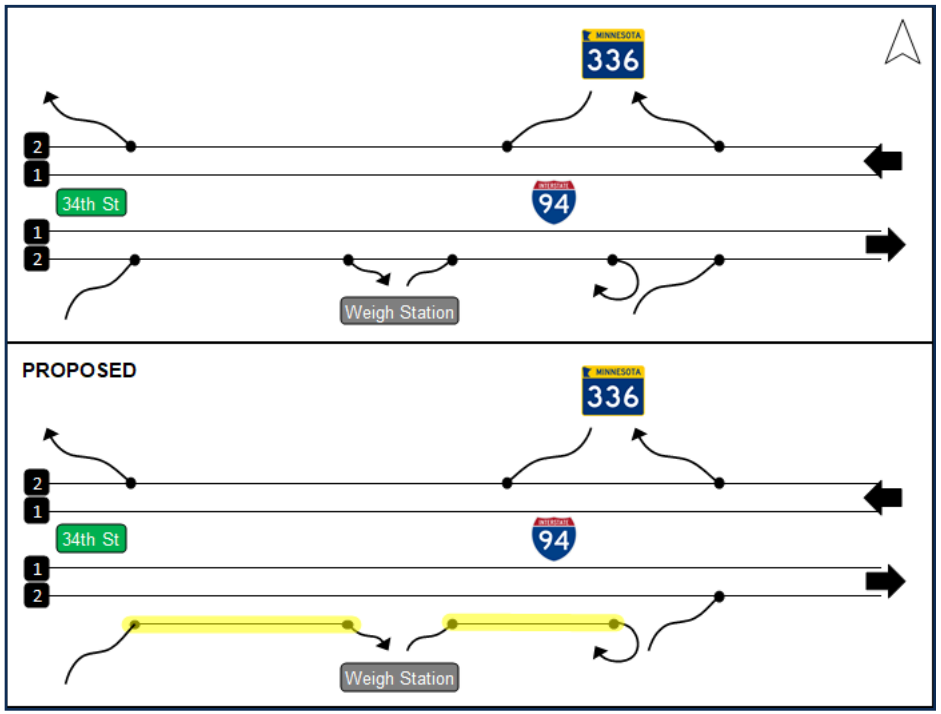


Project Cost: $14.7 - 18.0 Million

N-5: I-94 EB Auxiliary Lanes (Between 34th Street, Weigh Station, and MN 336)

This project adds auxiliary lanes between 34th Street and the truck weigh station and the truck weight station and the exit loop ramp to NB MN 336. This project was developed through the first responder and freight focus groups that noted the number of near misses and large speed differentials west and east of the weigh station (interaction with vehicles and heavy trucks exiting I-94 to the weigh station / entering I-94 from the weigh station).

Figure 5.9. I-94 EB Auxiliary Lanes (Between 34th Street, Weigh Station, and MN 336) Schematic



Project Cost: $4.5 - 5.5 Million

N-6: 40th Avenue N Interchange Reconfiguration

This project includes a reconfiguration of the I-29 & 40th Avenue N interchange. This project is intended to improve safety and provide long-term operational benefits for the growing industrial land uses near the interchange. Specifically, an emphasis on reducing the potential of wrong-way drivers on I-29. This project is being studied independently by NDDOT and is planned for construction in 2026.

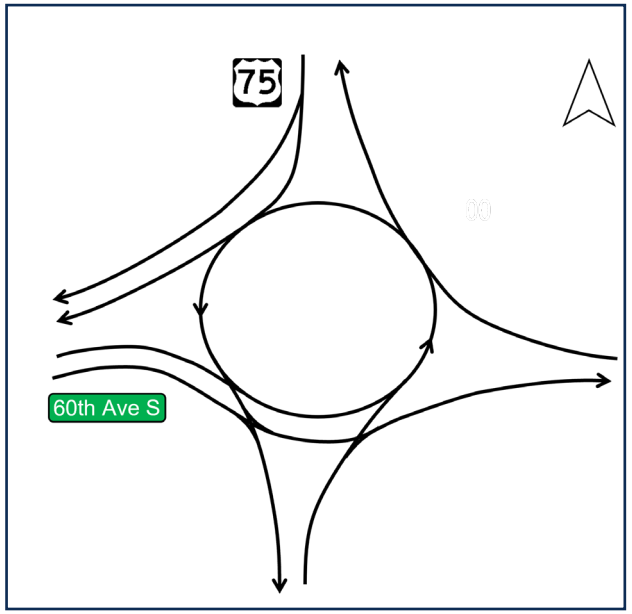
Project Cost: $17.6 - 21.5 Million

N-7: 52nd Avenue S / 60th Avenue S Widening (Between University & US 75)

This project includes widening the 52nd Avenue S / 60th Avenue S from University Drive to 8th Street (US 75). During the 2022 construction season, this route was heavily used as an alternative route to bypass construction on I-94. This project would be completed in anticipation for I-94 full reconstruction activities beginning in 2031. Two key assumptions for this project include:

- No widening of the existing bridge over the Red River. Consideration should be given to alternative and/or new routes for bicyclists / pedestrians to cross the Red River.
- Expansion of the Roundabout at 60th Avenue S and US 75 would be required to receive 2 lanes on 60th Avenue S (from the west), shown in **Figure 5.10**.

Figure 5.10. Roundabout Expansion Schematic at 60th Avenue S & US 75



N-8: Re-Start TIM Group

Traffic Incident Management is becoming critical for metro areas given increased traffic growth over the last 10+ years. An emphasis on quick clearance, alternative route planning, training, and incentives can lessen the overall impact (operationally and safety implications) of an incident.

N-9: Development of Traffic Management Center

Many of the TSMO strategies discussed in Chapter 4 are dependent on a Traffic Management Center. NDDOT is currently advancing the development and design of a TMC located in Bismarck, ND.

