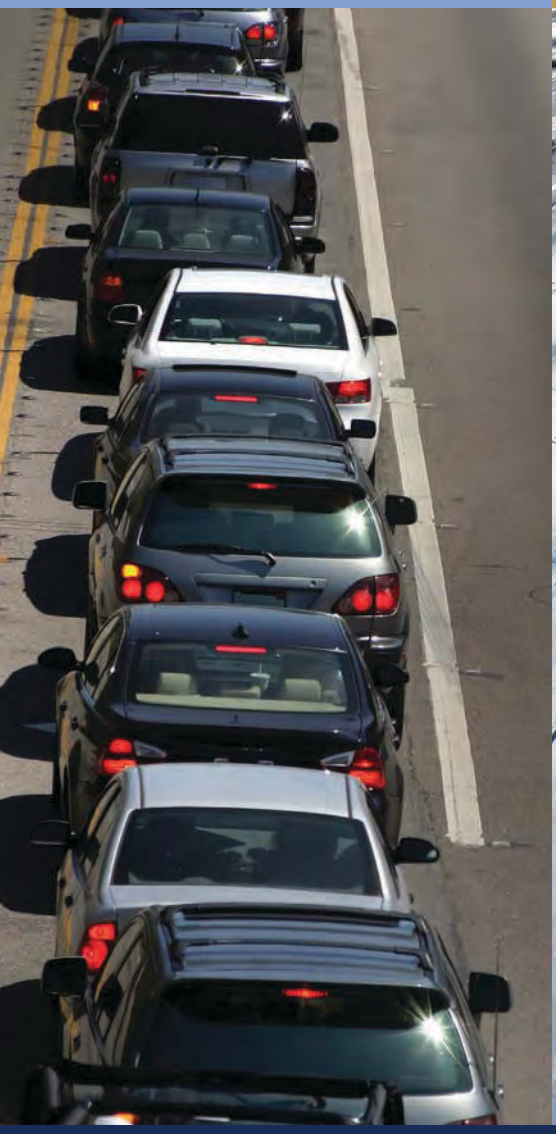
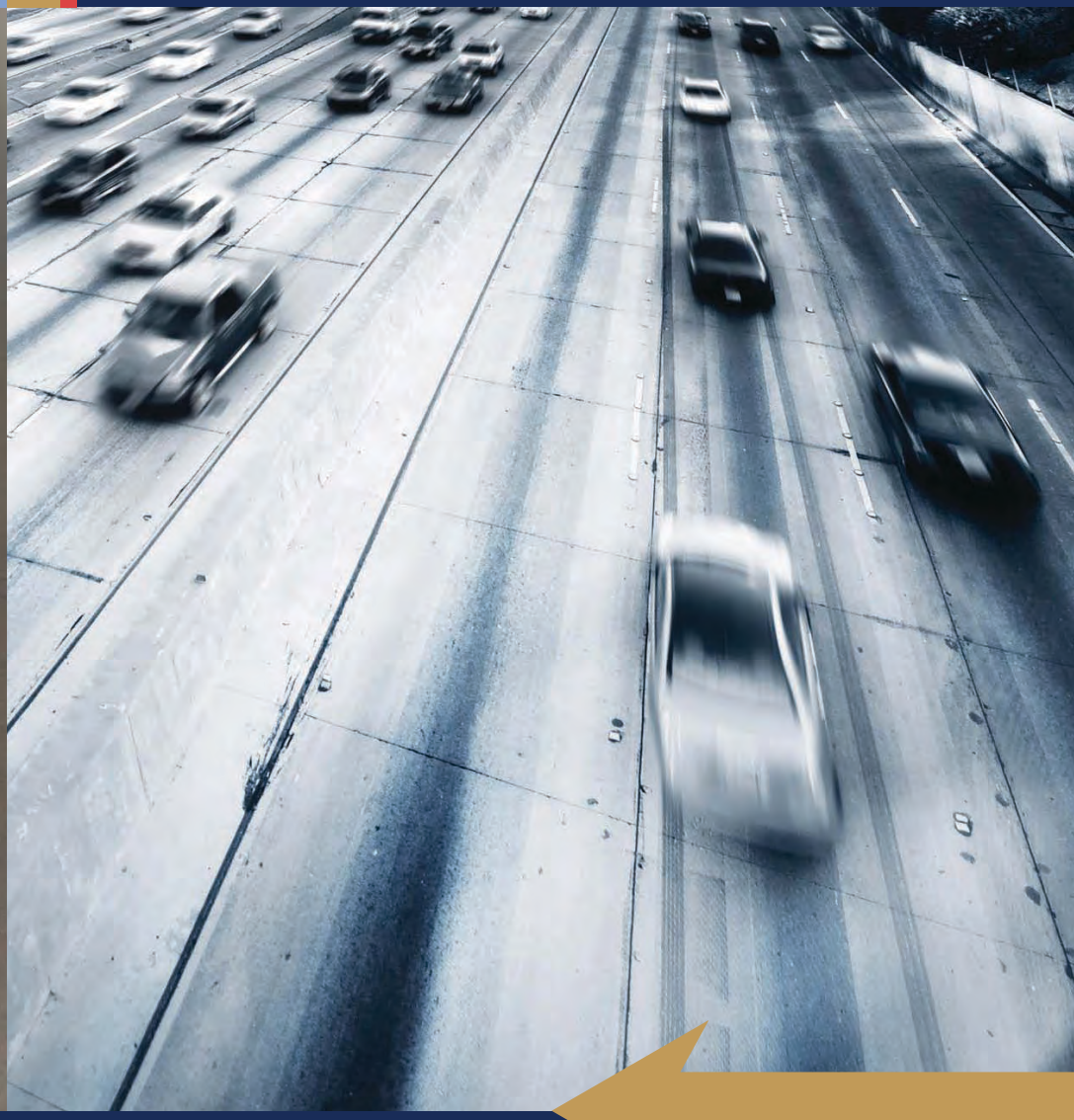
Fargo-Moorhead Council of Governments

Traffic Operations Incident Management Strategy





Final Report

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PREPARED BY:

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Engineers
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I. EXECUTIVE SUMMARY

A. Introduction

The goal of the Traffic Operations Incident Management Strategy is to combine information from previous studies along with further analysis to develop a list of improvements (roadways, ITS, policies, and protocol) that will enhance the current practice of moving people and goods in and out of the Fargo-Moorhead metropolitan area in the event of an incident or emergency.

B. Stakeholder Involvement

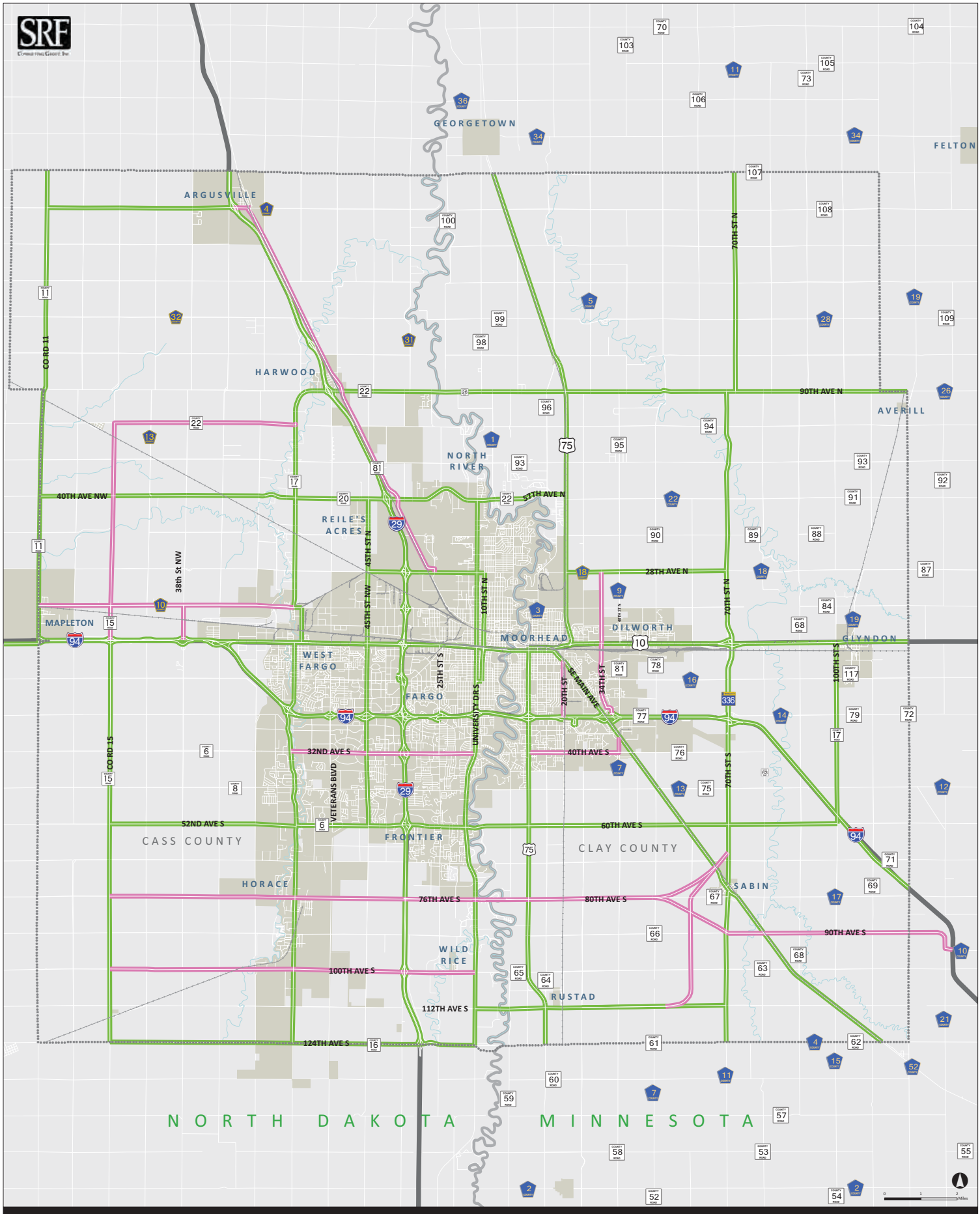
Stakeholder input was instrumental in shaping the study process and its recommendations. Stakeholder meetings and Study Review Committee (SRC) meetings took place throughout the study process. A brown bag luncheon also gave members of the general public and Fargo-Moorhead Metropolitan Council of Government's (Metro COG's) Policy Board an opportunity to review the study's recommendations and submit comments on them. At the conclusion of the study process, the study was reviewed and recommended by the Metro COG's Transportation Technical Committee and approved by the Policy Board.

C. RSTI Network

One of the main objectives of the study is the further refinement of the Regionally Significant Transportation Infrastructure (RSTI) concept and corridors as originally defined in the 2009 Fargo-Moorhead Metropolitan Area Long-Range Transportation Plan. RSTI routes are existing or future arterial roadways that carry large volumes of traffic, including freight. The roadways are generally higher speed facilities that are important to the metropolitan area. They may include strategic Red River crossings, Interstates or major US highways, emergency alternate routes, or reliever routes to the Interstate. Stakeholders agreed on an updated RSTI network map and identified issues that limited the effectiveness of the routes (see map). Solutions to many of these deficiencies and associated cost estimates are proposed in the Capital Improvement Cost Estimates chapter.

D. Beltway Vision, Design Parameters, and Conceptual Alignments

The need for a metropolitan beltway has been previously described in numerous Metro COG Long-Range Transportation Plans and Extraterritorial Studies. A metropolitan beltway vision, design parameters, and conceptual alignments are proposed as part of this study. The purpose of the beltway is to provide a reliable, high speed bypass around the Fargo-Moorhead urban core that can be used for the movement of freight, for inter-regional travel wishing to avoid the urban area, as a reliever route to congested Interstates or arterials, or as an alternate route/evacuation route during incidents or emergency situations. It would be designed to include a major Red River crossing both north and south of the urban core to accommodate motorists traveling in either direction. The long-term beltway design would be constructed as a four-lane rural expressway and would transition to an urban expressway in already developed areas.



EXISTING AND PROPOSED REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

- RSTI CORRIDOR ADDITION
- EXISTING RSTI CORRIDOR
- STATE/COUNTY BOUNDARY
- MPO PLANNING AREA
- MUNICIPAL BOUNDARY

Various options for both an interim and a long-term alignment are proposed based on the corridor vision, design parameters, and stakeholder input. It should be noted that the beltway is also part of the RSTI network. Further analysis will be needed to select the exact alignment, but a number of options are presented for consideration.

Many incremental steps, completed over several decades, will need to be taken before the ultimate beltway corridor vision will be realized. Through much of this period, the beltway system will be comprised of two-lane roadways, with specific segments expanded as capacity or mobility needs dictate. It can be anticipated that construction of the entire beltway may take 50 years to complete; with near term activities targeted toward corridor preservation and specific roadway segment improvements.

E. Capital Improvement Cost Estimates

RSTI network and beltway issues were originally identified by local and state agency representatives at five stakeholders meetings and then prioritized at the first Study Review Committee meeting. Many of the high-priority issues identified correspond to problems related to the interim and long-term beltway alignments. Capital improvement projects and associated cost estimates are proposed to address the high-priority issues.

Costs estimates are calculated for 28 projects throughout the region, covering one of seven main issue areas:

- Flooding issues ($29.6M)
- At-grade railroad crossing issues ($67.7M)
- Gravel roadway surface issues ($78.5M)
- Geometric issues ($6.7M)
- Bridge issues ($45.6M)
- Potential future capacity issues ($42.5M)
- Interchange issues ($41.6M)

F. ITS Recommendations

While the 2008 Intelligent Transportation Systems (ITS) Plan recommendations generally focus on mobility enhancement, the recommendations in this study concentrate on deploying ITS to improve traffic incident management efforts. Deployments are proposed for the short- and mid-term time frames. Planning-level cost estimates for each of the proposed deployments are also given.

A variety of ITS devices or related improvements are proposed, such as:

1. Dynamic message signs (DMSs)
2. Flooding/pavement condition monitors
3. Video integration/sharing
4. Traffic operations center (TOC) deployment and video management platform selection
5. Vehicle detection (e.g., Autoscope, loop detectors)
6. At-grade train detection
7. Fiber optic/communication network extensions
8. Communication network extensions
9. Surveillance (e.g., closed circuit TV)

G. Agency Coordination, Planning, and Response Recommendations

This study also details a number of recommendations for improving traffic incident management coordination, planning, and response in the Fargo-Moorhead metropolitan area. Recommendations focus on the continued progression towards the development of a TOC and the creation of a traffic incident management program. The latter of the two includes items such as after action reports and incident debriefings, the re-establishment of the Metro COG Traffic Incident Management Committee, and the development of region-wide emergency traffic control and scene management guidelines. Emergency alternate routes are also discussed including the identification of routes, development of an operations guide, drafting of partnership agreements, and use of static and dynamic message signs to help move traffic during these emergency situations. Finally, a number of performance measures are proposed for consideration to monitor and assess traffic incident management efforts in the region.

H. Next Steps

The study concludes with a series of next steps and recommendations that Metro COG should take in subsequent years. Many of these recommendations are cost-effective solutions to address traffic incident management issues at a fraction of the cost of large capital improvement projects. A few of the notable next steps include:

1. Add the revised RSTI network to the Long-Range Transportation Plan update.

2. Conduct corridor studies, by key beltway segment, to document the rationale for the selection of a preferred long-term beltway route and to identify specific beltway improvements and priorities.

3. Include the proposed capital improvement projects in the Long-Range Transportation Plan update. Prioritize the projects and pursue available funding opportunities.

4. Secure funds for short-term ITS recommendations.

5. Finalize the process of sharing video feeds between NDDOT and the City of Fargo (i.e., connect fiber optic cable networks, install software, sign memorandum of understanding, etc.).

6. Continue working with stakeholders towards the development of a TOC.

7. Re-establish the Metro COG Traffic Incident Management Committee, which will include stakeholders from emergency management, law enforcement, fire, and highway staff.

8. Using the Traffic Incident Management Committee, select and implement some of the highest priority recommendations proposed in this study, whether it is the development of an emergency alternate route operations guide, creation of an after-action report form, or other recommendations.

9. Prioritize recommended traffic incident management performance measures based on usefulness and ease of obtaining information. Begin tracking identified performance measures related to traffic incident management.

II. STUDY BACKGROUND

This study develops a Traffic Operations Incident Management Strategy for the Fargo-Moorhead metropolitan area. Specifically, this study identifies a network of emergency alternate routes; low-cost roadway improvements; operational strategies and improvements; policies and protocols to enhance the movement of people and goods in and out of the Fargo-Moorhead metropolitan area in the event of a major incident or emergency.

In recent years, Metro COG has completed several planning activities that have identified the need for a clear strategy regarding the use of emergency alternate routes and/or an incident management protocol for the surface transportation system in the Fargo-Moorhead metropolitan area. These plans have placed a high priority on improved communication and coordination for planned special events, unplanned incidents, and natural or manmade disasters.

Following the passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the Metro COG Policy Board approved a Transportation Security Initiative (TSI) in April of 2008. The TSI was developed to provide a framework for Metro COG to respond to SAFETEA-LU requirements regarding integrating security into the MPO program. The TSI is included as Appendix G within the 2009 Fargo-Moorhead Metropolitan Area Long-Range Transportation Plan. Development of this Traffic Operations Incident Management Strategy is a response to recommendations made within the TSI that was adopted by Metro COG.

The 2009 Fargo-Moorhead Metropolitan Traffic Operations Action Plan provides additional guidance regarding the need for clearer incident management protocol and traffic management studies, which require a high level of coordination among two Departments of Transportation, three municipal signal operators, and a host of law enforcement, and emergency management agencies.

III. STAKEHOLDER INVOLVEMENT

A. Introduction

Stakeholder involvement is critical to the success of any study or project. Stakeholders provided key input that influenced the direction of the study and its eventual recommendations. At the start of the study process, a series of stakeholder meetings were held to collect information and input. In addition, a Study Review Committee (SRC) met on two separate occasions to guide the study process and its outcomes. At the second SRC meeting, staff from various stakeholder agencies were also invited to attend. A brown bag luncheon also gave members of the general public and Fargo-Moorhead Metropolitan Council of Government's (Metro COG's) Policy Board an opportunity to review the study's recommendations and submit comments on them. At the conclusion of the study process, the study was reviewed and recommended by the Metro COG's Transportation Technical Committee and approved by the Policy Board.

B. Stakeholder Meetings

To kick-off the study, a series of five stakeholder meetings were held on August 24, 2010. Invited individuals were split into five different meeting groups based on agency type and geography, and included:

1. North Dakota emergency staff
2. Minnesota emergency staff
3. North Dakota agency staff
4. Minnesota agency staff
5. Red River Regional Dispatch Center (RRRDC) – Operations Law Enforcement Committee

Twenty-eight stakeholders attended the information-gathering sessions (see meeting handouts and sign-in sheets in Appendix A). The meetings focused on collecting input on the draft RSTI corridors and current incident management response efforts.

Major outcomes/issues from these meetings included the following:

1. Existing RSTI corridors were confirmed, some additional corridors were identified, and problem areas along these routes were also noted.

2. Beyond mutual aid agreements, there is a lack of formal agreements between agencies in regard to alternate routes or incident management. A formalized alternate route identification process may allow the use of local routes, significantly reducing the travel time and distance of an alternate on only state-owned roads.

3. A traffic operations center is needed to provide coordinated control of all signals, dynamic message signs, cameras, etc. in the region.

4. Further study is needed on a potential ring road/bypass corridor around the urban core, as well as another Red River crossing in the southern Fargo-Moorhead Metropolitan Area.

5. More cameras, detection, and DMS are needed in the region, primarily on the Interstate system.

6. The RRRDC communicates with 57 different agencies in the region and will continue to improve its capabilities with future technologies such as Next Generation 911.

7. All responders can communicate with one another via Metro Channel 3. With the State of Minnesota continuing to move toward the Allied Radio Matrix for Emergency Response (ARMER) system, some communications problems may occur, even with the patch.

C. Study Review Committee Meeting #1

The first SRC meeting was held on October 25, 2010 (see Appendix B for meeting minutes). It consisted of representatives from a number of agencies including:

1. Minnesota Department of Transportation (Mn/DOT)
2. North Dakota Department of Transportation (NDDOT)
3. North Dakota Highway Patrol
4. Minnesota State Patrol
5. Cass County Sheriff's Office and Highway Department
6. West Fargo Police Department
7. Fargo Fire and Engineering Departments
8. Moorhead Fire and Engineering Departments

The group further refined the RSTI network and identified issues with each of the routes. The issues were classified together by type (i.e., flooding, roadway surface, etc.) and the group discussed and prioritized potential construction projects. Many of the top-tier projects correspond to a potential future beltway system around the urban area. The SRC then discussed currently programmed projects that will alleviate some of these issues, including projects identified in 2009 Fargo-Moorhead Metropolitan Area Long-Range Transportation Plan. Potential beltway alignments were also discussed at the meeting.

ITS improvements to enhance traffic incident management efforts in the region were also discussed. One of the goals of this study is to identify and prioritize additional ITS improvements that are currently not programmed. Some of the ITS improvements proposed at the meeting included DMS, flooding/pavement condition sensors, vehicle detection, closed circuit TV (CCTV), and at-grade train detection.

The SRC also discussed how TOCs are organized in other states. Staffing of the TOC can follow a number of different models depending on operational goals. However, no matter what model is used, all TOC concepts require a reliable data transport between the center and the devices in the field.

D. Stakeholder and Study Review Committee Meeting #2

SRC members and other stakeholders were invited to review and discuss the draft study recommendations on February 22, 2011 (see Appendix C for meeting minutes). Two separate meetings were held in order to focus on traffic operations or traffic incident management-related chapters of the study. Overall the report's recommendations were well-received by attendees.

A series of ITS improvements and their corresponding cost estimates were some of the items discussed at the meetings. The proposed installation of DMSs was one of the ITS recommendations of particular interest to the group. Proposed locations for future DMSs were further refined by stakeholders.

The concept of an emergency alternate route operations guide for the metropolitan area was encouraged by the group for further consideration. The routes would be used to temporarily divert traffic around an incident occurring on an Interstate that could cause significant delays. Implementation of an emergency alternate route is a highly-involved process requiring early planning to ensure successful coordination of stakeholders and resources. Pre-planning the routes and other major tasks to be performed by various agencies could help improve incident response.

IV. RSTI NETWORK

A. Introduction

One of the main objectives of this study is the further refinement of the RSTI concept and corridors. An initial RSTI corridor map was included in the 2009 Fargo-Moorhead Metropolitan Area Long-Range Transportation Plan and was further developed in the months following the Plan's adoption (see Figure 1). The first set of stakeholder meetings and the first SRC meeting provided input as to potential additions or deletions to the RSTI network. Finally, development of the metropolitan beltway conceptual alignments added new routes to the final agreed-upon RSTI network.

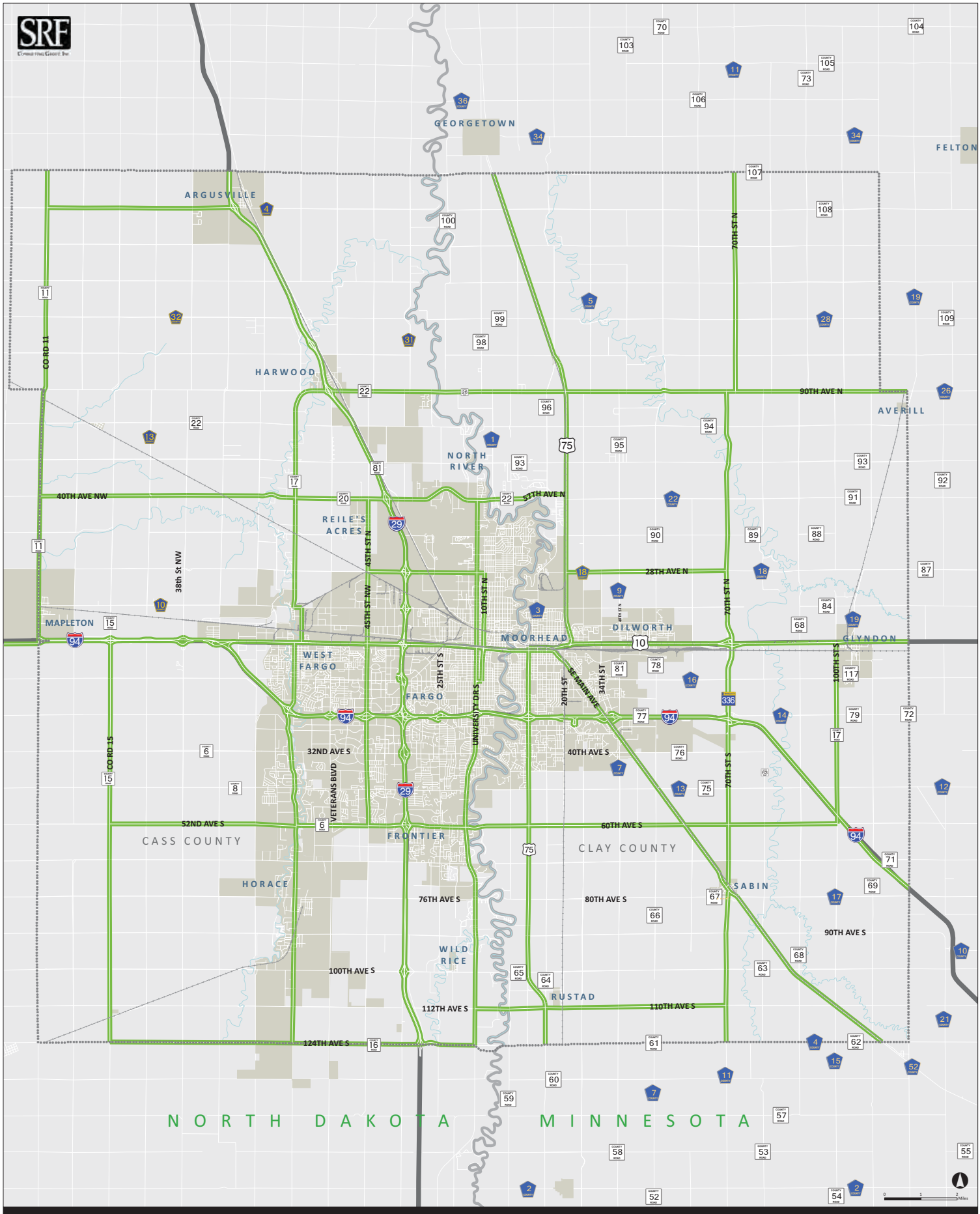
B. RSTI Corridors Defined

RSTI routes are existing or future arterial roadways that carry large volumes of traffic, including freight. The roadways are generally higher speed facilities that are important to the metropolitan area. They may include strategic Red River crossings, Interstates or major US highways, emergency alternate routes, or reliever routes to the Interstate. The following general screening criteria assisted stakeholders in the identification of RSTI routes (Table 1).

C. RSTI Corridor Additions

Figure 2 shows the 16 routes that were added as a result of the study process (see Table 2). The numbering of routes in Table 2 corresponds to numbers on the map in Figure 2. Routes added to the network generally can be grouped into the following categories:

- **Beltway Routes** – conceptual alignments studied as part of the long-term beltway such as 76th Avenue South or 100th Avenue South.
- **Emergency Alternate Routes** – parallel roadways to the Interstate that were identified as emergency alternate routes such as Cass County 81 or Cass County 10 that could be used if an incident temporarily closed either Interstate 29 (I-29) or I-94.
- **Interstate Interchange Connections** – roadways such as 34th Street South in Moorhead that provide new access to I-94 because of recent construction activities.



PRE-STUDY REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS (2009)

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

EXISTING RSTI CORRIDOR

STATE/COUNTY BOUNDARY

MPO PLANNING AREA

MUNICIPAL BOUNDARY

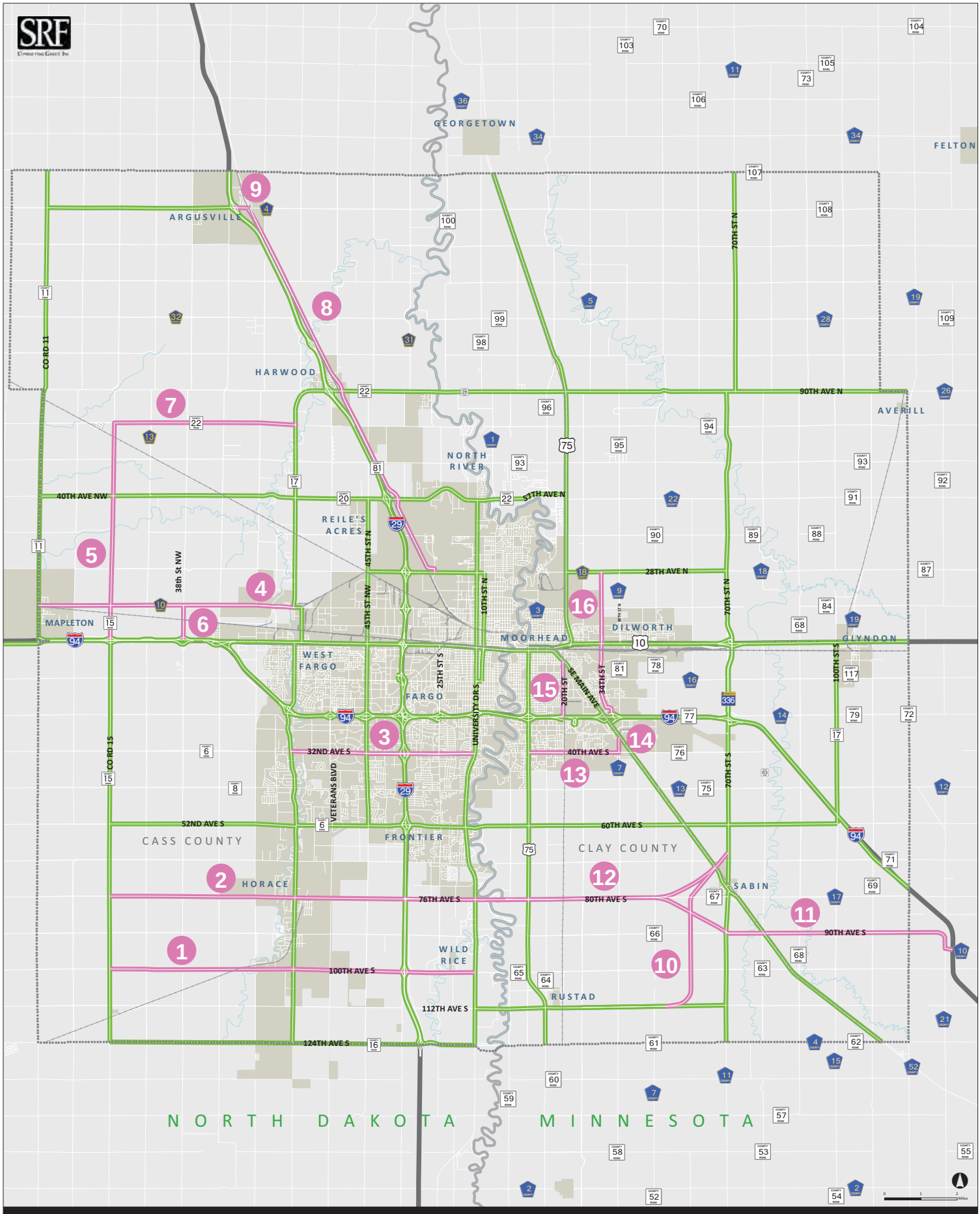
Figure 1

Table 1. RSTI Corridor Screening Criteria

Consider Roadways with the following:	Avoid Roadways with the following:
• Interstate, state highway, and/or truck route designations whenever possible	• Within the 100-year and 500-year floodplain whenever possible
• Existing or future principal arterial or minor arterial functional classifications whenever possible	• Weight restrictions
• Roadway designs that can handle freeway-type traffic volumes (e.g., adequate number of lanes, lane widths, shoulder widths, geometrics, frequency of secondary access, etc.)	• Height restrictions imposed by bridge clearance, power lines, etc.
• Access control guidelines to promote higher speeds	• Bridges along the route that create bottlenecks
• East-west routes with a Red River crossing or potential future crossing	• Multiple four-way stops or 90-degree turns
• Bridges along the route with sufficiency ratings above 65 (good or excellent condition)	• Many traffic signals, unless the route has a coordinated signal timing plan
• bridges along the route with Non Deficient/Adequate statuses	• At-grade railroad crossings
• Pavement condition indices of 70 or above (good or excellent) to handle heavy truck traffic	• Pedestrian areas or dense urban areas
• Presence of ITS infrastructure	• Residential areas or schools zones
• Start and end at other RSTI corridors that are contiguous across multiple jurisdictions	• Level of service D, E, or F
• Routes on the perimeter of the urban area that act as reliever routes	• Congestion (volume/capacity ratio of 0.85 or higher for Interstate highways or 0.7 or higher for arterials/collectors)
• Spacing of two to four miles from other RSTI corridors	
• Ability to serve as an emergency detour or evacuation route	