N-10: Dynamic Message Signs / Closed Circuit Television Expansion

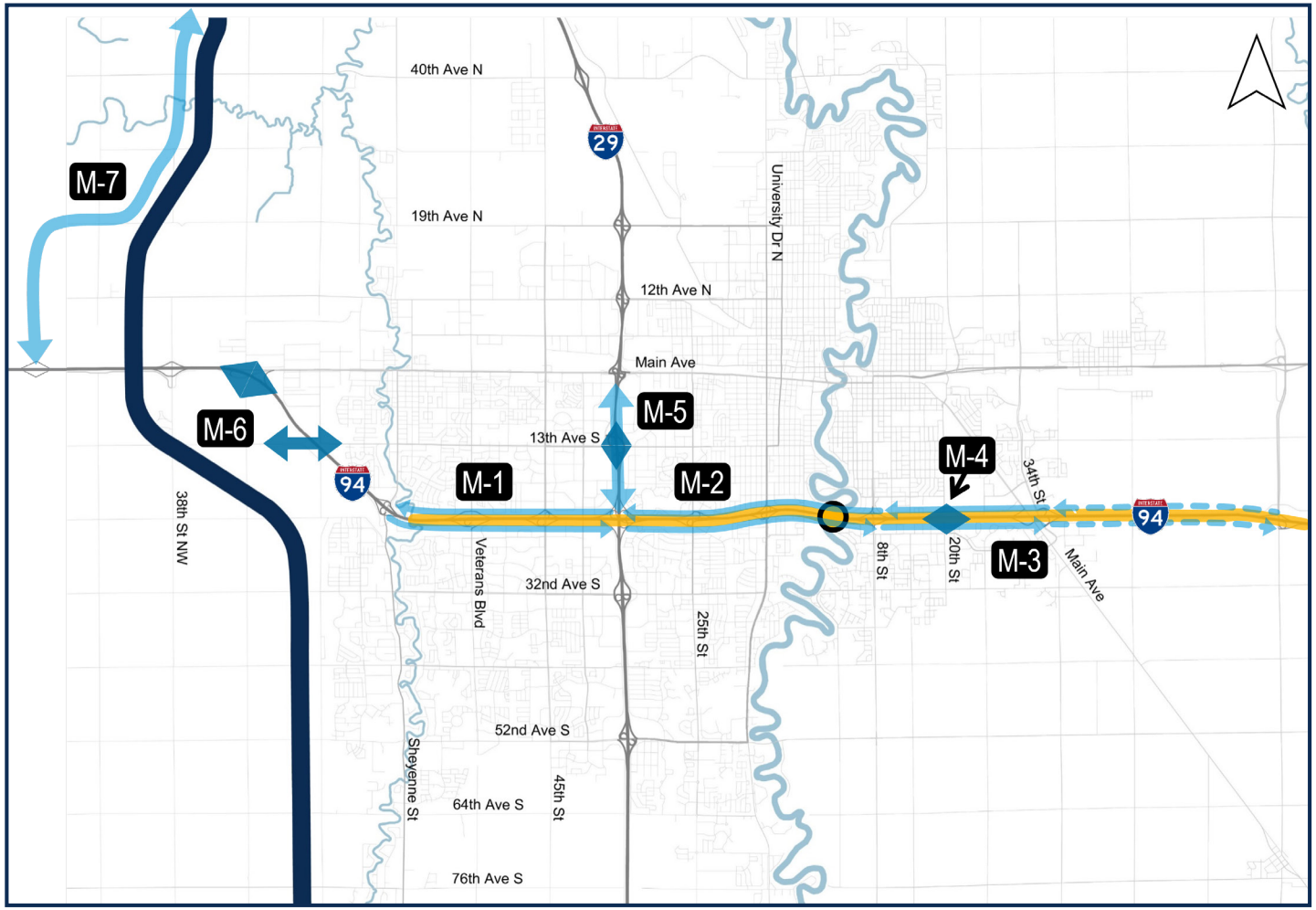
To enhance the effectiveness of the TMC, additional camera coverage will be important to have full coverage of the Interstate system. Strategically placed DMS throughout the metro area will also be important for traveler information and potential queue detection.

Mid-Term Projects

Mid-Term project locations are shown in **Figure 5.11**. IDs shown on the map correspond with the mid-term Interstate, interchange, and off-system improvements identified in the implementation plan shown previously in **Figure 5.2**. Mid-Term TSMO projects are not shown on the map, but detailed project descriptions are included later in this section.

System preservation projects (S-1 through S-5) are shown in orange in **Figure 5.11**. Projects M-1 through M-4 are expansion projects that are intended to be constructed at the same time as full reconstruction of I-94 from Sheyenne Street to MN 336.

Figure 5.11. Mid-Term Project Locations



M-1. I-94 Expansion to 6 Lanes
M-2. I-94 Expansion to 8 Lanes
M-3. I-94 Mobility Improvements
M-4. 20th Street Reconfiguration
M-5. I-29 Braided Ramps between 13th Ave S & I-94
- **13th Ave S Reconfiguration**

M-6. I-94 & Main Ave Improvements
- **Including 13th Ave S I-94 Overpass**

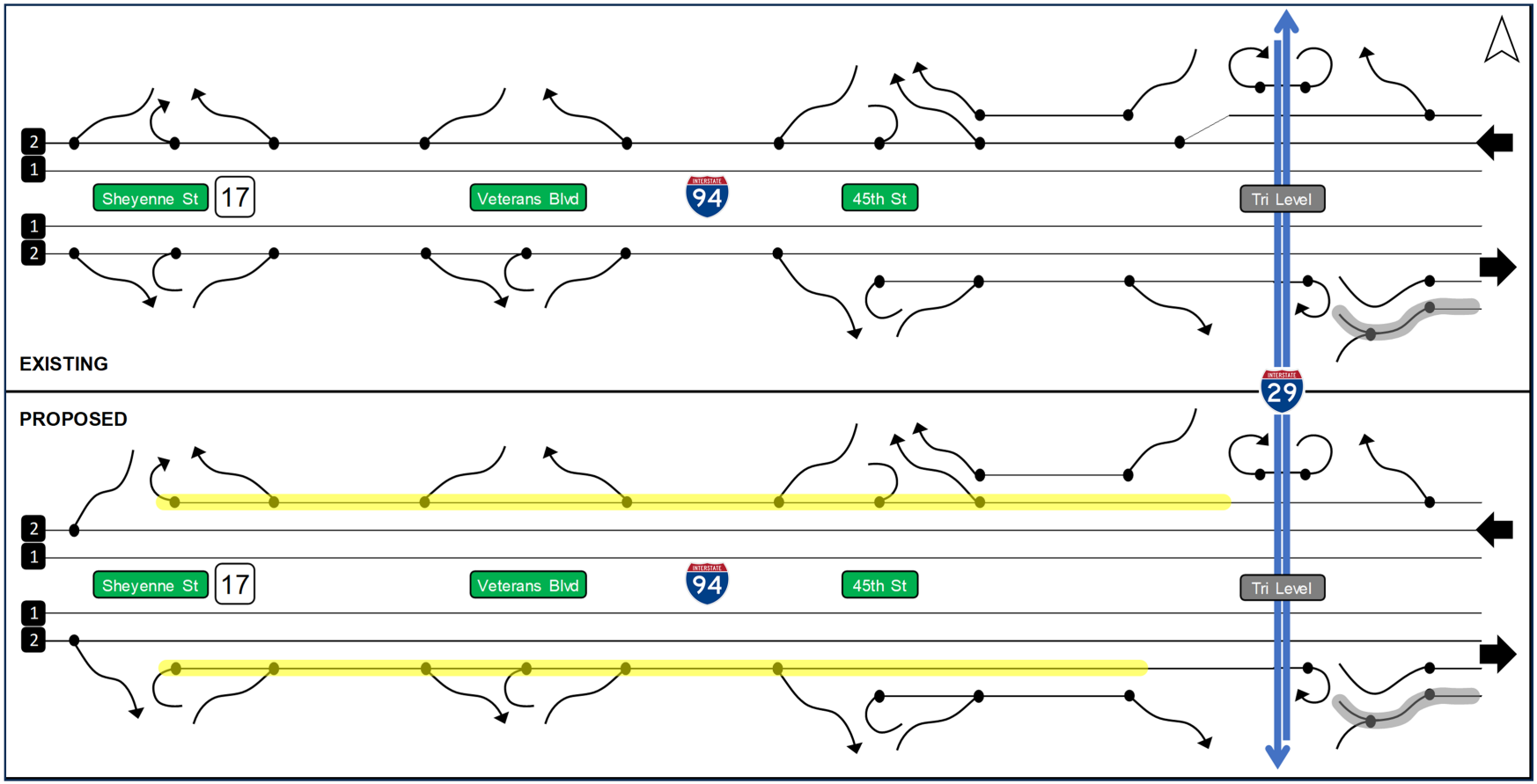
M-7. NW Perimeter Road

TSMO Improvements
- **Ramp Metering (Ring 1)**
- **Service Patrol**
- **Smart Work Zones**

M-1: I-94 Expansion to 6 Basic Lanes (Between Sheyenne Street & I-29)

This project adds one basic freeway lane in each direction between Sheyenne Street and I-29. In the WB direction, this project removes the existing lane drop within the system interchange. This project, combined with ramp metering, is intended to reduce congestion and improve reliability west of I-29, specifically at the weave locations between I-29 & 45th Street.