Table 2. RSTI Network Additions

State	#	RSTI Corridor Addition	Segment	Location
North Dakota	1	Cass County 14/100th Ave S	Cass County 15 to Cass County 81/University Ave S	Horace
	2	76th Ave S	Cass County 15 to Red River	Horace
	3	32nd Ave S	Cass County 17/Sheyenne St to Cass County 81/University Dr S	West Fargo/Fargo
	4	Cass County 10/36th St SE	Cass County 11/Meridian Rd to Cass County 17	Mapleton and West Fargo
	5	Cass County 15 and 165th Ave SE	I-94 to Cass County 22/64th St N	East of Mapleton
	6	38th St NW	I-94 to Cass County 10/ 36th St SE	West of West Fargo
	7	Cass County 22/64th Ave N	165th Ave SE to Cass County 17	Prosper
	8	Cass County 81	19th Ave N to Cass County 4/ 25th St SE	Fargo, Harwood, Argusville
	9	Cass County 4/25th St SE	I-29 to Cass County 81	Argusville
Minnesota	10	60th St S	CSAH 8/110th Ave S to Clay County 67/80th Ave S	Southwest of Sabin
	11	CSAH 10/90th Ave S	West of CSAH 11/70th St S to I-94	Southeast of Sabin
	12	Clay County 67/80th Ave S	Red River to west of CSAH 11/ 70th St S	West of Sabin
	13	Clay County 76/40th Ave S	TH 75/8th St S to CSAH 7/40th St S	Moorhead
	14	CSAH 7/40th St S	Clay County 76/40th Ave S to CSAH 52/Main Ave SE	Moorhead
	15	20th St	I-94 to CSAH 52/SE Main Ave	Moorhead
	16	34th St	I-94 to CSAH 18/28th Ave N	Moorhead



EXISTING AND PROPOSED REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

RSTI CORRIDOR ADDITION

EXISTING RSTI CORRIDOR

STATE/COUNTY BOUNDARY

MPO PLANNING AREA

MUNICIPAL BOUNDARY

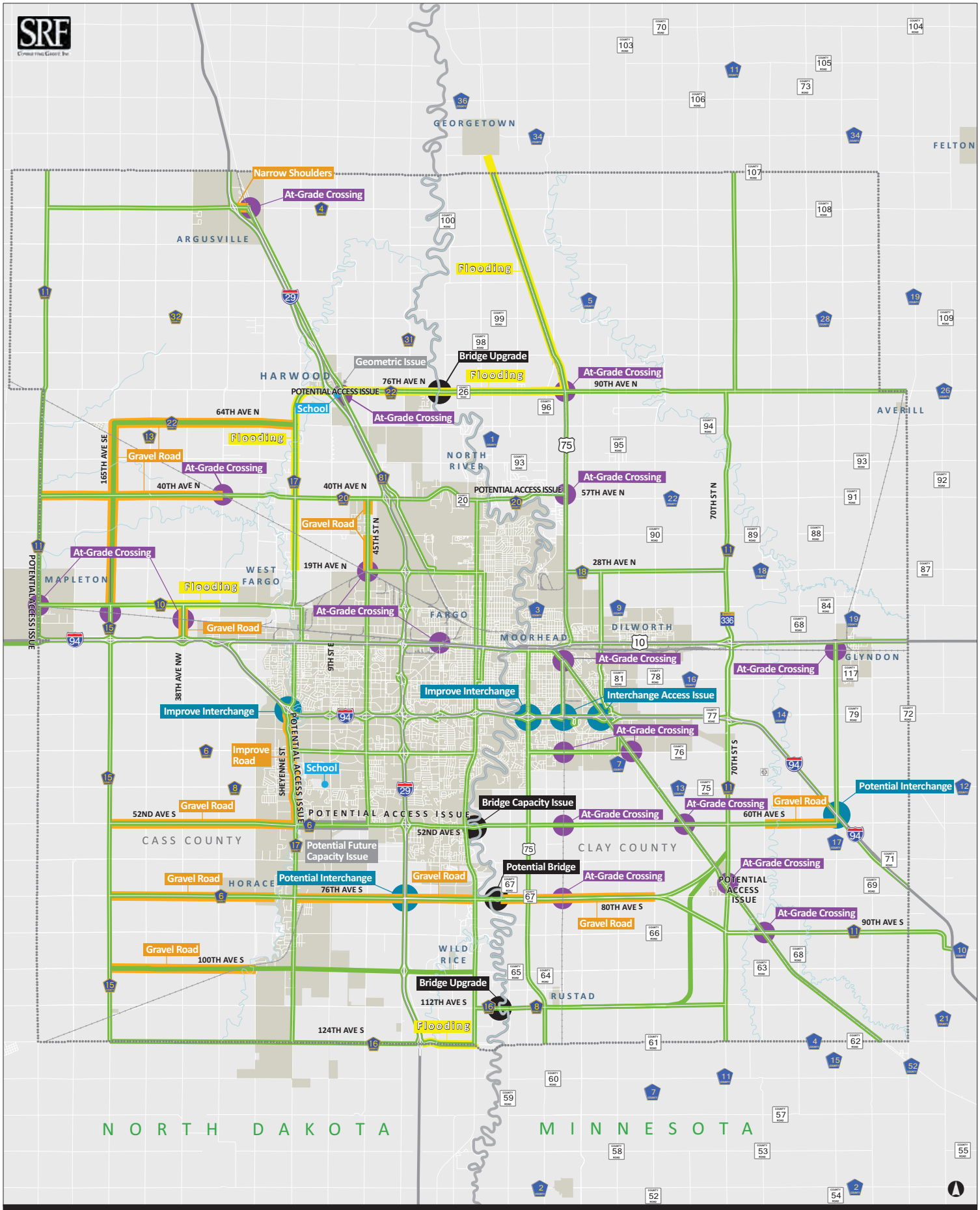
Figure 2

D. RSTI Issues

With the help of stakeholders, the study also identified issues along the RSTI corridors that reduce their abilities to function efficiently (see Figure 3). Primarily issues identified by stakeholders that limit a particular roadway's use as a RSTI corridor include:

1. Flooding issues
2. At-grade railroad crossings issues
3. Gravel roadway surface issues
4. Roadway shoulder issues
5. Geometric issues
6. Roadway deficiency issues
7. Adjacent land use issues
8. Bridge issues
9. Capacity issues
10. Interchange issues

From this list of issues, the SRC identified high-priority improvement projects to resolve these limitations. It can be expected that these capital improvement projects will be added to the Metro COG Long-Range Transportation Plan and eventually programmed by the appropriate agency that owns the roadway (see the Capital Improvement Cost Estimates chapter for more details).



REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) ISSUES MAP

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

- AT-GRADE RAILROAD CROSSING
- INTERCHANGE ISSUE
- BRIDGE ISSUE
- FLOODING
- ROADWAY ISSUE
- REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS
- STATE/COUNTY BOUNDARY
- MPO PLANNING AREA
- MUNICIPAL BOUNDARY

Figure 3

V. BELTWAY VISION, DESIGN PARAMETERS, AND ALIGNMENTS

A. Introduction

The need for a metropolitan beltway has been previously described in numerous Metro COG Long-Range Transportation Plans and Extraterritorial Studies. In order to keep the beltway on the urban periphery, modifications to these routes have been made over the years to account for the expanding urban area. This chapter goes beyond past long-range planning efforts and lays out a vision and design parameters for the beltway corridor. It also describes both interim and long-term beltway alignments and discusses the steps necessary to make the beltway a reality in the long-term. It can be anticipated that construction of the entire beltway may take 50 years to complete; with near term activities targeted toward corridor preservation and specific roadway segment improvements.

B. Long-Term Corridor Vision

The purpose of the beltway is to provide a reliable, high speed bypass around the Fargo-Moorhead urban core that can be used for the movement of freight, for inter-regional travel wishing to avoid the urban area, as a reliever route to congested Interstates or arterials, or as an alternate route/evacuation route during incidents or emergency situations. It would be designed to include a major Red River crossing both north and south of the urban core to accommodate motorists traveling in either direction. The long-term beltway design would be constructed as a four-lane rural expressway and would transition to an urban expressway in already developed areas.

Many incremental steps, completed over several decades, will need to be taken before the ultimate corridor vision will be realized. Through much of this period, the beltway system will be comprised of two-lane roadways, with specific segments expanded as capacity or mobility needs dictate.

C. Design Parameters

Proposed corridor design parameters are outlined in Table 3 and supplemented with Figure 4. The typical sections shown in Figure 4 are conceptual in nature and represent a long-term vision for the beltway. They may be modified in the future as needed. The design parameters will comply with Mn/DOT, Clay County, NDDOT, and Cass County standards. In addition, these ultimate roadway design parameters will be supplemented with the National Cooperative Highway Research Program (NCHRP) 350 safety standards (including those related to break-away signs, clear zones, guard rails, etc.). Designing roadway improvements to these standards will allow NDDOT and Mn/DOT to sign the beltway as an official emergency alternate route to be used by Interstate traffic, if an incident closes down either I-29 or I-94. These standards also allow for the other types of uses described above in the long-term corridor vision.

Table 3. Long-Term Metropolitan Beltway Design Parameters

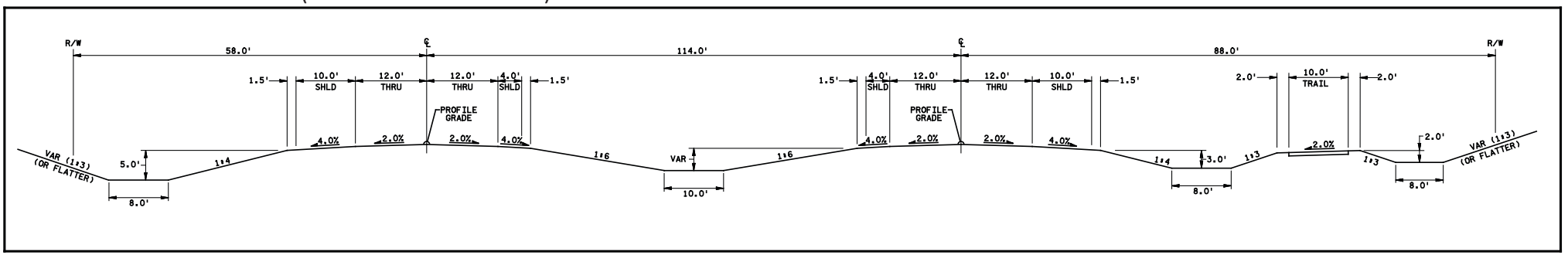
Termini	A circumferential roadway that begins and ends at an Interstate, with full system interchange access to I-29, I-94, and US 10
Configuration	Scope of perimeter road system should reflect purpose (as noted previously) and accommodate major directional traffic flows
Functional Class.	Principal arterial or minor arterial (depends on segment)
Alignment	Existing roadways should be used when possible, except for curves that eliminate 90-degree turns or to avoid developed areas/natural features
Red River or Diversion Crossings	Red River or Diversion bridge crossings should be designed above the 100-year floodplain
Floodplain	Roadway should be elevated above the 100-year floodplain
Design Speed	65 mph (rural segments); 45 mph (urban segments)
Posted Speed	55 mph (rural segments); 40 mph (urban segments)
Long-term Typical Roadway Section	Expressway design – four-lane divided, 12-foot lanes, 10-foot paved outside shoulders, and left/right turn lanes at major intersections (see Figure 4)
Weight Limits	10-ton roadway needed to accommodate heavy truck traffic
Long-term ROW[1]	Rural Section: 260-feet with trail; 230-feet without a trail Urban Section: 130-feet with sidewalks on both sides
Intersection Spacing[2]	1/2 mile (minimum); 1 mile (preferred)
Signal Spacing	1 mile; but should be discouraged; use stop signs or other traffic control devices (roundabouts) on approach roads
Private Access	Future private accesses discouraged; use frontage/backage roads
Railroad Crossings[3]	Consider grade separation, if the number of rail exposures exceeds 300,000 or high safety needs are present
LOS	LOS C or better
Land Use	Develop land adjacent to beltway in a manner that implements sound land use policy and provides compatible land uses, minimizes noise impacts, uses good access management, and assures adequate building setbacks to accommodate future ROW needs. Official mapping or local platting and subdivision techniques should be used to protect the corridor.
Jurisdiction	County and State; as ultimate system is constructed, jurisdictional transfers may be appropriate
Pedestrian and Bicycle Trails	10-foot separated trail in rural areas (potentially to connect to the North Country Trail route) and sidewalks in urban areas
ITS	DMS and other ITS improvements, strategically located to alert travelers to beltway opportunities during incidents, congestion, events, etc.

[1] *A 260-foot ROW is required for a four-lane divided rural expressway with 12-foot lanes, a 10-foot paved outside shoulder, and a trail (230-feet is required if the trail is removed). A 130-foot ROW is required for a four-lane divided urban expressway with sidewalks on both sides of the roadway. See Figure 4.*

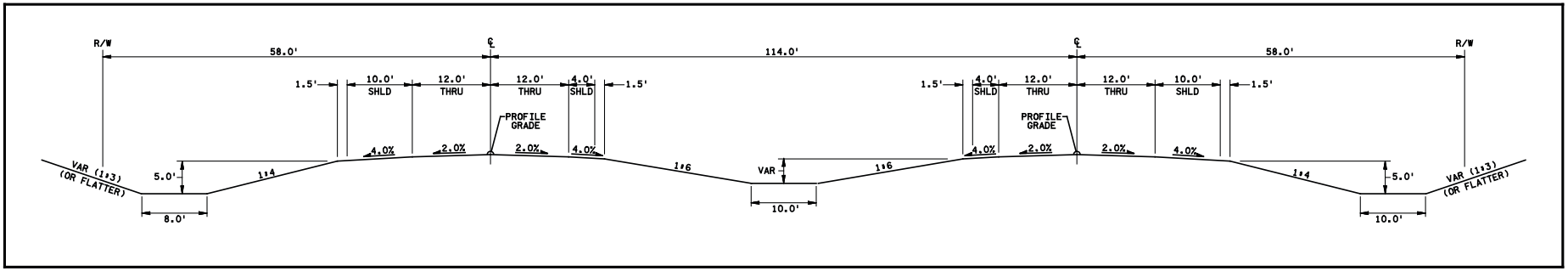
[2] *Intersection access spacing is based in part on Mn/DOT access management guidelines for TH 336, which is an already completed segment of the proposed beltway. Spacing also reflects the unique purpose of the beltway, which requires more stringent access management than other roadways with similar functional classifications.*

[3] *The number of railroad exposures can be determined by multiplying the 2035 forecasted average daily traffic volumes by the average number of trains at that particular crossing.*

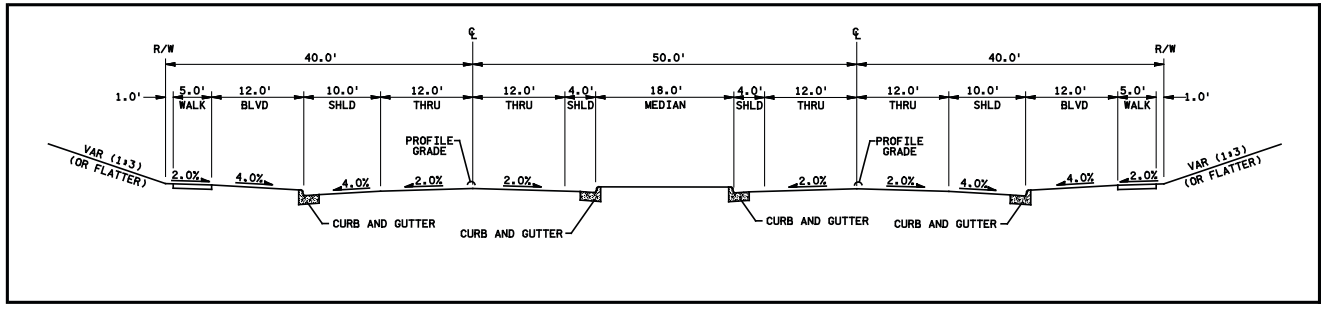
RURAL EXPRESSWAY WITH TRAIL (260' RIGHT OF WAY WIDTH)



RURAL EXPRESSWAY WITHOUT TRAIL (230' RIGHT OF WAY WIDTH)



URBAN EXPRESSWAY WITH SIDEWALKS (130' RIGHT OF WAY WIDTH)



PROPOSED LONG-TERM BELTWAY CORRIDOR TYPICAL SECTIONS

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

Figure 4

D. Beltway Conceptual Alignments

Various options for both an interim and a long-term alignment are proposed based on the corridor vision and design parameters (see Figure 5). The conceptual alignments also incorporate input gathered at the first series of stakeholder meetings and the first SRC meeting. The alignments were developed to help in the RSTI corridor selection process (the beltway alignments are also designated as RSTI corridors) and as a base to make ITS location recommendations. Further analysis will be needed to select the exact alignment, but a number of options are presented for consideration. In addition, an "I-94 Connector" is also proposed as a long-term option.

Interim Alignment:

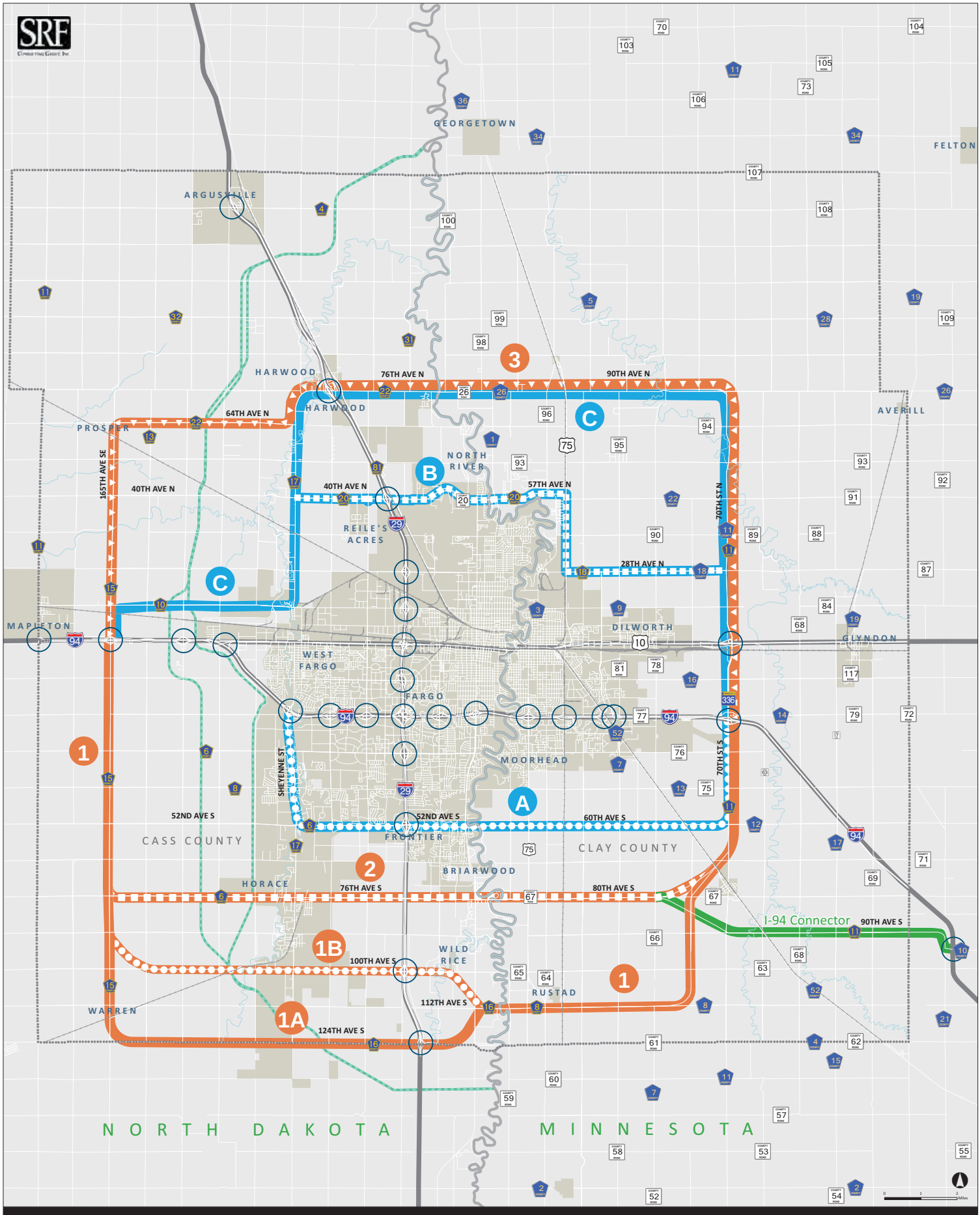
The interim beltway uses a combination of existing state and county roads. Whereas the entire long-term beltway cannot be used at the present time, the interim beltway can be used immediately, until appropriate improvements can be made to the long-term beltway (i.e., roads paved, bridges and interchanges constructed, etc.). Three interim beltway options are described below and shown in Figure 5.

- Option A: This option uses the 52nd Avenue South/60th Avenue South corridor to cross the Red River. The alignment essentially follows the same route as described by previous Metro COG Long-Range Transportation Plans. In addition, existing interchanges at I-94/Sheyenne Street, I-29/52nd Avenue South, and I-94/Trunk Highway (TH) 336 make this a viable interim route. Recent improvements to the 52nd Avenue South corridor also help its present usability and extend its effectiveness. However, existing and future development around Option A limit its long-term use as a beltway route.

Some of the key identified improvements needed along Option A include:

1. Widening Sheyenne Street from two to four lanes from 52nd Avenue South to I-94
2. Widening 52nd Avenue South from two to four lanes from Sheyenne Street to 45th Street South
3. Widening 52nd Avenue South/60th Avenue South from two to four lanes from University Drive to TH 75, if additional capacity is needed
4. Widening of the 52nd Avenue South Red River Bridge from two to four lanes and raising the west abutment

- Option B: This option uses the northern Red River crossing northeast of the Hector International Airport at Cass County 20/40th Avenue North and County State Aid Highway (CSAH) 22/57th Avenue North. This route is given as an option because it provides an existing Red River crossing on the northern limits of Fargo and has an existing I-29 interchange. It also has a grade separated crossing of the Hillsboro Subdivision railroad line. However, Option B requires motorists to make several 90-degree turns and there are a number of private accesses along the route.



METROPOLITAN BELTWAY CONCEPTUAL ALIGNMENTS

FARGO-MOORHEAD
TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)
FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

BELTWAY CONCEPTS
INTERIM BELTWAY OPTIONS A B C
LONG-TERM BELTWAY OPTIONS 1/1A 1B 2 3
I-94 CONNECTOR
INTERCHANGES

PROPOSED FLOOD DIVERSION ALIGNMENT OPTIONS

*Note: Congress has not authorized the project and alignments are subject to change

STATE/COUNTY BOUNDARY
MPO PLANNING AREA
MUNICIPAL BOUNDARY

Figure 5

Some of the key identified improvements needed along Option B include:

1. Making safety improvements to the at-grade KO subdivision railroad crossing at Cass County 15, north of I-94

2. Raising the roadway on Cass County 17 from 19th Avenue North to Cass County 20/ 40th Avenue North due to flooding concerns

3. Widening the shoulders on CSAH 18/28th Avenue North from TH 75 to CSAH 11/70th Street North

- Option C: This option incorporates the northern Red River bridge crossing at Cass County 22/76th Avenue North and CSAH 26/90th Avenue North. Option C is farther out on the urban periphery compared to Option B and also requires less 90-degree turns for motorists. Option C also has I-29 interchange access, which is in Harwood. However, routing the beltway through Harwood also introduces its own set of issues including existing development, an at-grade railroad crossing, and proximity to an elementary school.

Some of the key identified improvements needed along Option C include:

1. Making safety improvements to the at-grade KO subdivision railroad crossing at Cass County 15, north of I-94
2. Raising the roadway on Cass County 17 from 19th Avenue North to I-29 due to flooding concerns
3. Raising the roadway on Cass County 22/76th Avenue North and CSAH 26/ 90th Avenue North from I-29 to TH 75 due to flooding concerns
4. Preserving a footprint for a grade separation of Cass County 22/76th Avenue North and the Hillsboro Subdivision railroad line just west of Cass County 81 in Harwood (safety or railroad exposures threshold needed)

With certain improvements, as identified above and in the Capital Improvement Cost Estimates chapter of this report, the interim beltway option will function relatively well, even though portions of it are already or will be surrounded by urban development. However, as growth continues along the interim beltway, it will lose its ability to function as a bypass route around the metropolitan area. Because the interim alignment will not meet the vision of the beltway, long-term beltway alignment options are proposed.

Long-term Alignment:

During this interim period, it will be important for affected jurisdictions (primarily Cass and Clay Counties) to adopt and use the beltway vision and design parameters to implement sound and effective corridor preservation activities for the long-term beltway option. TH 336 is a good example of an already completed segment of the beltway that meets the long-term design parameters.

Critical expansion of the long-term beltway is proposed so that it is outside of the anticipated 2035 developed urban area. This expansion is primarily on the southern and western legs of the long-term beltway. Given the existing and planned development around the 52nd Avenue South corridor in

Fargo, the southern leg of the long-term beltway alignment will need to be routed further south to remain on the urban periphery. The western leg of the beltway will need to be expanded west due to existing development pressures and access issues on Sheyenne Street, Cass County 10, and Cass County 17 in West Fargo. By selecting an alignment outside of the anticipated urban area and by implementing the proposed design parameters, these issues can be avoided. The selected long-term beltway alignment should also take into account the final alignment for the Red River Flood Diversion (potential diversion options are shown in Figure 5). The following options are proposed for the long-term beltway alignment (see Figure 5):

- Option 1A/1B: The first option uses the existing southern Red River bridge crossing at Cass County 16/112th Avenue South and CSAH 8/110th Avenue South, which is well outside of the urban area. West of the Red River, the alignment either curves south to use the existing I-29 interchange at Cass County 16/124th Avenue South (Option 1A) or curves north to use the existing I-29 interchange at Cass County 14/100th Avenue South (Option 1B). On the Minnesota side of the Red River, the alignment diverts from the existing road alignment to bypass Sabin (additional analysis will be required to limit negative impacts to agricultural land) and intersect the Otter Tail Valley railroad line at a 90-degree angle.

Major issues with this option include determining the best alignment to bypass Sabin. In addition, the existing Red River crossing at 110th Avenue South is offset from the existing I-29 interchanges by one mile in either direction, requiring new roadway alignments to make either connection.

Some of the key identified improvements needed along Option 1 include:

1. Paving Cass County 14/100th Avenue from Cass County 15 to Horace (Option 1B only)
2. Constructing new curves to make the connection between either I-29 interchange and the Red River crossing
3. Widening of the 112th Avenue South Red River Bridge from two to four lanes
4. Constructing new roadway alignment to bypass Sabin

- Option 2: With a potential future Red River crossing at 76th Avenue South, this corridor becomes a logical long-term beltway alignment option to consider. Major issues associated with this route include its overall proximity to a fast growing urban area, which will be magnified with the recent construction of a new high school at 72nd Avenue South and 25th Street South. In addition, the 76th Avenue South corridor may no longer be on the urban periphery given the time needed to plan and construct a new Red River crossing and I-29 interchange. In addition, the route travels through Horace, creating access issues.

Some of the key identified improvements needed along Option 2 include:

1. Paving Cass County 6/76th Avenue South from Cass County 15 to 25th Street South, except for a segment in Horace from the Sheyenne River to Cass County 17
2. Constructing a new interchange at I-29/76 Avenue South
3. Constructing a new four-lane Red River bridge at 76th Avenue South/80th Avenue South to accommodate a future four-lane section.
4. Paving Clay County 67/80th Avenue South from the Red River to Sabin
5. Constructing a new roadway alignment to bypass Sabin

- Option 3: The third option is the only proposed long-term route with a northern Red River crossing. Similar to Option C for the interim route, it uses the Red River bridge crossing at Cass County 22/76th Avenue North and CSAH 26/90th Avenue North. While there is I-29 interchange access on this route in Harwood, routing traffic through this already developed area presents major issues, as discussed previously. To avoid the urban area, this beltway options follows the Cass County 22 alignment west of Harwood, before turning south on 165th Avenue Southeast for five miles to connect with Cass County 15 (a jurisdictional transfer from the township to the county or state would be needed for 165th Avenue Southeast). Furthermore, the use of the I-94/Cass County 15 interchange avoids Mapleton, which is one interchange to the west.

Some of the key identified improvements needed along Option 3 include:

1. Making safety improvements to the at-grade KO subdivision railroad crossing at Cass County 15, north of I-94
2. Paving 165th Avenue Southeast from Cass County 22/64th Avenue North to Cass County 10
3. Paving Cass County 22/64th Avenue North from 165th Avenue Southeast to Cass County 17
4. Raising the roadway on Cass County 17 from Cass County 22/64th Avenue North to I-29 due to flooding concerns
5. Raising the roadway on Cass County 22/76th Avenue North and CSAH 26/90th Avenue North from I-29 to TH 75 due to flooding concerns
6. Widening the 76th Avenue North Red River bridge from two to four lanes
7. Preserving a footprint for a grade separation of Cass County 22/76th Avenue North and the Hillsboro Subdivision railroad line just west of Cass County 81 in Harwood (safety or railroad exposures threshold needed)

I-94 Connector:

In addition to the long-term beltway, the construction of an "I-94 connector" is recommended from the I-94/CSAH 10 interchange to Sabin (see Figure 5). This extension will act as a direct bypass route for I-94 traffic. Given dominate I-94 traffic flows and the way that I-94 angles southeast as it

leaves the metropolitan area, this southern leg reduces the distance traveled for I-94 bypass traffic compared to a northern bypass leg (Option 3), if I-94 is closed due to an incident. If the 76th Avenue South corridor is selected (Option 2), then the "I-94 connector" would require about three miles of new roadway (not on existing county roads) to align the future river crossing at Clay County 67/80th Avenue South with CSAH 10/90th Avenue South, which is one mile to the south.

E. Next Steps

The objective of the current analysis is to establish a vision and design parameters for the beltway, present alternative alignment options for future investigation, and identify major infrastructure improvements that will be required.

It is noteworthy that a number of the local improvements needed to support the beltway's development are already listed in the 2009 Metro COG Long-Range Transportation Plan, some of which are even programmed as short range improvements (2010-2015). For example: the overlay of 11 miles of Cass County 15 or the grading of four miles of CSAH 11. Thus, this study is very timely. Further, it is important that Metro COG and its local partners accept and use the beltway vision and design guidelines now, so as to achieve the maximum benefit from current or anticipated short range investments.

However, as noted earlier, full implementation of the ultimate build-out of the metropolitan beltway will take many decades. To assist technical staff and policymakers in charting a course to reach their long-range beltway goal and to assure that interim infrastructure investments are made in a manner that fulfill and do not conflict with this goal, the following incremental actions are proposed:

Short-term Recommendations (2011 - 2025):

1. Continue improvements to the interim beltway infrastructure so as to extend the life of this system, and provide ample time to preserve the ultimate beltway alignment.

2. Include this beltway analysis in the Long-Range Transportation Plan update, coordinate the beltway program with RSTI corridor planning, and consider this work during short and long-range project design/programming, future system functional classification, or jurisdictional changes.

3. Conduct corridor studies, by key beltway segment, to document the rationale for the selection of a preferred long-term beltway route and to identify specific beltway improvements and priorities. As part of this documentation, conduct a benefit-cost analysis on whether to build specific high-need segments of the beltway compared to the entire route.

4. Reach a consensus on key intergovernmental beltway issues (e.g., 76th Avenue South Red River bridge crossing, Harwood urban area safety, "I-94 Connector," etc.).

5. Include in future Metro COG traffic models, the beltway's ultimate configuration and post specific future volumes, so as to help local staff prioritize the appropriate sequencing of future beltway infrastructure investments.

6. Adopt, at the metropolitan and local levels, the recommended ultimate beltway alignment, and incorporate it into local comprehensive plans. Then, using the appropriate design parameters (e.g., right-of-way, intersection spacing, private access, land use), undertake an ongoing program of corridor preservation. Beltway protection should use all available local land use management techniques (zoning, subdivisions, platting, official mapping, corridor signage, etc.).

7. As the Red River Diversion is planned and constructed, secure funds to accommodate both beltway and flood mitigation projects.

8. Seek, as a unified metropolitan area, discretionary state and federal funding for the beltway targeted toward improving safety, mobility, incident management, freight flows, and arterial reliever routes.

Mid-term Recommendations (2026 - 2035):

1. Design and construct infrastructure projects to standards that will accommodate, as appropriate for the phase of improvement, the long-term beltway system. It is understood in the early years, such improvements will probably be driven by local needs (and not the beltway), but as the beltway becomes more functional and established, specific beltway improvements can be expected to be programmed on their own merit. For example:

   – A two-lane gravel county/township roadway on the beltway alignment (e.g., 165th Avenue Southeast) would not be designed and paved to a four-lane expressway section now, but when improved it should be designed for 10-ton loads, the ultimate right-of-way should be secured, and its alignment should be located in the right-of-way to allow for the future capacity expansion of the long-term expressway design or,

   – Bridge/grade separations, due to their long life cycles (50+ years), should be reconstructed/constructed with sufficient width for long-term restriping as a four-lane structure.

2. Review the beltway vision, design parameters, and alignment periodically so as to maintain its functionality.

3. Undertake, as the beltway develops, appropriate and timely jurisdictional transfers, functional classification changes, and designation amendments.

4. Develop and maintain a prioritized list of beltway improvements, encourage their inclusion into city, county, and state plans and programming documents, and support cooperative project implementation (e.g., county/county projects at Red River, city/county projects, state/county, etc.).

5. Complete necessary studies (e.g., corridor, access management, environmental documentation, PS and E, etc.) specific to critical beltway segments and use the beltway vision and design parameters as fundamental design elements.

Long-term Recommendations (2036+):

1. Be alert for opportunities to coordinate appropriate future intermodal facilities, connections, or transportation technologies into the beltway vision and design (e.g., freight terminals, rail yard relocations, high speed rail, etc.).

VI. CAPITAL IMPROVEMENT COST ESTIMATES

A. Introduction

The capital improvement cost estimates described in this section address a series of issues originally identified by local and state agency representatives at five stakeholders meetings held on August 24, 2010. All of the issues identified by these groups correspond to perceived shortcomings in the RSTI network. The issues were then prioritized at the first Study Review Committee meeting on October 25, 2010. Many of the high-priority issues identified correspond to problems related to the interim and long-term beltway alignments. Following the October 25th meeting, the beltway alignments and related locations of high-priority issues were further modified. Capital improvement projects were then proposed to address the high-priority issues.