Figure 5.12. I-94 Expansion to 6 Basic Lanes (Between Sheyenne Street & I-29) Schematic



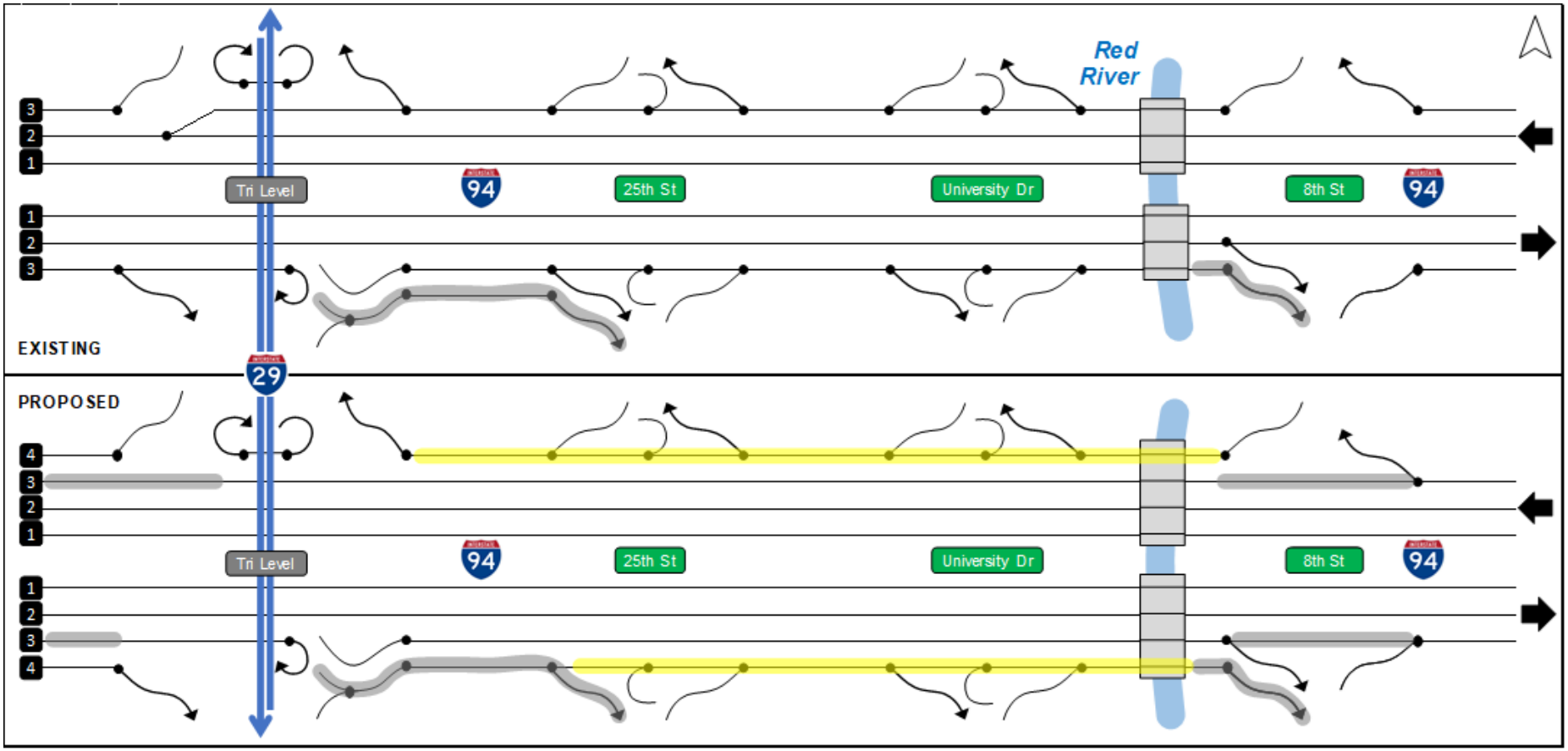
Project Cost: $10.7 - 13.1

Project M-1 is combined with Interstate reconstruction project S-2.

M-2: I-94 Expansion to 8 Basic Lanes (Between I-29 & 8th Street)

This project adds one basic freeway lane in each direction between I-29 and 8th Street. This project will improve the utilization of both flyover lanes from SB I-29 to EB I-94 since the outside lane will not drop at 25th Street. This project, combined with ramp metering, is intended to reduce congestion and improve reliability in the core of I-94 through Fargo.

Figure 5.13. I-94 Expansion to 8 Basic Lanes (Between I-29 & 8th Street) Schematic



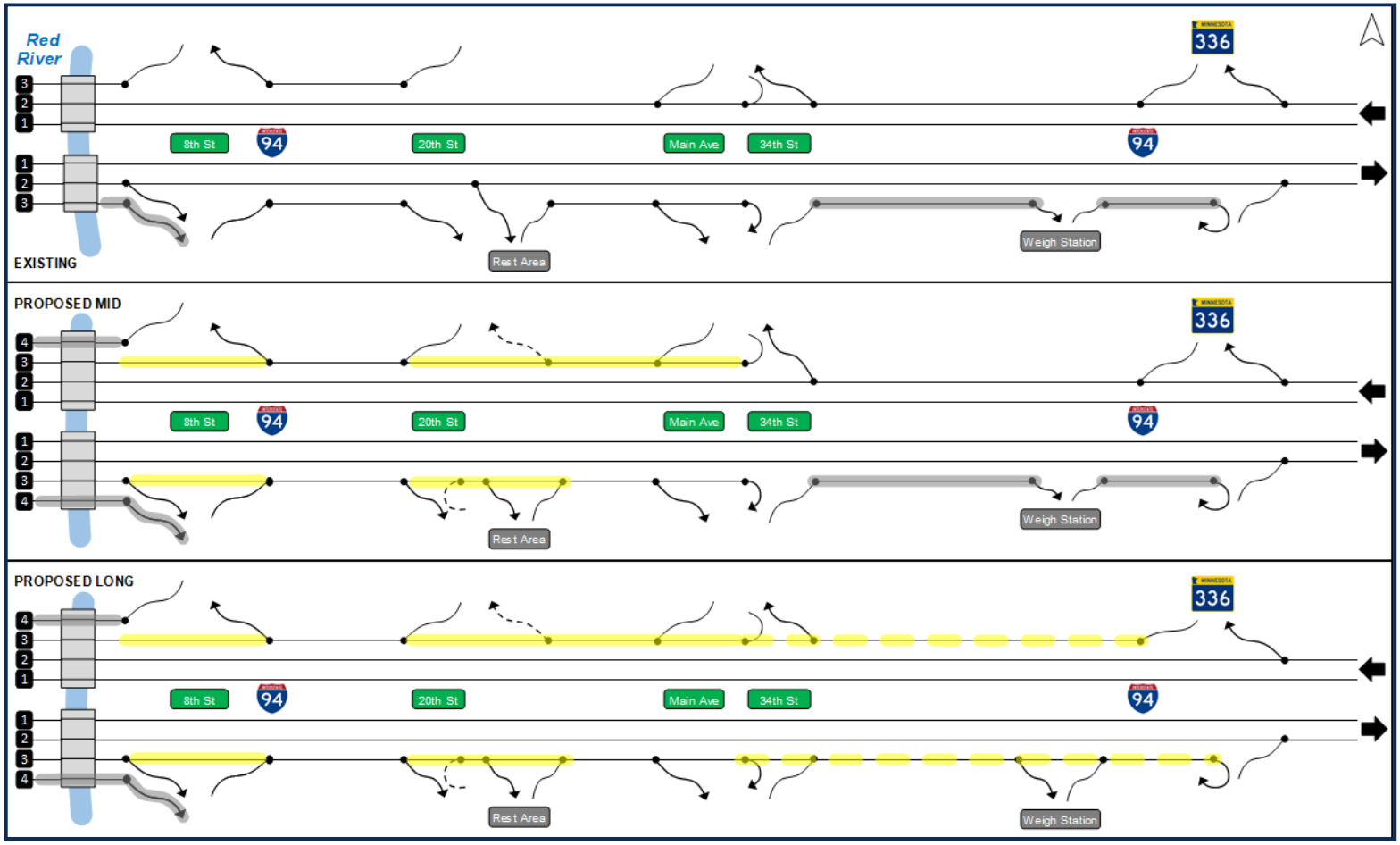
Project Cost: $23.7 - 29.0

Project M-2 is combined with Interstate reconstruction project S-3 and bridge replacement project S-4.

M-3: I-94 Mobility Improvements (Between 8th Street & MN 336) & M-4: 20th Street Reconfiguration

This project includes mobility improvements between 8th Street & MN 336. Mobility improvements may include ramp metering (discussed in M-8 & L-6), shoulder widening, auxiliary lanes, and basic freeway expansion. A combination of these treatments will improve day-to-day operations and provide flexibility for staging traffic during routine maintenance or lane closures due to weather events or disabled vehicles. An example of potential mobility improvement (basic freeway expansion) along I-94 is shown in **Figure 5.14**. The study team recommends further corridor analysis to identify potential TSMO and geometric improvements along I-94.

Figure 5.14. I-94 Expansion to 6 Basic Lanes (Between 8th Street & MN 336) & 20th Street Reconfiguration Schematic



The 20th Street reconfiguration, shown by the dashed lines in **Figure 5.14**, would occur concurrently with the I-94 mobility improvements. Lateral clearance under the 20th Street and the BNSF railroad bridges need to be improved via bridge replacements for mainline expansion to occur. This interchange reconfiguration is being studied independently by City of Moorhead and Metro COG.

Project Cost: To be determined through follow-on independent studies

Project M-3 is combined with Interstate reconstruction project S-5.

M-5: I-29 Braided Ramps (Between 13th Avenue S & I-94)

This project would remove the I-29 weavings section between 13th Avenue S and I-94 by adding bridges over the entry / exit ramps to 13th Avenue S. As shown in green in **Figure 5.15** and **Figure 5.16**, slip ramps between the I-94 ramps and 13th Avenue S ramps are included in this project. These are included to provide full access for all movements and to not restrict movements between I-94 and 13th Avenue S. This project is intended to provide long-term operational and safety benefits by removing weaving conflict points.

Figure 5.15. I-29 Braided Ramps (Between 13th Avenue S & I-94)

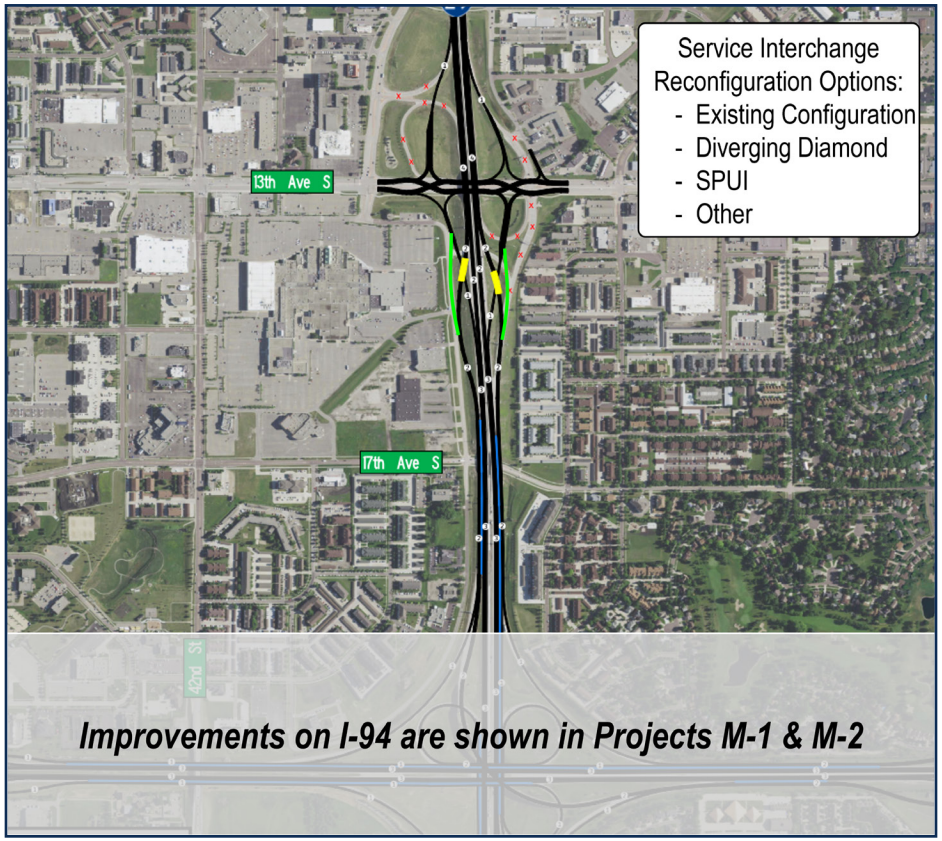
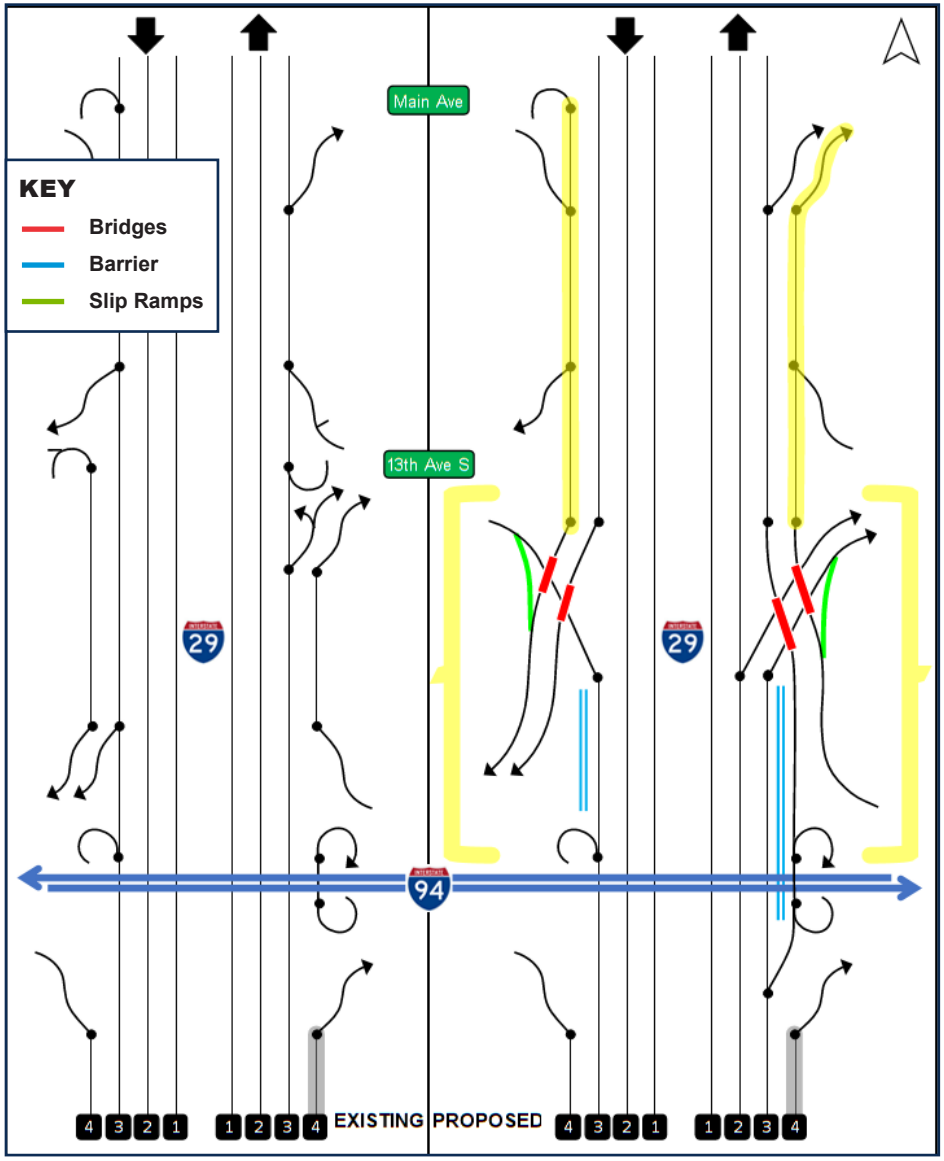