B. Capital Improvement Cost Estimates

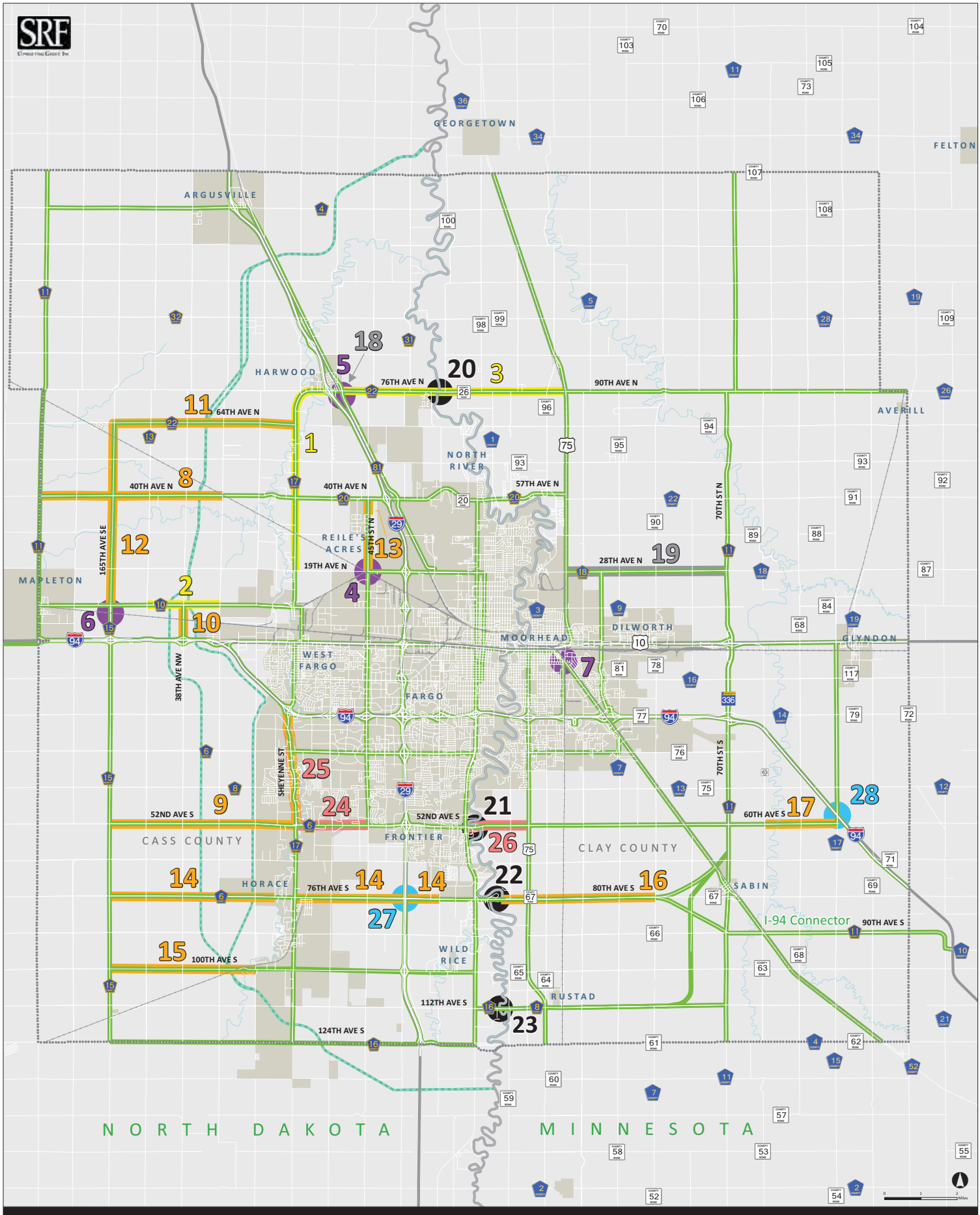
Figure 6 identifies the location of 28 proposed capital improvement projects throughout the Fargo-Moorhead metropolitan area. The numbering in Table 4 corresponds to locations in Figure 6. Table 4 provides additional information such as details on the project, roadway/project termini, distance of project, and estimated cost.

The capital improvement cost estimates are planning-level in nature and will be further refined as the projects move forward. The proposed projects also may be modified depending on available funding and needs. In addition, high priority projects may be added or subtracted depending on the final route selected as the interim and long-term beltways. Furthermore, the final agreed-upon alignment of the Red River Flood Diversion project will create additional high priority capital improvement projects (e.g., bridge structures for major roadways over the diversion) not currently detailed in this study (see Figure 6 for potential diversion alignment options).

The cost estimates include three main cost components: construction, engineering (15 percent of construction cost), and contingency (10 percent of construction cost). Costs were estimated using the same methodology used in the 2009 Metro COG Long-Range Transportation Plan. In fact, many of the capital projects listed in Table 4 were also identified in the Plan and some were even programmed as short-range improvements (2010-2015).

As shown in Table 4, total costs are given for the seven issue areas, including:

- Flooding issue
- At-grade railroad crossing issue
- Gravel roadway surface issue
- Geometric issue
- Bridge issue
- Potential future capacity issue
- Interchange issue



PROPOSED CAPITAL IMPROVEMENT PROJECTS
FARGO-MOORHEAD
TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)
FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

- REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS
- PROPOSED FLOOD DIVERSION ALIGNMENT OPTIONS

*Note: Congress has not authorized the project and alignments are subject to change

- AT-GRADE RAILROAD CROSSING
- INTERCHANGE ISSUE
- BRIDGE ISSUE
- POTENTIAL FUTURE CAPACITY ISSUE
- GEOMETRIC ISSUE
- FLOODING ISSUE
- ROADWAY SURFACE ISSUE
- STATE/COUNTY BOUNDARY
- MPO PLANNING AREA
- MUNICIPAL BOUNDARY

Figure 6

Table 4. Capital Improvement Cost Estimates

Issue	#	Project	Corridor	Segment Termini/Notes	Distance (Miles)	Listed in Long-Range Transportation Plan	Estimated Cost
Flooding	1	Raise roadway	Cass County 17/69th St N	19th Ave N to I-29	5.5	No	$11,700,000
	2	Raise roadway	Cass County 10/12th Ave NW	166th Ave SE to 26th St NW	2.0	No	$4,300,000
	3	Raise roadway	Cass County 22/76th Ave N (ND) and CSAH 26/90th Ave NW (MN)	I-29 to TH 75	6.4	No	$13,600,000
	Total Cost						**$29,600,000**
At-Grade Railroad Crossing	4	Grade separation	45th St N	South of 19th Ave N	N/A	Yes	$10,900,000
	5	Grade separation	Cass County 22/76th Ave N	East of I-29	N/A	No	$10,900,000
	6	Grade separation	Cass County 15/165th Ave SE	North of I-94	N/A	No	$10,900,000
	7	Grade separation	CSAH 52/Main Ave SE (triple grade separation)	20th St S and 21st St S	N/A	Yes	$35,000,000
	Total Cost						**$67,700,000**
Gravel Roadway Surface	8	Pave 2 lanes to 10-ton standard	Cass County 20/40th Ave N	Cass County 11/163rd Ave SE to 26th St NW	5.0	No	$7,500,000
	9	Pave 2 lanes to 10-ton standard	52nd Ave S	Cass County 15 to Cass County 17/Sheyenne St	5.0	No	$7,500,000
	10	Pave 2 lanes to 10-ton standard	38th Ave NW	I-94 to Cass County 10/36th St SE	0.9	No	$1,400,000
	11	Pave 2 lanes to 10-ton standard	Cass County 22/64th Ave N	165th Ave SE to Cass County 17	5.0	No	$7,500,000
	12	Pave 2 lanes to 10-ton standard	165th Ave SE	Cass County 22 to Cass County 10	5.0	No	$7,500,000
	13	Pave 2 lanes to 10-ton standard	45th St N	19th Ave N to Cass County 20/40th Ave N (potential realignment east of Reiles Acres)	2.0	No	$3,800,000
	14	Pave 2 lanes to 10-ton standard	76th Ave S	Cass County 15 to 25th St S, except for a segment in Horace	9.5	Yes (in part)	$23,800,000
	15	Pave 2 lanes to 10-ton standard	Cass County 14/100th Ave S	Cass County 15 to Sheyenne River (west of 169th Ave SE)	4.0	No	$6,000,000
	16	Pave 2 lanes to 10-ton standard	Clay County 67/80th Ave S	Red River to Clay County 66	4.2	Yes (ROW preservation)	$10,500,000
	17	Pave 2 lanes to 10-ton standard	CSAH 12/60th Ave S	Clay County 63/80th St S to CSAH 17/100th St S	2.0	No	$3,000,000
	Total Cost						**$78,500,000**
Geometric Issue	18	Widen intersection	Cass County 81 to Cass County 22/76th Ave N	Difficult SB to WB movement for trucks	N/A	No	$60,000
	19	Widen shoulders	CSAH 18/28th Ave N	TH 75 to CSAH 11/70th St N	4.4	No	$6,600,000
	Total Cost						**$6,700,000**
Bridge Issue	20	Widen bridge to add more shoulder width	Cass County 22/76th Ave N (ND) and CSAH 26/90th Ave NW (MN)	Assumes widening 4' for shoulders on each side; potential four-lane bridge needed in long-term	N/A	No	$1,300,000
	21	Widen bridge to 4 lanes/raise west bridge abutment	Cass County 6/52nd Ave S (ND), Clay County 12/60th Ave S (MN)	Capacity issue with a two-lane bridge across the Red River	N/A	Yes	$13,100,000
	22	Construct new 4-lane bridge	76th Ave S (ND), 80th Ave S (MN)		N/A	Yes (ROW preservation)	$30,000,000
	23	Widen bridge to add more shoulder width	Cass County 16/112th Ave S (ND), CSAH 8/110th Ave S (MN)	Assumes widening 6' for shoulders on each side; potential four-lane bridge needed in long-term	N/A	No	$1,200,000
	Total Cost						**$45,600,000**
Potential Future Capacity Issue	24	Upgrade from 2 lanes to 5 lanes	Cass County 6/52nd Ave S, includes roundabout modifications	Cass County 17/Sheyenne St to 45th St S, includes roundabout modifications	2.0	Yes (in part)	$12,500,000
	25	Upgrade from 2 lanes to 5 lanes	Cass County 17/Sheyenne St	Cass County 6/52nd Ave S to I-94, includes roundabout modifications	3.2	Yes	$20,000,000
	26	Upgrade from 2 lanes to 5 lanes	Cass County 6/52nd Ave S (ND), CSAH 12/60th Ave S (MN)	University Dr S to TH 75, excludes Red River bridge, but includes roundabout modifications	1.6	Yes (in part)	$10,000,000
	Total Cost						**$42,500,000**
Interchange Issue	27	New I-29 interchange	I-29/76th Ave S		N/A	Yes	$20,800,000
	28	New I-94 interchange	I-94/60th Ave S		N/A	No	$20,800,000
	Total Cost						**$41,600,000**

Some of the key capital improvements are described in more detail on the following pages:

Flooding:

Three high-priority flooding projects are listed in Table 4 and total $29.6M. All of the projects propose raising roadways that are affected by either the Sheyenne or Red Rivers. In addition, all of the projects correspond to one of the proposed beltway alignments. The methodology assumed that raising the roadway would cost $0.85M per lane mile. For instance, raising Cass County 17 from 19th Avenue North to I-29 was estimated to cost $11.7M (see #1 on Figure 6).

At-Grade Railroad Crossing:

While there are numerous at-grade railroad crossings throughout the metropolitan area, stakeholders identified four crossings that should be considered for grade separation. It was estimated that each grade separation would cost approximately $10.9M, except for the CSAH 52/Main Ave SE project, which is estimated to cost $35.0M due to the complexity of the intersection. The four projects total $67.7M. It is likely that incremental improvements would be made at many of the crossings prior to a grade separation being constructed. For the two projects that are part of the beltway system, the beltway design parameters propose that a grade separation be considered when the number of rail exposures (2035 forecasted average daily traffic volumes multiplied by the average number of trains at that particular crossing) exceeds 300,000 or if high safety needs are present. Of particular note are the proposed Cass County 22/76th Avenue North and the Hillsboro Subdivision railroad line grade separation just west of Cass County 81 in Harwood (see #5 on Figure 6). This crossing will require additional analysis due to the close proximity of the railroad crossing to Cass County 81, existing development in Harwood, an elementary school, and the I-29 interchange.

Gravel Roadway Surface:

Given the long-term nature of the RSTI network and beltway concepts (proposed on the urban periphery), it is not surprising that many gravel roads were recommended to be paved. The ten projects represent the highest number of projects in any category and the highest total cost ($84.5M). All of the projects are located on the RSTI network and/or the beltway, thus 10-ton standards were assumed so freight haulers could use the roadways. The estimated cost to pave a two-lane roadway to these 10-ton standards is approximately $0.6M per lane mile in rural areas and $1.0M per lane mile in more urban areas. One project listed involves paving a 9.5-mile segment of 76th Avenue South (see #14 on Figure 6) from Cass County 15 to 25th Street South ($23.8M). The paved segment would then connect Horace and I-29 (if a future interchange is constructed) with a recently paved segment east of 25th St that provides southern access to the new high school.

Geometric Issue:

Two projects totaling $6.7M address geometric issues. The first project is located in Harwood and was identified as I-29 traffic was detoured to Cass County 81 during recent construction in the area (see #18 on Figure 6). Southbound freight haulers on Cass County 81 currently have a difficult time making the westbound movement onto Cass County 22/76th Avenue North to travel west to the I-29 interchange. The proposed project would widen the intersection to address this issue. The second project is north of Dilworth and involves widening the CSAH 18/

28th Avenue North shoulders by six feet on both sides (see #19 on Figure 6). It is assumed that the existing surface would be improved along with the widening and would cost approximately $0.6M per lane mile for a total project cost of approximately $6.6M.

Bridge Issue:

Stakeholders stressed the importance of high-quality Red River bridge crossings. All four of the bridge projects listed concentrate on the Red River and total $45.6M. One such project is widening the existing 52nd Avenue South bridge (see #21 on Figure 6) from two to four lanes ($13.1M). As part of this project, the west abutment would also be raised as suggested by stakeholders. Capacity improvements on either side of the bridge would extend the four-lane section in both directions from the Red River. A new Red River crossing (see #22 on Figure 6) cost estimate was generated for the 76th Avenue South Red River bridge ($30.0M). This improvement corresponds with other paving projects and a new I-29 interchange. The other two bridge projects (76th Avenue North and 112th Avenue South) involve widening the shoulders on the bridge, with a longer-term project being expansion of the bridges to four lanes, if needed.

Potential Future Capacity Issue:

As discussed previously, if the 52nd Avenue South bridge is expanded to four lanes, then a four-lane section (see #24 on Figure 6) would be extended west along 52nd Avenue South to University Drive South (connecting to the existing four-lane section) and east of the Red River to TH 75 (a main north-south arterial). Assuming $1.0M per lane mile, the cost of the project would be $10.0M. The other two projects would extend the four-lane section along existing segments of Sheyenne Street and 52nd Avenue South (see #25 and #26 on Figure 6). In total, the three projects would complete a four-lane section along a major stretch of the proposed interim beltway from the I-94/Sheyenne Street interchange to TH 75. The total cost for the three projects is $42.5M.

Interchange Issue:

Two interchanges were determined to be high-priority projects by stakeholders. A new Interstate interchange was assumed to cost $20.8M. One interchange would be located at I-29 and 76th Avenue South (see #27 on Figure 6), and would fit the design parameters that call for interchange access along the long-term beltway route (76th Avenue South). The interchange would also line up with a future Red River crossing. The other interchange is located at I-94 and 60th Avenue South, which is northeast of Sabin (see #28 on Figure 6). An I-94 interchange at this location would line up with the existing Red River crossing at 52nd Avenue South/ 60th Avenue South and provide a connection with another RSTI route (CSAH 17/ 100th Street South, which heads north to Glyndon). Further analysis will be needed to determine if interchanges at either of these two locations are warranted.

As mentioned previously, the cost estimates are planning-level in nature. More detailed analysis will be required to determine the exact needs of each project. The projects and associated costs may be further prioritized and defined in future planning and programming activities such as the next update to the Metro COG Long-Range Transportation Plan.

VII. ITS RECOMMENDATIONS

A. Introduction

ITS tools are becoming an increasingly important in decreasing traffic delays, traffic incidents, air pollution, etc. in the Fargo-Moorhead metropolitan area. ITS can improve the situational awareness of all users including system managers and the traveling public. In addition, ITS technology provides system managers with enhanced tools for decision making by supplying them with more robust and accurate data.

While the 2008 ITS Plan recommendations generally focus on mobility enhancement, the recommendations in this report concentrate on deploying ITS to improve traffic incident management efforts. Deployments are proposed for short- and mid-term time frames. The years proposed for each time frame are planning-level in nature and do not correspond to any particular future programming or funding dates. Instead, the years given are meant to serve as a basis for further discussion and analysis. However, the time frames are consistent with the activities and timeframes proposed in the Beltway Vision, Design Parameters, and Conceptual Alignments chapter.