Figure 5.16. I-29 Braided Ramps (Between 13th Avenue S & I-94)



Project Cost: $28.7 - 35.1 Million

M-6: I-94 & Main Ave Improvements (Including 13th Avenue S I-94 Overpass)

This project would provide more direct access from I-94 to areas of West Fargo. Although this study did not identify operational deficiencies at the Main Avenue interchange, the City of West Fargo anticipates significant development pressures north and south of the Main Avenue interchange once the Diversion is completed. Local access needs and connectivity to/from I-94 would be improved considerably with an interchange reconfiguration.

Project Cost: $29.3 - 35.8 Million

M-7: NW Perimeter Road

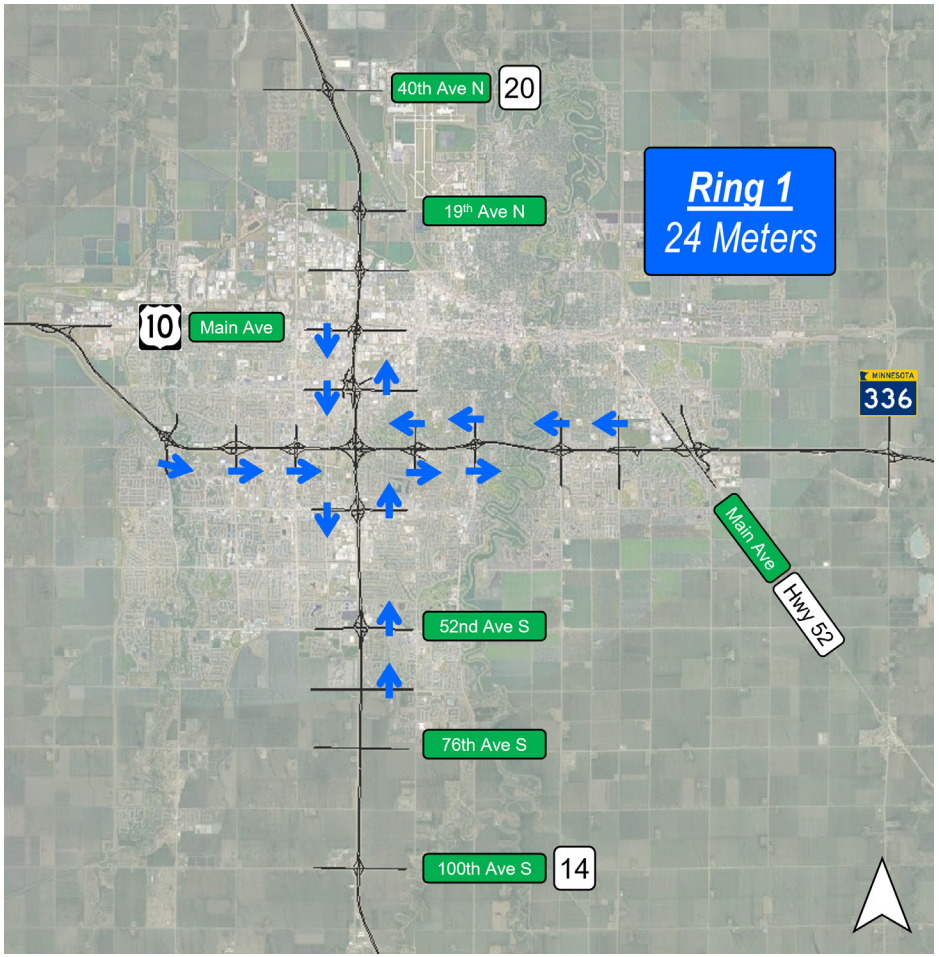
This project would utilize ROW purchased for the Diversion to construct a roadway paralleling the Diversion alignment in the NW quadrant of the metro area. Detailed discussion on the NW perimeter road is included in Chapter 4 and **Appendix E**.

M-8: Ramp Metering (Ring 1)

This project would add ramp meters within the core of the metro area. As noted previously in project N-9, a TMC is necessary for implementation of ramp metering. As shown in **Figure 5.17**, 24 ramp meter locations were identified in the mid-term plan. Ideally, these meter locations would be installed at the onset of I-94 construction activities. This would allow both DOTs to actively manage demand into the I-94 corridor during construction, resulting in less significant Interstate disruptions during mainline reconstruction.

The added benefit of flattening peak demand impacted the level of geometric improvements identified along I-29 and I-94. Many of the Interstate slowdowns detailed in the existing and future conditions are caused by a heavy 15-minute or 30-minute peak demand that causes the system to break down throughout the metro area. Ramp metering can flatten the peak demand entering the Interstate system, resulting in less severe bottlenecks / slowdowns during peak times.

Figure 5.17. Mid-Term Ramp Meter Locations



Project Cost: $400k - 600k Per Ramp Meter (includes ramp meter, fiber, and ramp widening)

M-9: Service Patrol

This program would add DOT staff driving the I-29 / I-94 Interstate system in trucks equipped with portable message boards and supplies to support disabled vehicles, state patrol, or first responders during an incident. This program would be similar to MnDOT's Freeway Incident Response Safety Team or other Highway Helper programs throughout the country. This program will be an integral part to reducing disruptions and improving safety along I-94 during reconstruction.