A variety of ITS devices or related improvements are proposed, such as:

<u>Short-term ITS Improvements (2011-2025):</u>

1. DMSs
2. Flooding/pavement condition monitors
3. Video integration/sharing
4. TOC deployment and video management platform selection
5. Vehicle detection (e.g., Autoscope, loop detectors)
6. At-grade train detection
7. Fiber optic network extensions
8. Surveillance (e.g., CCTV)

<u>Mid-term ITS Improvements (2026-2035):</u>

1. Communication network extensions
2. Vehicle detection
3. Surveillance

B. ITS Cost Estimates

The ITS cost estimates shown in Table 5 are planning-level in nature and may be modified depending on available funding and needs. The ITS cost estimates include the cost to purchase the various ITS components, as well as the installation costs. Unit costs are derived based on bid prices for recently completed projects in the Midwest. In cases where a future deployment intensity range is proposed, an average cost is shown in Table 5. For example, if detection is recommended every one to two miles, then the cost of detection spaced at one-mile intervals is averaged with the cost of detection spaced at two-mile intervals. It should be noted that the cost estimates do not include extension of electrical service or cable connections. The costs and proposed projects may be further refined in the 2012 ITS Plan update.

Table 5. ITS Cost Estimates

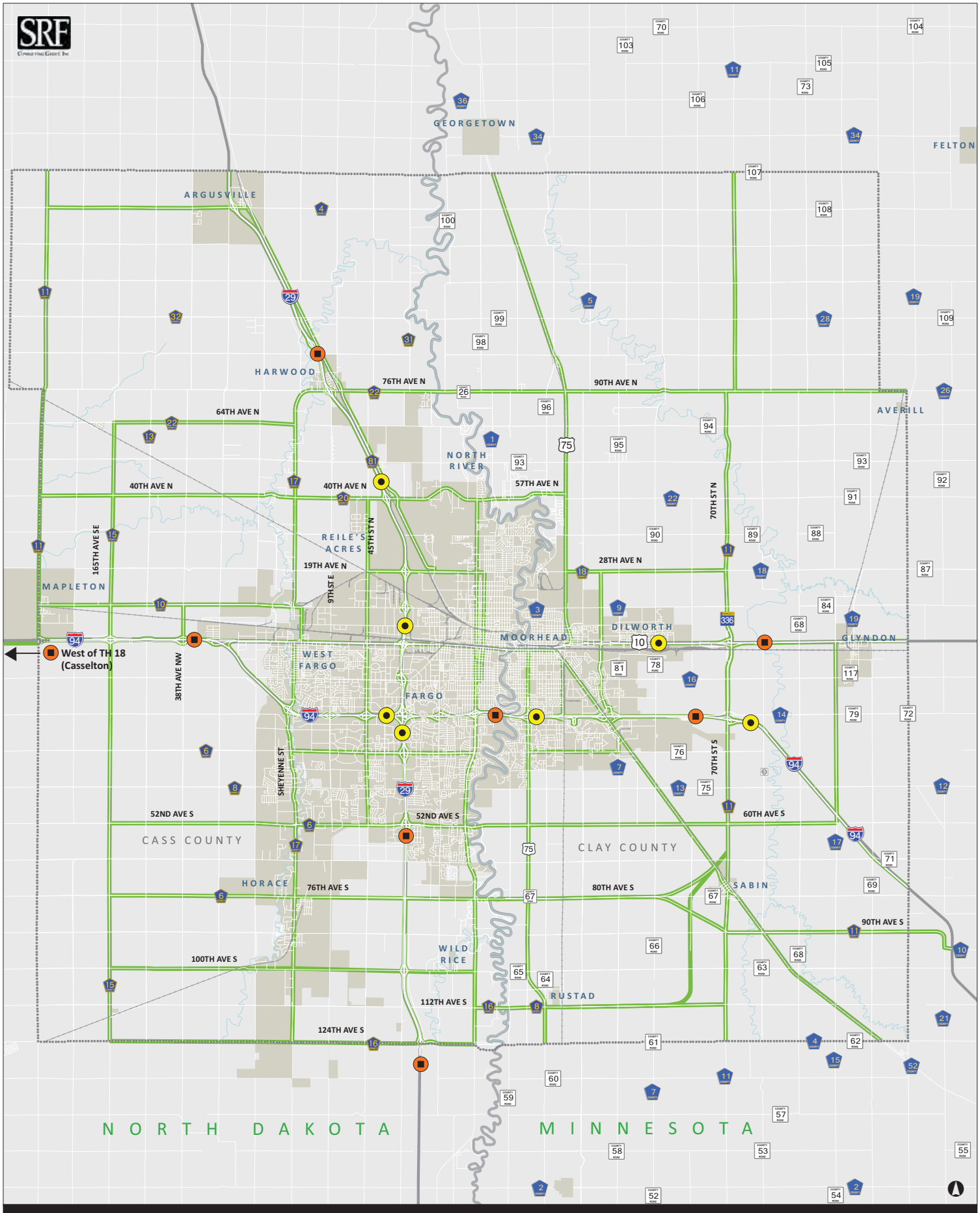
Timeframe	ITS Improvement	Units Proposed	Price per Unit	Rounded Total Estimated Cost
Short-Term (2011-2025)	DMSs	6 DMSs	$75,000	$450,000
	Flooding/Pavement Condition Monitors	6 Monitors	$30,000	$180,000
	Vehicle Detection	93 Detectors	$15,000	$1,400,000
	At-grade Train Detection	11 Detectors	$9,000	$ 100,000
	Fiber Optic Cable	126,720 Linear Feet (24 Miles)	$10	$1,270,000
	Surveillance	11 CCTV Cameras	$25,000	$280,000
	Total Cost			**$3,680,000**
Mid-Term (2026-2035)	Mesh Wireless Technology	68 Nodes	$7,000	$480,000
	Vehicle Detection	51 Detectors	$15,000	$770,000
	Surveillance	34 CCTV Cameras	$25,000	$ 850,000
	Total Cost			**$2,100,000**

C. Short-Term ITS Improvements (2011-2025)

DMSs:

DMSs are valuable ITS assets because they provide travelers with useful information upstream of an incident. Information displayed on DMSs can notify the motorists of upcoming delays, recommend an emergency alternate route, or direct motorists to an Interstate exit to best access a particular event at the FargoDome (see Figure 7).

Four of the DMS deployments correspond with a potential metropolitan beltway system (#4, 5, 7, and 8) and are approximately one mile upstream of potential diversion points. The DMSs would give motorists advance warning of an upcoming incident or congestion and suggest the beltway as an alternate route.



EXISTING AND PROPOSED DYNAMIC MESSAGE SIGNS (DMS)

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

- PROPOSED DMS
- EXISTING DMS
- REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS
- STATE/COUNTY BOUNDARY
- MPO PLANNING AREA
- MUNICIPAL BOUNDARY

Figure 7

Recommended locations for DMSs include:

1. Eastbound I-94 (west of TH 18, near Casselton) – this location gives eastbound I-94 traffic information about incidents in the Fargo-Moorhead metropolitan area approximately 13 miles before the I-94/Main Avenue exit in West Fargo. If needed, motorists will be able to exit I-94 and access services such as fuel, food, and lodging in Casselton.
2. Eastbound I-94 (near 38th Avenue Northwest) – a DMS at eastbound I-94 near 45th Street South is currently programmed for 2014 in the Transportation Improvement Program (TIP)/North Dakota Statewide Transportation Improvement Program (STIP). It is recommended that this DMS be deployed further west (near 38th Avenue Northwest), allowing motorists to divert to Main Avenue if needed.
3. Eastbound I-94 (near the Red River) – especially useful for Interstate closures east of the metropolitan area that result from severe winter weather events. This location gives eastbound motorists an opportunity to exit I-94 and access services such as fuel, food, and lodging in Moorhead. Mn/DOT has programmed a DMS at this location for 2012.
4. Eastbound I-94 (west of TH 336) – allows for the diversion of eastbound I-94 traffic to US 10 via TH 336 during a severe winter weather event or other incident (there is already a DMS for westbound I-94, east of TH 336).
5. Northbound I-29 (south of Cass County 16/124 Avenue South) – there are currently three different I-29 interchanges under consideration for use as part of the southern leg of long-term beltway alignment (124th Avenue South, 100th Avenue South, and 76th Avenue South, if constructed). At this time, a DMS at 124th Avenue South is recommended because it is the I-29 interchange furthest to the south, thus a DMS in this location could service the other two interchanges for northbound traffic. Modifications to this DMS location may occur as the future beltway alignment is further refined.
6. Northbound I-29 (south of 52nd Avenue South) – a DMS at this location is currently programmed for 2014 in the TIP/North Dakota STIP.
7. Southbound I-29 (north of Cass County 22/76th Avenue North) – allows for diversion of southbound I-29 traffic at Cass County 22/76th Avenue North. This interchange provides access to both the proposed interim and long-term beltway alignments.
8. Westbound US 10 (east of TH 336) – allows for diversion of westbound US 10 traffic to I-94 via TH 336 due to an incident on US 10 in Dilworth or Moorhead. TH 336 provides an exceptional two-mile expressway linkage between I-94 and US 10. In addition to a short distance, TH 336 is located outside of the developed urban area and has a grade separated railroad crossing. Mn/DOT has programmed a DMS at this location for 2012.

In addition to the DMS recommendations listed as part of this study, other DMS locations are currently being proposed as part of the 19th Avenue North Corridor Study to assist with FargoDome event traffic. The intent of the proposed DMSs is to suggest alternate routes during FargoDome events based on roadway congestion and available parking. The DMSs could also be used to alert motorists on I-29 to congestion at the 12th Avenue North interchange and direct through traffic to use the furthest left through lane to avoid stopped traffic in the right lane.

It is important to note that the 19th Avenue North Corridor Study is an ongoing study and DMS locations could be modified or additional DMSs could be suggested prior to completion of the study. The five preliminary DMS deployment sites currently being consider are listed below, but are not shown in Table 5 or Figure 7 because the study is still in progress:

1. Northbound I-29 (south of Main Avenue)
2. Eastbound 12th Avenue North (west of 18th Street North)
3. Northbound 10th Street North (south of 17th Avenue North)
4. Eastbound 19th Avenue North (I-29 interchange area)
5. Eastbound 19th Avenue North (west of 18th Street North)

Flooding/Pavement Condition Monitors:

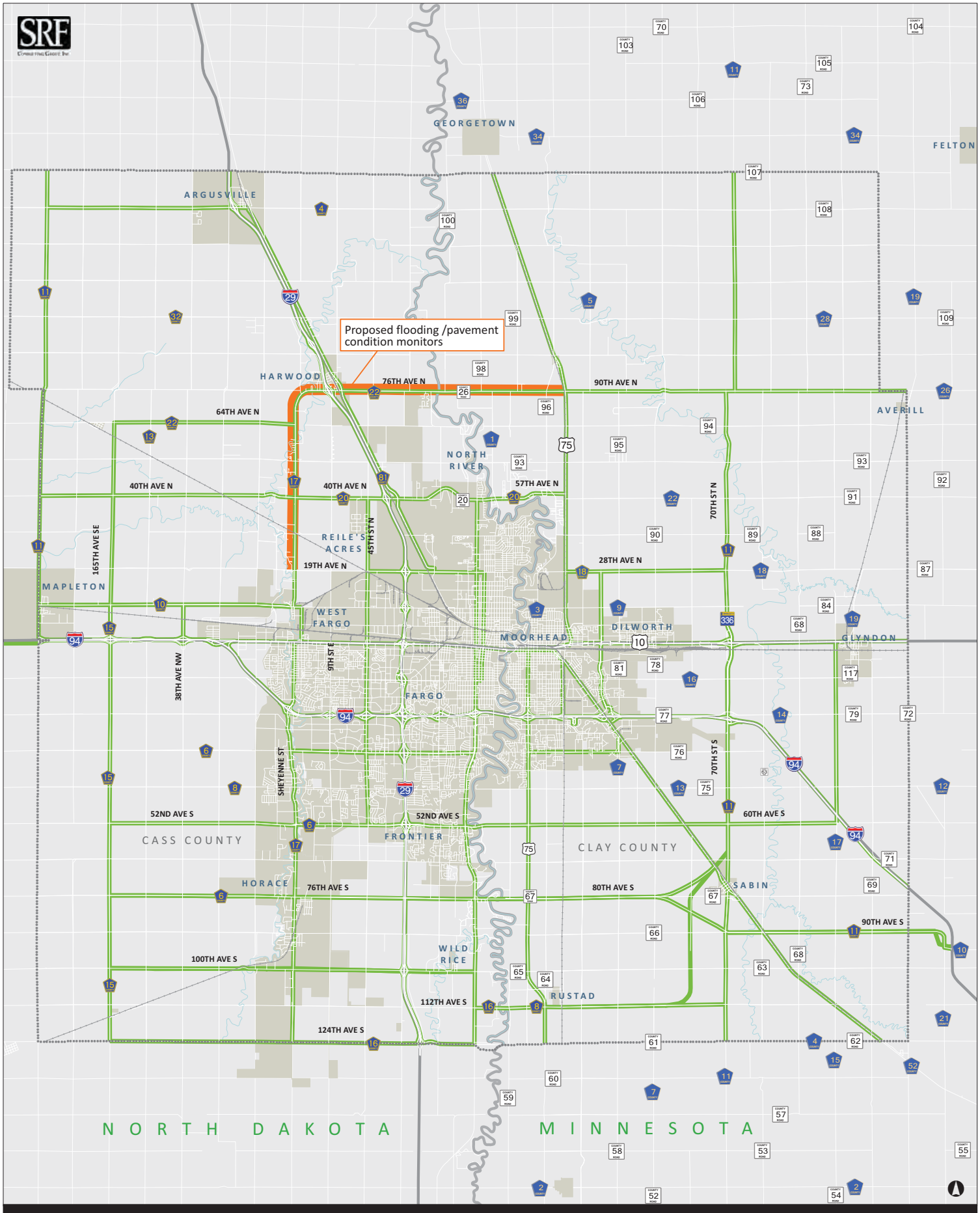
During the stakeholder meetings held on August 24, 2010, flooding concerns were identified along two of the RSTI corridors in the Harwood area (Cass County 17 and Cass County 22/ CSAH 26). At the first Study Review Committee (SRC) held on October 25, 2010, raising portions of these roadways to mitigate the previously identified flooding concerns was determined to be a priority capital improvement project (see the Capital Improvement Cost Estimates chapter). In addition, these two roadways were identified as part of the interim and/or long-term beltway (see Beltway Corridor Vision, Design Parameters, and Conceptual Alignments chapter).

Raising both of these roadways in the near future may not be feasible due to existing funding constraints. However, adding flooding/pavement condition monitors along the roadways is recommended as an interim solution (see Figure 8). The monitors will automatically detect if the road is threatened by flood waters and then transmit this information to the appropriate agencies, emergency responders, and eventually, the general public. The deployment of the monitors reduces the need for staff to continuously inspect the roadway, allowing them to be redirected to other tasks during a flood event. It is assumed that approximately six monitors would be needed along the nearly 12 miles of roadway. Further analysis will be needed to determine specific locations and spacing.

Video Integration/Sharing:

CCTV is becoming a common traffic management tool in the Fargo-Moorhead metropolitan area as more cameras are deployed. This tool provides real-time, visual information on the status of congestion/traffic flows, as well as helping to identify incidents. This information can also be given to emergency responders to aid in their response efforts.

The two agencies with CCTVs at this time, NDDOT and the City of Fargo, are currently on different video platforms. NDDOT currently operates both Pan-Tilt Zoom (PTZ) cameras and Autoscope video detection cameras in the metropolitan area. The camera feeds can only be viewed and operated from the NDDOT District Office in Fargo. The City of Fargo also operates its own set of PTZ cameras. A mixture of Pelco IP cameras and Axis Ethernet video encoder/servers transmit the video content to compatible client computers.



PROPOSED FLOODING/PAVEMENT CONDITION MONITORS

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

- PROPOSED FLOODING/PAVEMENT CONDITION MONITORS
- REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS
- STATE/COUNTY BOUNDARY
- MPO PLANNING AREA
- MUNICIPAL BOUNDARY

Figure 8

Traffic flows or incidents affecting local roadways in Fargo often affect the state system and vice-versa. A good example of this interdependence is events at the FargoDome, which have a noticeable impact on both systems. There would be tremendous advantages to sharing video access with one another, including improved traffic and incident management, as well as emergency response.

In the past, the two agencies did not have adequate access to each others' video feeds. However, significant steps are currently being taken to allow NDDOT and the City of Fargo to share video data. A phased implementation process is underway, which will begin with connecting the NDDOT and City of Fargo fiber optic cable networks in 2011. As video data is transmitted from each camera via fiber optic cable, interconnecting the two networks will allow for the subsequent sharing of video feeds from both agencies' cameras. In order to create redundancy in the network connections, the systems will be interconnected in two different locations (i.e., I-94/ 45th Street South and I-29/12th Avenue North).

In addition to these physical interconnections, a number of other modifications need to be made including upgrades to software. Furthermore, a draft memorandum of understanding has been drafted by the two agencies to describe the purpose of the project and maintenance expectations. It is recommended that these and other remaining tasks be finalized in the near future.