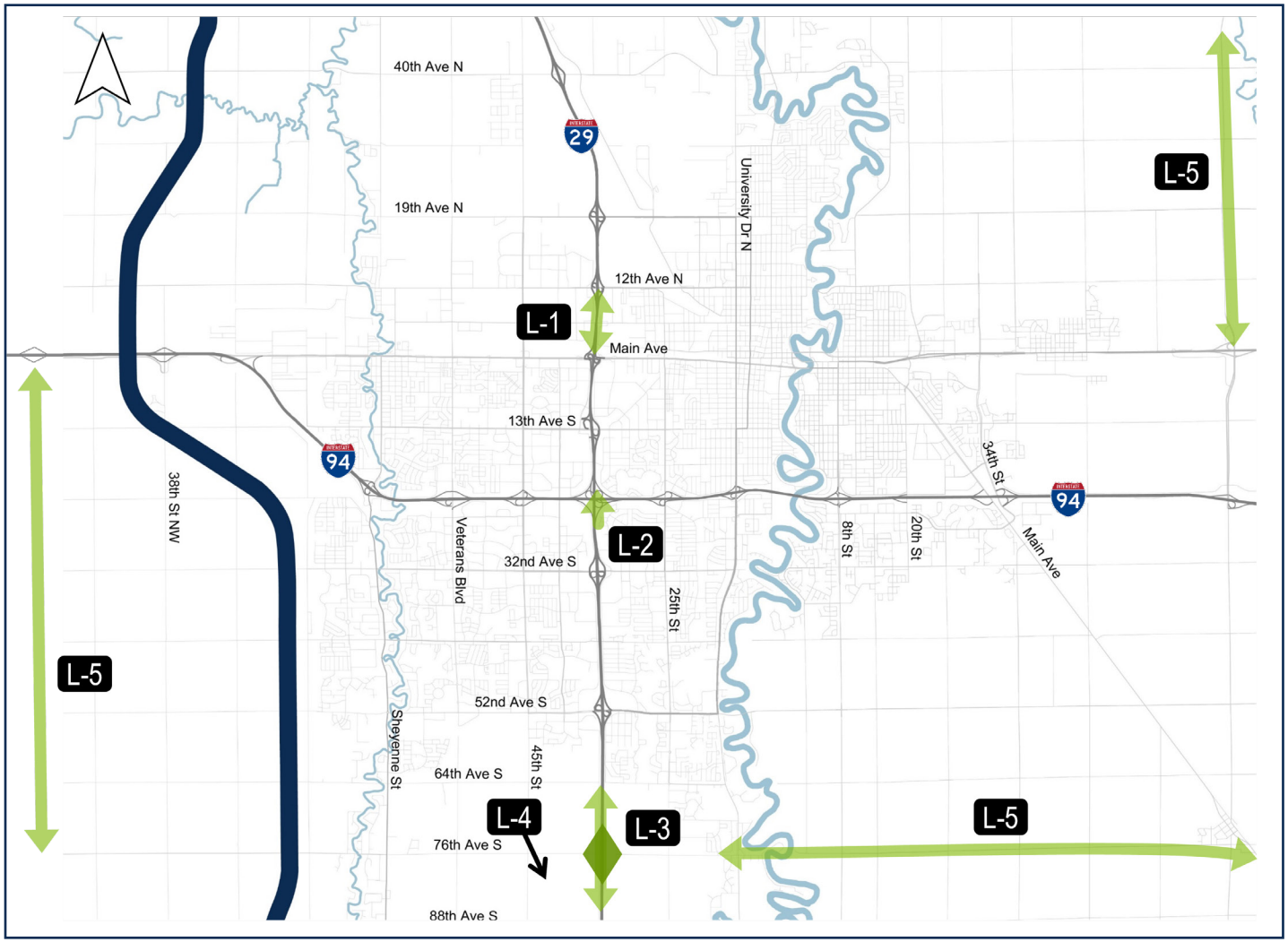
M-10: Smart Work Zones

Smart work zones continuously monitor areas impacted by road work to protect workers and drivers through increased awareness to conditions. The use of a smart work zone typically involves portable detection and / or monitoring equipment, portable DMS, and wireless communication. Smart work zones will help provide instant feedback to the TMC during I-94 reconstruction.

Long-Term Projects

Long-Term project locations are shown in **Figure 5.18**. IDs shown on the map correspond with the mid-term Interstate, interchange, and off-system improvements identified in the implementation plan shown previously in **Figure 5.2**. Long-Term TSMO projects are not shown on the map, but detailed project descriptions are included later in this section.

Figure 5.18. Long-Term Project Locations



L-1. I-29 Aux Lanes
L-2. Braided NB Loop
L-3. New Interchange at 76th Ave S (includes C-D Roads)
L-4. 100th Ave S Improvements
L-5. Perimeter Road(s)

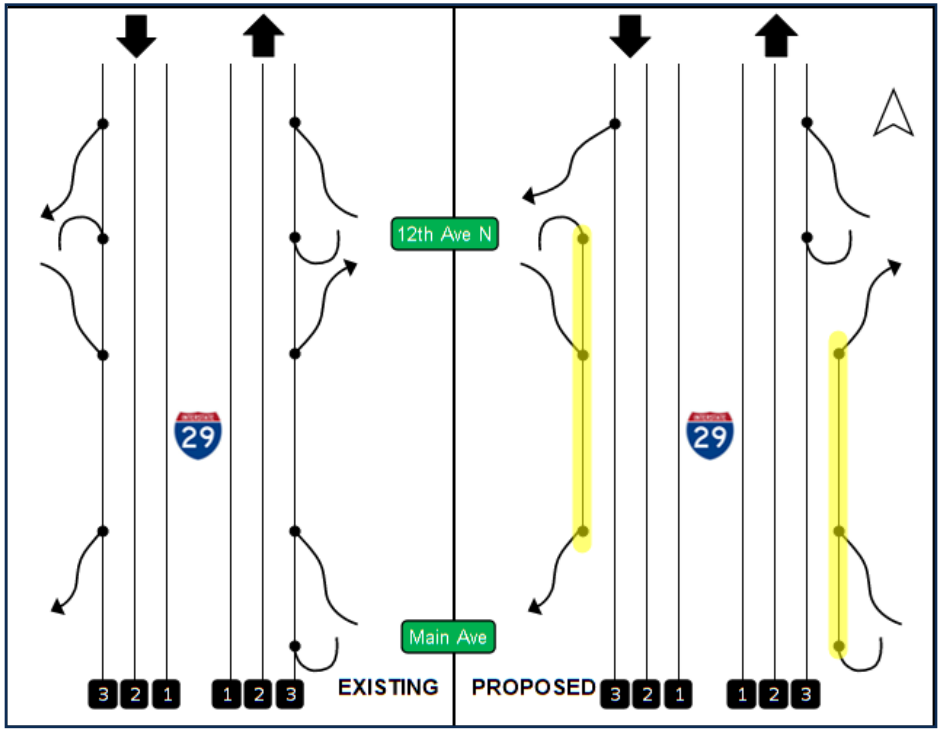
TSMO Improvements

- **Ramp Metering (Ring 2)**

L-1: I-29 Auxiliary Lanes (Between 12th Avenue N & Main Ave)

This project would add auxiliary lanes between the upstream loop entrance ramps and downstream exit ramps on I-29 between 12th Ave N and Main Ave. This project is intended to provide more acceleration distance for loop entrance ramps while reducing congestion along I-29.