TOC Deployment:

While early stages of the TOC's development are currently taking place, standardization of some of the systems may not occur for a number of years. A comprehensive summary of this recommendation is further discussed in the 2008 Fargo-Moorhead ITS Plan. The TOC will coordinate traffic information and provide for uniform control of traveler information. One of the main goals of the TOC is to collect all of the traffic-related data for the region, regardless of ownership. Coordination of all systems may not be feasible during this time frame, but transmitting all of the data to one central location will be possible.

One system that should be coordinated during this time frame is the video feed. A major step in this integration is the selection of a standard video management platform. As discussed previously, NDDOT and the City of Fargo are currently taking steps to share their video feeds. However, they do not use the same video platform, which limits usability. The agreed upon video platform must meet the needs of NDDOT and the City of Fargo, as well as a future TOC. For cost-effectiveness purposes, many of the existing cameras will be able to be used with the new video platform. However, some decoders and other data transmission devices will need to be added.

Vehicle Detection (e.g., Autoscope, loop detectors):

In the short-term, vehicle detection is recommended along I-94 and I-29 in the metropolitan area. Upcoming construction projects along I-94 will provide good opportunities for deploying vehicle detection systems along these segments of Interstate.

These construction projects include:

1. I-94 (Veterans Boulevard to Red River) – concrete repair scheduled for both directions of I-94 in 2013.
2. I-94 (Red River to 20th Street South) – concrete repair scheduled for both directions of I-94 in 2013.
3. I-94 (TH 75 interchange) – interchange improvements scheduled for 2016.

Additional detection is recommended around the I-94/TH 336 interchange and the I-29/ Cass County 22 interchange (see Figure 9). These last two proposed areas coincide with major Interstate interchanges where traffic may be diverted during an incident. Acquiring real-time information on traffic flows will help emergency responders know the number of vehicles approaching and leaving a diversion point, as well as the number of vehicles using the secondary route. With knowledge of the capacity of the secondary route, traffic flows can be compared to the available capacity to determine if the route can handle the extra traffic. In addition, staff resources can be deployed to the appropriate interchange ramps or other locations to assist with traffic management. Finally, five miles of non-intrusive vehicle detection is currently programmed by Mn/DOT on US 10 and TH 75 in 2012. To coincide with these improvements, vehicle detection is recommended east of these proposed investments on US 10.

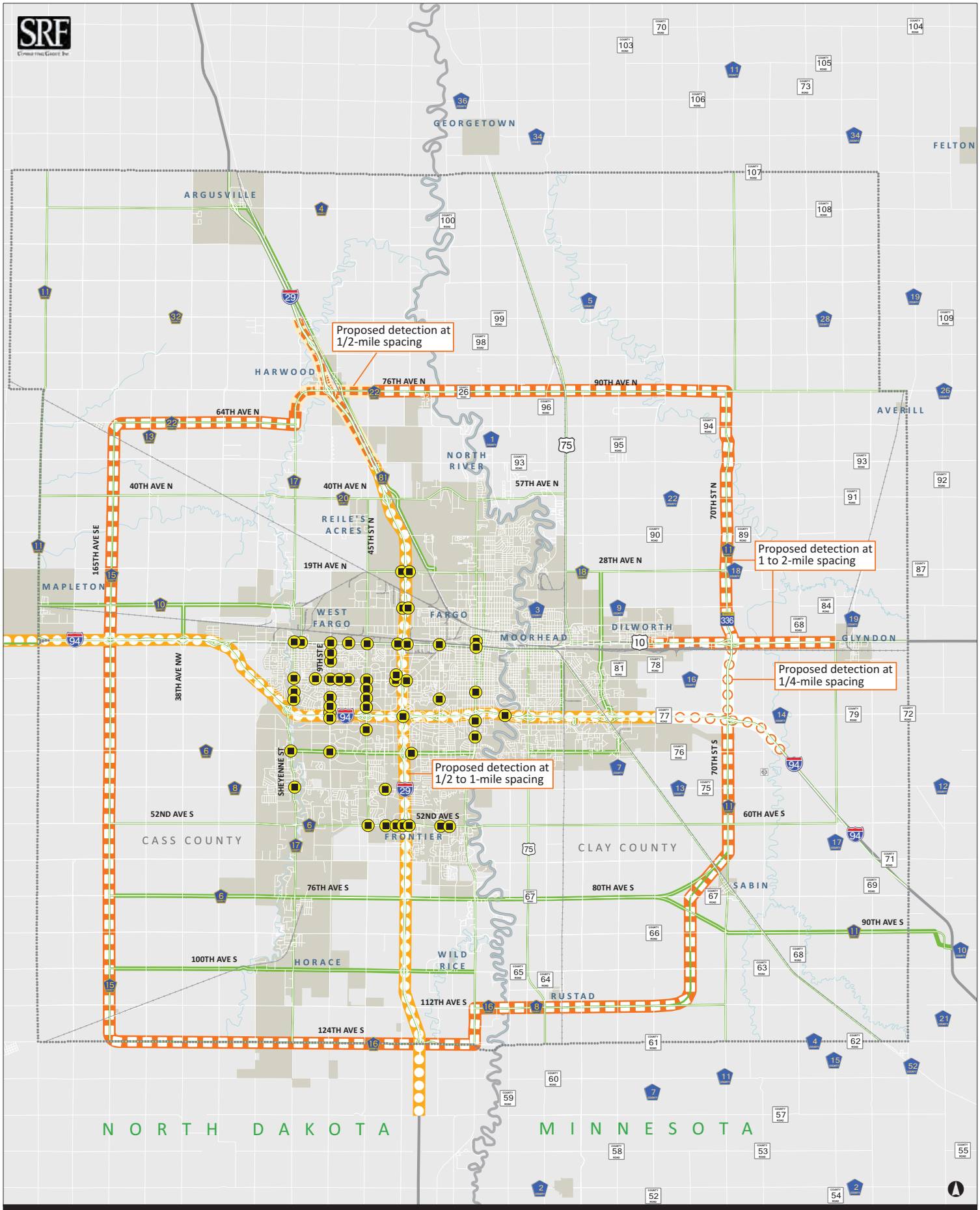
Recommended areas for vehicle detection include:

1. I-94 – Detection is recommended along I-94 throughout the metropolitan area, from west of Mapleton (Cass County 11) to two miles west of TH 336 (additional detection is recommended around the I-94/TH 336 interchange area as described below). Detection spacing along I-94 is recommended every one-half to one mile. Areas that may need one-half mile spacing may include segments of I-94 in the urban core where interchanges are spaced closer together, around the Red River, and near the I-94/I-29 system interchange.

2. I-94/TH 336 interchange area – Detection is recommended two miles east and two miles west of the I-94/TH 336 interchange along I-94. Detection is also recommended on the two-mile segment of TH 336 between I-94 and US 10. Detection spacing is recommended every one-quarter mile because this is a major traffic diversion point for the metropolitan area. These improvements will supplement the existing and recommended DMSs in this area.

3. I-29 – Detection is proposed along I-29, stretching from two miles south of Cass County 16/ 124th Avenue South to two miles south Cass County 22/76th Avenue North (additional detection is recommended around the I-29/Cass County 22 interchange area as described below). It is recommended that detection be placed every one-half to one mile.

4. I-29/Cass County 22 interchange area – Detection is recommended two miles north and south of the I-29/Cass County 22 interchange along I-29. Detection is also proposed to be installed one mile east and west of the interchange along Cass County 22. Since this area is more rural in nature and not as heavily used as the I-94/TH 336 interchange, detection should be installed every one-half mile. Proposed detection near Harwood also corresponds with adjacent short-term ITS recommendations for flood/pavement condition monitors.



EXISTING AND PROPOSED VEHICLE DETECTION (e.g., AUTOSCOPE)

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)
FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

PROPOSED DETECTION
- 1/4-MILE SPACING
- 1/2-MILE SPACING
- 1/2 TO 1-MILE SPACING
- 1 TO 2-MILE SPACING

EXISTING DETECTION

REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS

STATE/COUNTY BOUNDARY
MPO PLANNING AREA
MUNICIPAL BOUNDARY

Figure 9

5. US 10 – Detection is proposed from the existing signal at Main Street in Dilworth (the furthest signal east along US 10 in Dilworth) to roughly CSAH 17 in Glyndon. Spacing of the detectors is recommended for every one to two miles due to rural nature of the surrounding area.

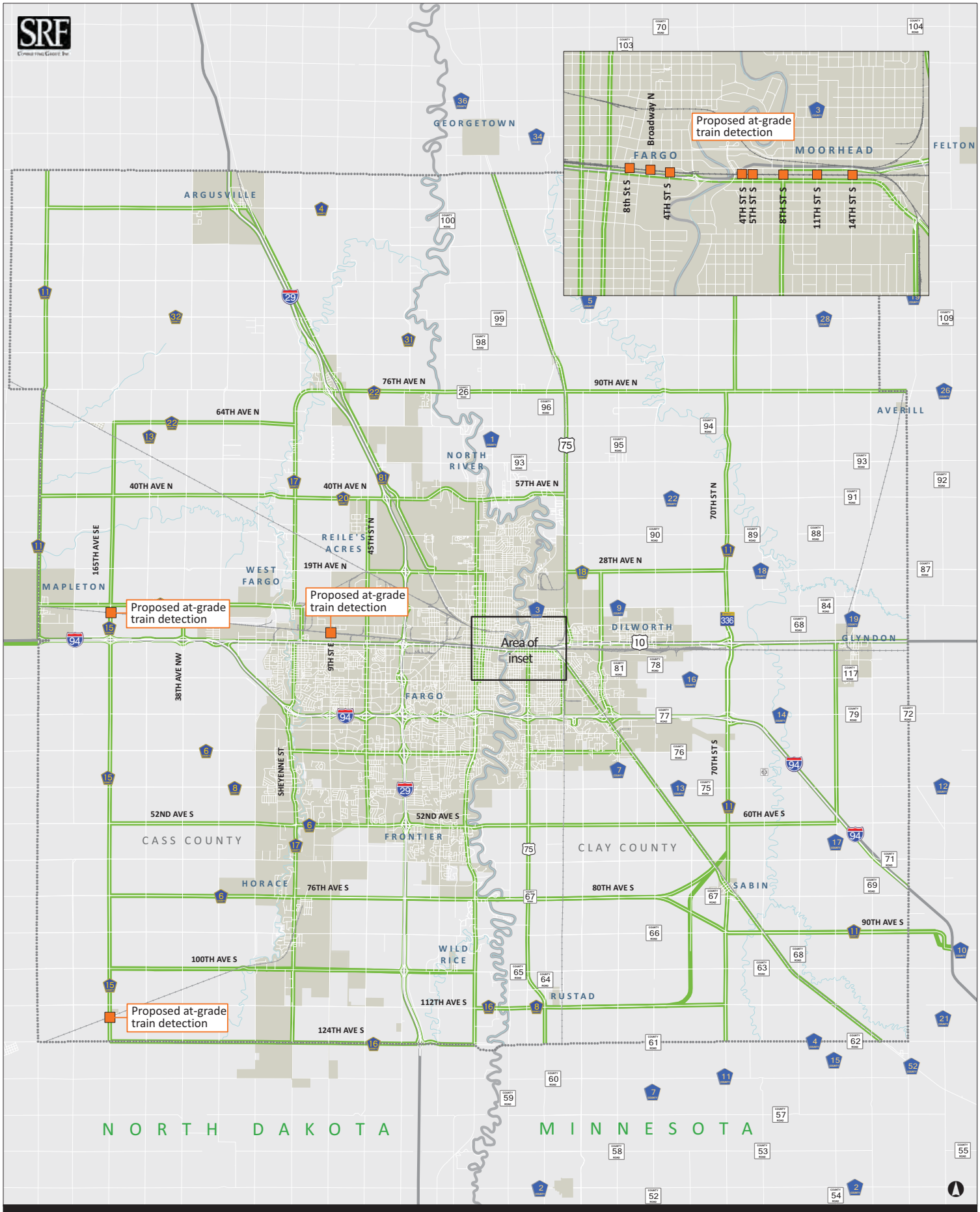
At-Grade Train Detection:

At-grade train detection sends a notification when a train is occupying a specific intersection. There are many low-cost proven methods that can accomplish this task, including use of pre-empt relay outputs from railroad equipment or stand-alone radar sensor devices. Having this real-time information can help to improve incident management efforts by rerouting emergency responders to roadways with grade-separated railroad crossings. If no train is present, then responders may be able to use the roadways to save time versus traveling to the nearest grade separated crossing. This information could drastically improve response times for fire, ambulance, law enforcement, and other responders. In addition, the information could be used by Metro Area Transit (MAT) to improve on-time performance.

With an average of 50-70 trains per day, the Burlington Northern Santa Fe (BNSF) KO subdivision is the main set of railroad tracks that transverse the region. The tracks extend east-west through the heart of the metropolitan area and cut through West Fargo, Fargo, Moorhead, and Dilworth. In addition, the tracks run through the Fargo and Moorhead downtowns where there is a mix of at-grade and grade separated crossings. Recommended locations for at-grade train detection correspond with many of the KO subdivision at-grade crossings in the urban area, as well as one crossing of the Red River Valley and Western Railroad, which is of secondary importance. These proposed locations are shown in Figure 10 and Table 6. It should also be noted that an at-grade detection system was previously designed and tested in the region, although it is no longer operational.

Table 6. Recommended Locations for At-Grade Train Detection

Railroad	Closest Municipality	Intersecting Street
BNSF (KO Subdivision)	Mapleton	Cass County 15
	West Fargo	9th St NE
	Fargo	8th St S
		6th St S
		4th St S
	Moorhead	4th St S
		5th St S
		TH 75/8th St S
		11th St S
		14th St S
Red River Valley and Western Railroad	Horace	Cass County 15



PROPOSED AT-GRADE TRAIN DETECTION

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

- PROPOSED AT-GRADE TRAIN DETECTION
- REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS
- STATE/COUNTY BOUNDARY
- MPO PLANNING AREA
- MUNICIPAL BOUNDARY

Figure 10

Fiber Optic Backbone Extension:

Fiber optic cable allows for the transmission of data from ITS devices to an end-user. This linkage provides the real-time data that is useful to emergency responders. A variety of jurisdictions including NDDOT, Mn/DOT, City of West Fargo, City of Fargo, and the City of Moorhead have fiber facilities in the region and many have planned future expansions of their networks. In fact, Mn/DOT has funds programmed for 2012 that include expansion of their fiber optic network in the metropolitan area. In addition, fiber optic capacity can be leased from a variety of other entities.

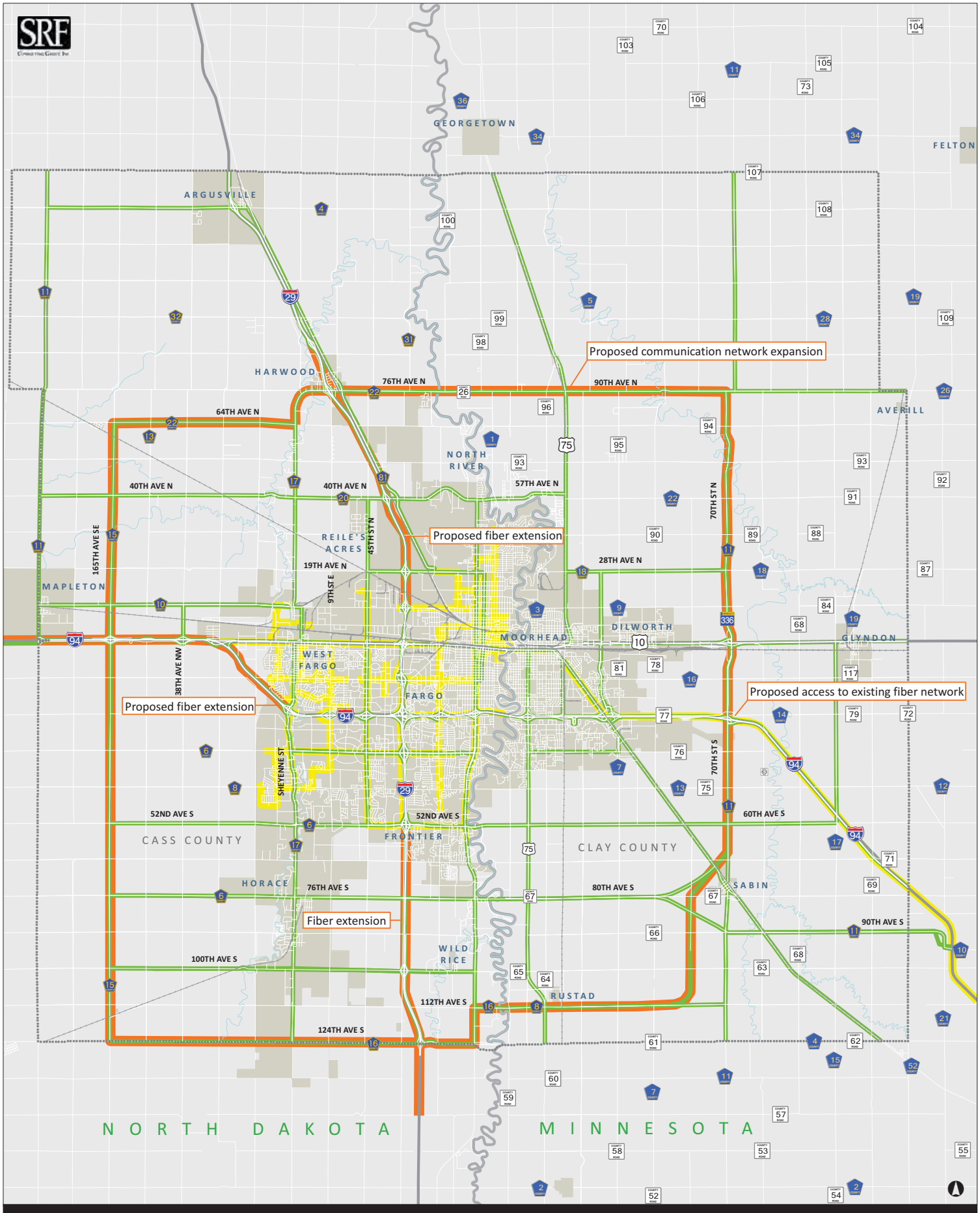
Extension of the fiber backbone in all four directions to the interchanges where the proposed long-term beltway would intersect either I-94 or I-29 is recommended in the short-term (see Figure 11). More specifically, the fiber should be extended approximately one mile beyond the diversion points to connect to the proposed DMS installations. Extending the fiber to these four points would allow for the deployment of ITS devices at these identified traffic diversion points.