Figure 5.19. I-29 Auxiliary Lanes (Between 12th Avenue N & Main Ave) Schematic

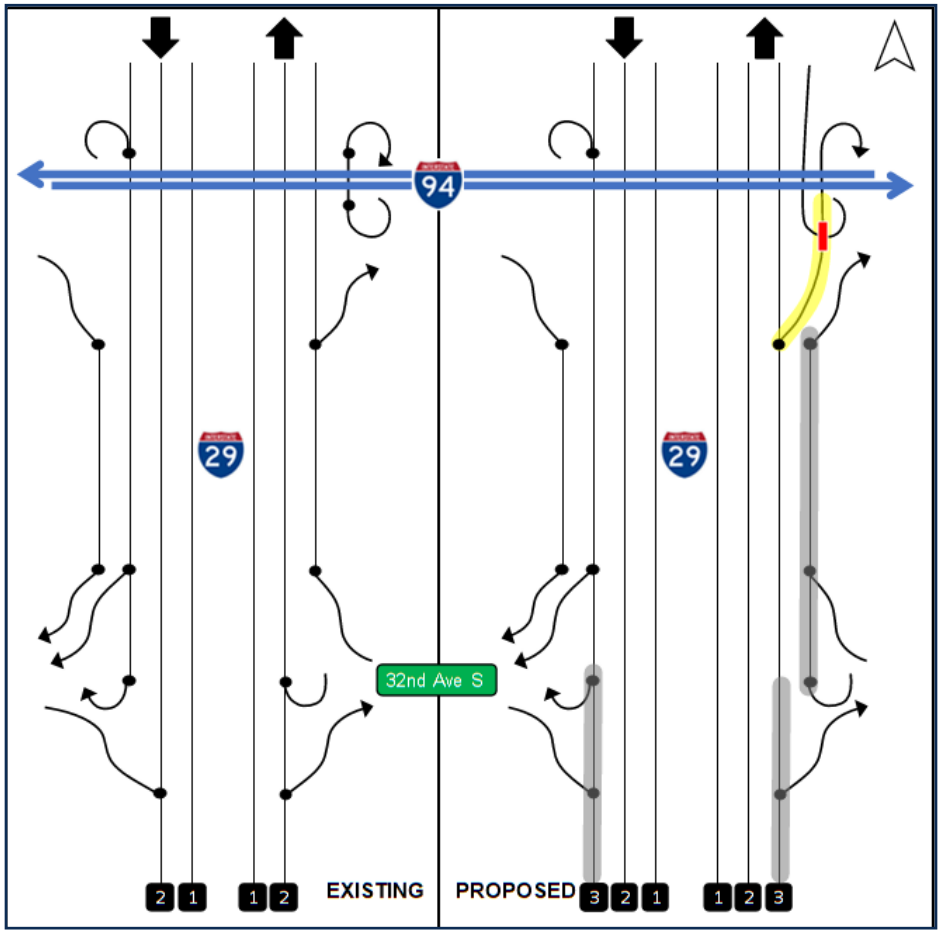


Project Cost: $9.2 - 11.3 Million

L-2: Braided NB Loop Ramp (At I-29 / I-94 System Interchange)

This project would remove the NB I-29 weaving section by adding a bridge over the EB I-94 to NB I-29 loop ramp at the system interchange. This project is intended to provide long-term operational and safety benefits by removing weaving conflict points.

Figure 5.20. Braided NB Loop Ramp (At I-29 / I-94 System Interchange) Schematic



Project Cost: $3.7 - 4.5 Million

L-3: New Interchange at 76th Avenue S

This project adds a new interchange at I-29 & 76th Avenue S. Due to proximity of the 76th Avenue S interchange to the planned 64th Avenue S interchange, the study team recommends the consideration of C-D Roads that tie in the 64th Avenue S and 76th Avenue S interchanges with the 52nd Avenue S ramps to the south. C-D Roads would shift all weaving movements off of I-29 mainline lanes, keeping the I-29 mainline lanes at acceptable LOS. This project is being studied independently by City of Fargo and Horace.

POTENTIAL ALTERNATIVE MODIFICATIONS

Depending on the level of growth on I-29 at the time of 76th Avenue S development / construction, additional widening under 52nd Avenue S may be needed. Traffic volumes from 76th & 64th Avenue S are routed to:

- Single lane merge onto NB I-29
- Single lane diverge from SB I-29

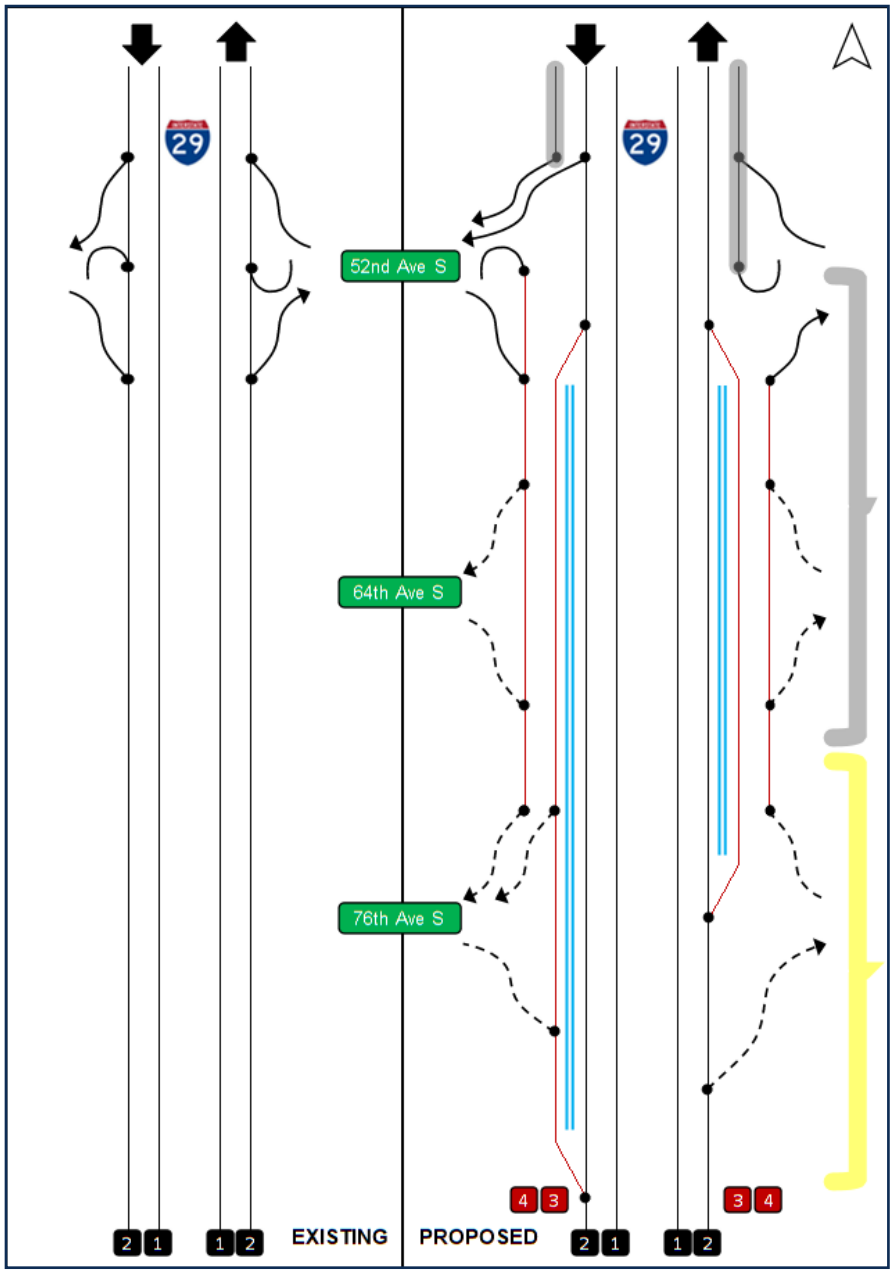
It is likely that 6 lanes (3 in each direction) will be needed under 52nd Avenue S. This would change the current merge / diverge from the CD road to:

- Single lane add onto NB I-29 (instead of the single lane merge shown in **Figure 5.21.**
- Two lane exit from SB I-29 - with lane balance (option lane)

Traffic volumes along the potential C-D road system should be re-forecast once the 64th Ave S interchange is constructed to determine the optimal lane configuration.

Project Cost: $48.6 - 59.4 Million
(Project cost includes C-D roads)

Figure 5.21. New Interchange at 76th Avenue S Schematic



L-4: 100th Avenue S Improvements

This project includes a reconfiguration of the I-29 & 100th Avenue S interchange. This project is intended to update the design of the interchange from rural to urban standards as development expands into south Fargo. This project will improve safety and provide long-term operational benefits.

Project Cost: $17.6 - 21.5 Million

L-5: Perimeter Road(s)

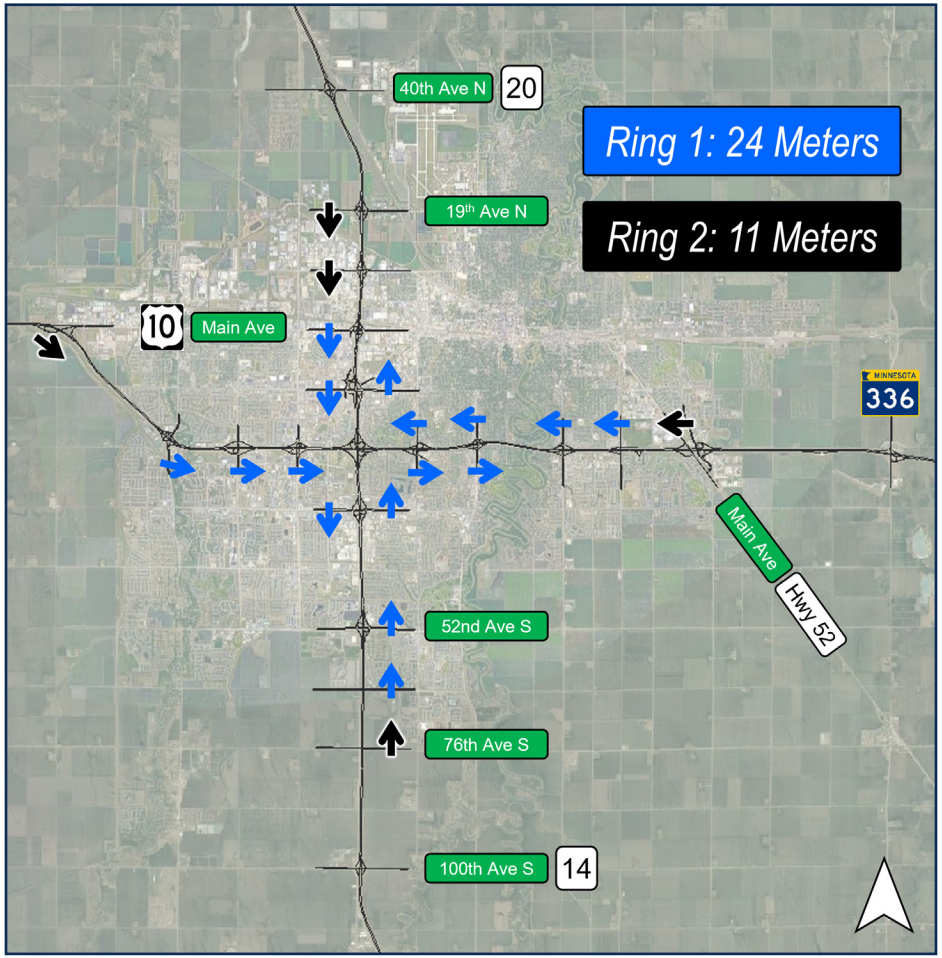
This project would construct the remaining perimeter roads in the NE, SE, and SW quadrants of the metro area. Detailed discussion on the NW perimeter road is included in Chapter 4.

L-6: Ramp Metering (Ring 2)

This project would add ramp meters to the remainder of the core of the metro area. As shown in **Figure 5.22**, 11 ramp meter locations were identified in "Ring 2" in the long-term plan.

Project Cost: $400k - 600k Per Ramp Meter
(includes ramp meter, fiber, and ramp widening)

Figure 5.22. Mid-Term & Long-Term Ramp Meter Locations



6 | Conclusion & Next Steps

The implementation plan including near-, mid-, and long- term projects discussed in the previous chapter is intended to be a dynamic document that is refined every 5-10 years. It is anticipated that the near-term projects are currently the highest priority needs on the Interstate system, and the project development process on those projects will be initiated or continue before the next update of this plan. This document is the first refresh of the original IOS completed in 2011, which laid the groundwork for many of the strategies that are recommended as part of this study.

Implementation Plan

The plan developed for the IOS is the first step towards full implementation of the strategies. During later refinement and implementation steps, the following questions should be considered before construction.

- **Combining System Preservation & Expansion Projects:** Can projects on common segments be shifted around to combine expansion and system preservation?
- **Operational & Safety Consideration:** What are the operational and safety implications if the project is delayed?
- **Limiting Disruptions to the Traveling Public:** How often can work be performed on the Interstate mainline? Can we improve operations / safety during construction?
- **Input from Stakeholders:** Do local communities have adequate access to the Interstate system? Could their access be improved?

TSMO Projects

The IOS included numerous TSMO projects in the implementation plan. Many of these projects are dependent on a Traffic Management Center, so it is important to continue the advancement of a TMC. Additionally, efficient communication and coordination between North Dakota and Minnesota is an integral piece of day-to-day operations.

Safety Benefit

TSMO projects, specifically ramp metering and TIM / Service Patrol / Smart Work Zones, are one of the best ways to reduce crashes in the region. NDDOT and MnDOT should prioritize TSMO strategies to improve safety and reliability of the Interstate system.

Interstate Reconstruction

Through discussions with NDDOT and MnDOT, a large upcoming project in the metro area will be the rebuild 12 miles of I-94 from Sheyenne Street to MN 336 (including the Red River bridge). This study recommends adding basic freeway capacity to a large portion of I-94 during multi-year project. The study team also identified TSMO and off-system projects to lessen the impact of construction on users including:

- 52nd Avenue S / 60th Avenue S Widening (Between University & US 75)
- Ramp Metering (Ring 1)
- TIM / Service Patrol / Smart Work Zones
- Improved East/West Signal Coordination

With an anticipated construction beginning in 2030 – 2032, both DOTs need to begin initial steps for the combined implementation of capacity and system preservation needs along I-94.

Perimeter Roads

Once the diversion is completed, land that was previously in the floodplain will be ready for development. Before the development occurs, it is important that ROW preservation and access control policies are developed to preserve the perimeter road alignments. These roads will serve as an alternative route to already congested Interstate segments and arterial roadways, providing a more resilient system.

Incorporation into Metropolitan Transportation Plan

The Fargo-Moorhead MTP is a long-range and multimodal plan that identifies the region's transportation priorities for the next 20 to 25 years. Before a project can be programmed in Metro COG's four-year TIP, it must be included in the MTP. Therefore, is it recommended that the short-term projects included in this document that are not currently included in Metro COG's MTP and TIP (2023-2026) should be amended into both documents. Additionally, the upcoming 2050 MTP document should incorporate the projects included in this IOS update as part of the fiscally constrained, long-range, and multimodal regional transportation plan.

Appendix Material

The following appendices are included in the digital appendix.

- Appendix A: Study Review Committee, Focus Group, and DOT Management Meetings
- Appendix B: Base Year & Future Year Traffic Forecasts Memo
- Appendix C: Existing Conditions Memo
- Appendix D: Microsimulation Memos
  - TransModeler Microsimulation Methodology & Calibration Memo
  - Microsimulation Application & Results Memo
- Appendix E: Perimeter Road Memos
  - Perimeter Road Peer Community Review
  - Perimeter Road Future Forecasts and Cost Summary
    - Including Full Build-Out Analysis
- Appendix F: System Preservation Projects