ITS devices to be used include DMS, surveillance, and detection. The exact route from the existing fiber optic network to the urban periphery depends, in part, upon cooperation among jurisdictions owning the individual fiber networks. Therefore, the routes shown in Figure 11 are conceptual in nature. In addition, the end points of the fiber are subject to change based on further development of the long-term beltway alignments. End points include:

1. One mile south of the I-29/Cass County 16/124th Avenue South interchange (south extension) – location could be modified depending on final beltway alignment
2. One mile north of the I-29/Cass County 22/76th Avenue North interchange (north extension)
3. One to three miles west of the I-94/Cass County 15 interchange (west extension)
4. I-94/TH 336 interchange (east extension) – existing fiber runs along I-94, but an access point may need to be established at this interchange.

Surveillance (e.g., CCTV):

Existing surveillance in the region is concentrated at major intersections or interchanges in Fargo and West Fargo. In the short-term, additional surveillance is recommended to extend outward from what currently exists today (see Figure 12). The surveillance would be deployed at major I-29 and I-94 interchanges, as well as at the US 10/TH 336 interchange and other major US 10 intersections. While exact locations are still being determined, 10 cameras are currently programmed to be installed by Mn/DOT in 2012. Recommended deployments proposed as part of this study may need to be modified based on where Mn/DOT installs its cameras in 2012.



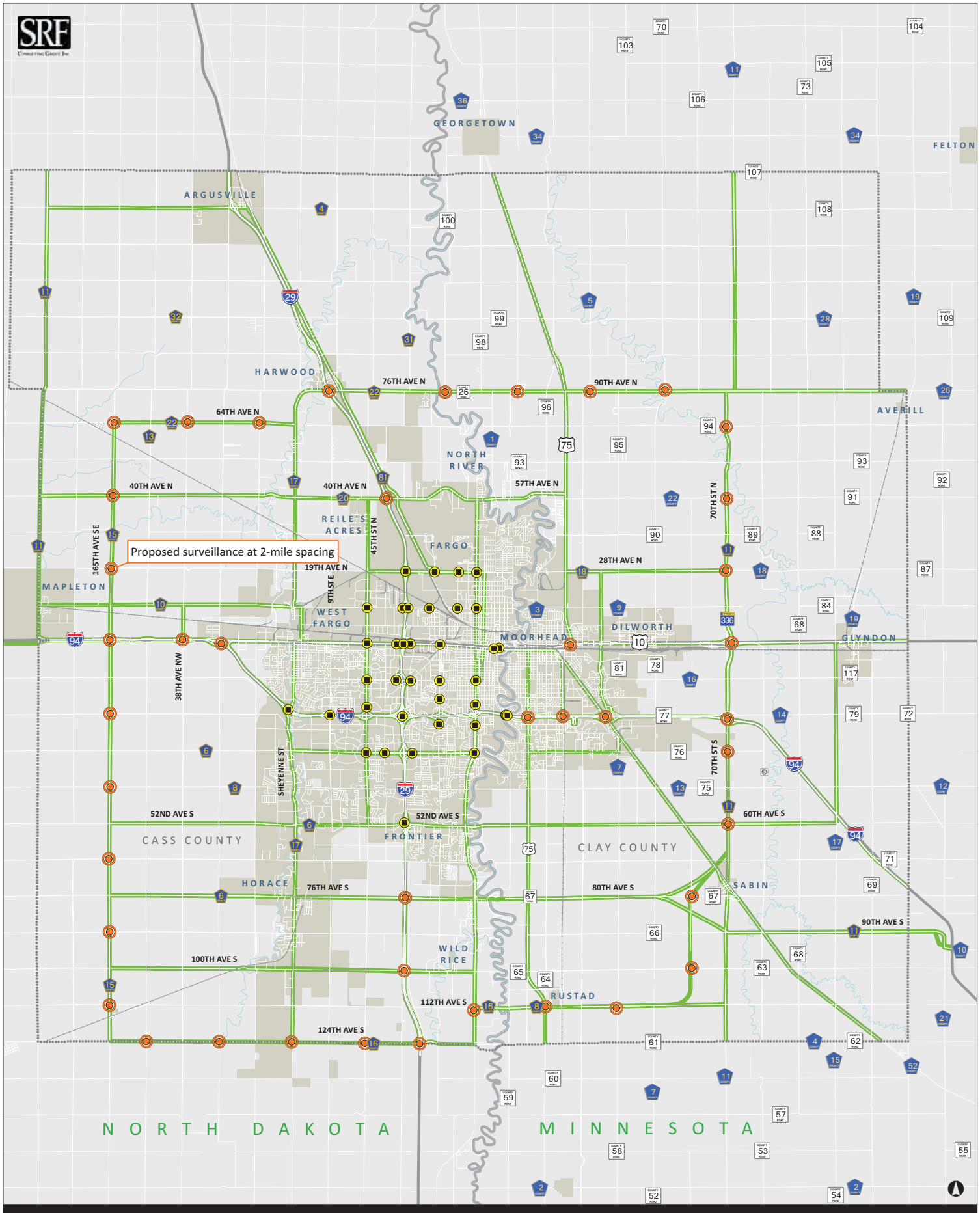
EXISTING AND PROPOSED FIBER OPTIC CABLE/COMMUNICATIONS NETWORK EXPANSION

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)

FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

- PROPOSED FIBER OPTIC CABLE / COMMUNICATIONS NETWORK EXTENSION
- EXISTING FIBER OPTIC CABLE
- REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS
- STATE/COUNTY BOUNDARY
- MPO PLANNING AREA
- MUNICIPAL BOUNDARY

Figure 11



EXISTING AND PROPOSED SURVEILLANCE (e.g., CLOSED CIRCUIT TV)

FARGO-MOORHEAD TRAFFIC OPERATIONS INCIDENT MANAGAMENT STRATEGY (2011)
FARGO-MOORHEAD METROPOLITAN COUNCIL OF GOVERNMENTS

- PROPOSED SURVEILLANCE
- EXISTING SURVEILLANCE
- REGIONALLY SIGNIFICANT TRANSPORTATION INFRASTRUCTURE (RSTI) CORRIDORS
- STATE/COUNTY BOUNDARY
- MPO PLANNING AREA
- MUNICIPAL BOUNDARY

Figure 12

The short-term list of 14 proposed surveillance locations includes:

1. I-94/Cass County 15 interchange
2. I-94/38th Ave NW interchange
3. I-94/Main Avenue interchange
4. I-94/TH 75 interchange
5. I-94/20th Street interchange
6. I-94/34th Street interchange
7. I-94/TH 336 interchange
8. US 10/TH 75 intersection (west junction)
9. US 10/TH 75 intersection (east junction)
10. US 10/TH 336 interchange
11. I-29/Cass County 14/100th Avenue South interchange
12. I-29/76th Avenue South area
13. I-29/Cass County 20/40th Avenue North
14. I-29/Cass County 22/76th Avenue North

D. Mid-Term ITS Improvements (2026-2035)

Communications Network Extension:

In the short-term recommendations, fiber optic cable was extended to the four main diversion points along the proposed beltway. In the mid-term, the communication network should be extended from these four points to run along the entire beltway alignment (see Figure 11). If the beltway design vision and design parameters are followed, then the beltway will provide a high-speed arterial route outside of the urban core. Extending communications capabilities along this route allow for the deployment of any number of ITS devices to better monitor the roadway.

The communication network may involve a simple extension of the fiber optic cable. A more cost-effective option to consider (given the flat topography of the area) is the use of a mesh wireless technology. This second option transmits that data between nodes that are spaced one mile or more apart.

Vehicle Detection and Surveillance:

Corresponding with the extension of the communication network, vehicle detection and surveillance should be deployed along the beltway (see Figures 9 and 12). Given the rural nature of the beltway alignment, these two ITS devices should be spaced further apart in comparison to a more urban setting. It is recommended that vehicle detection devices be installed every one to two miles, and surveillance spaced every two miles. A two-mile spacing for surveillance would assume that two cameras pointed toward each other would be able to view incidents at a distance of no greater than one mile. This distance appears reasonable given the relatively flat terrain. The surveillance locations shown in Figure 12 do not represent the exact locations for deployment, but are intended to represent the proposed two-mile spacing. Actual locations should correspond to major intersections or other high need areas.

AGENCY COORDINATION, PLANNING, AND RESPONSE RECOMMENDATIONS

E. Introduction

This report details a number of recommendations for improving traffic incident management coordination, planning, and response in the Fargo-Moorhead metropolitan area. Recommendations focus on the continued progression towards the development of a TOC and the creation of a traffic incident management program. The latter of the two includes items such as after action reports and incident debriefings, the re-establishment of the Metro COG Traffic Incident Management Committee, and the development of region-wide emergency traffic control and scene management guidelines. Emergency alternate routes are also discussed including the identification of routes, development of an operations guide, drafting of partnership agreements, and use of static and dynamic message signs to help move traffic during these emergency situations. Finally, a number of performance measures are proposed for consideration to monitor and assess traffic incident management efforts in the region.

F. TOC

The metropolitan area should continue development toward a regional TOC for the Fargo-Moorhead metropolitan area as documented in a number of recent planning studies including the 2008 Fargo-Moorhead ITS Plan, the 2009 Fargo-Moorhead Long-Range Transportation Plan, 2010 Fargo-Moorhead TOC Project ITS Architectures: Hybrid TOC and Centralized TOC versions, 2010 TOC Concept of Operations, and a number of other documents. With the participation of a number of agencies and jurisdictions, the TOC would collect and share traffic-related data for the entire region. Traffic operations infrastructure such as traffic signals, CCTVs, DMSs, ramp meters (if deployed in the future), and other related ITS devices would be managed with this data.

By giving TOC operators more robust and accurate traffic movement and incident data, a better coordinated response can be planned and conducted. A TOC will also increase overall system performance by placing different traffic management systems on the same platform, allowing them to share information with one another. This interoperability among systems will ultimately reduce driver delay and enhance safety through improvements such as coordinated signal timing plans and enhanced incident response. In addition, a TOC will provide more timely and accurate information to the traveling public through DMSs, the internet, and other media outlets.

G. Traffic Incident Management Program

The establishment of a traffic incident management program will bring consistency to emergency response, improve safety for emergency responders, and open the lines of communication between agencies. As a result of the program, the general public will benefit from a reduction in delays and secondary crashes. Led and endorsed by agency management, these benefits should be discussed with emergency responders of all agencies involved in emergency planning or

response. The comprehensive program will include elements such as ITS deployment, sharing of information between agencies, and training.

Other key elements of the program may include:

After Action Reports and Post Incident Debriefings:

After action reports and post incident debriefings are essential steps in improving traffic incident response. Both should be completed for all major incidents in the region, as well as other unique incidents to provide a learning opportunity for responding agencies.

The after action reports will document key decisions made during the incident and the resulting affects in order to identify opportunities for improvement. The post incident debriefings are a forum to celebrate successes experienced in the field and to establish best practices for future response. The debriefings should include all major responders involved with the incident, including dispatchers. The multi-agency and multi-disciplinary debriefings are not meant as a forum to criticize the response of any particular agency. Instead, they are meant to open dialogue between agencies and foster better communication in the future. Each post incident debriefing provides an opportunity for lessons learned that can be applied to future incidents.

Traffic Incident Management Committee/Regularly Scheduled Meetings:

If not conducted as a standalone meeting, a post incident debriefing could take place as part of a regularly scheduled traffic incident management (TIM) meeting. The TIM Committee should hold meetings on a quarterly, semi-annual, or annual basis and include stakeholders such as emergency managers, law enforcement, fire, and highway department staff. One of the main goals of the meetings would be to increase communication between various agencies. Potential topics of discussion include upcoming road construction, potential modifications to the emergency alternate routes, new ITS devices, performance measures, new laws or regulations pertaining to traffic incident management (e.g., move-over-law, steer-it, clear it, etc.), or other region-wide initiatives.

The following is a detailed background of various Metro COG committees and how a re-established TIM Committee would fit in with the existing Metro COG committee framework.

Metro COG's Transportation Security Initiative includes recommendations to make better use of the Metropolitan ITS Deployment Committee and the Metropolitan Incident Management Committee regarding issues of transportation security within the region. The Metropolitan Incident Management Committee was active between the years of 1995 and 2001 on a number of ongoing surface transportation issues related to traffic incident management. Since the formation of the Red River Regional Dispatch Center (RRRDC) and successful completion of its original (1994) Mission Statement, the Incident Management Committee has been inactive.

Parallel to the Metropolitan Incident Management Committee is Metro COG's ITS Deployment Committee. As with the Metropolitan Incident Management Committee, the Intelligent Transportation Systems Deployment Committee has been relatively inactive in recent years. As currently structured, the ITS Deployment Committee is seen as being too robust and diverse to handle the high priority ITS and traffic operations issues facing the Fargo-Moorhead

metropolitan area. In response to direction provided by relevant traffic operations stakeholders and Metro COG's Transportation Technical Committee and Policy Board, some of the work once handled by the Intelligent Transportation Systems Deployment Committee, is now handled by the Metropolitan Traffic Operations Working Group. The Metropolitan Traffic Operations Working Group has been primarily tasked with the implementation of the Metropolitan Traffic Operations Action Plan and continued deployment of a TOC for the region.

In keeping with the TSI recommendations, Metro COG should reassess the membership, role, and responsibilities of the Metropolitan ITS and TIM Committees. Such an action would better integrate security within the Metropolitan Planning program and allow for better engagement with relevant incident response managers within the Fargo-Moorhead metropolitan area. The committees should be reorganized and consolidated to create a more appropriate and context-relevant vehicle for the appropriate traffic operations and incident response managers to move forward with more formalized traffic operations and incident management procedures and strategies for the region. Both committees, as originally formed are heavily duplicative of one another, and would benefit from a formalized reorganization in light of recent ITS and traffic incident management activities within the Fargo-Moorhead metropolitan area (see Table 7).

As was done with traffic operations, Metro COG should consider forming an incident response managers "working group" to discuss priorities regarding following up on initiatives coming from this study. Part of these discussions would be an effort to better inform and educate traffic incident managers regarding ongoing traffic operations and ITS initiatives.

It is possible that a reorganized ITS and TIM Committee could be formed into one committee, with two smaller subcommittees; one dealing specifically with traffic operations, and the other with traffic incident management. It is suggested that this reorganization be coordinated with the pending update of the Metropolitan ITS Plan, which is scheduled to kick off in 2012.

Emergency Traffic Control and Scene Management Guidelines:

As part of the traffic incident management program, establishment of a set of emergency traffic control and scene management guidelines for the region should be considered. This training tool will ensure that all agencies are on the same page in terms of traffic incident management. The guidelines would be consistent with the Manual on Uniform Traffic Control Devices (MUTCD) and expand upon existing NDDOT work zone safety flip book. They would not be meant as a specific procedure to follow, but a general approach that could be applied to specific conditions in the field. The guidelines could also supply valuable diagrams that could be referenced such as those showing how to set up a traffic incident management area for incidents in a variety of settings (e.g., multi-lane freeway, signalized intersection, roundabout, off-ramp, etc.).

Potential topics for inclusion in the guidelines include:

1. Responder safety and visibility
2. Emergency vehicle lighting and markings
3. Arrival and vehicle positioning at an incident
4. Traffic incident management area establishment (i.e., advanced warning area, transition area and tapers, etc.)

5. Emergency alternate routes
6. Hazardous materials
7. Towing and recovery
8. Leaving the scene
9. Crash investigation
10. After action reports/post incident debriefings
11. Traveler information and the media

Table 7. TIM vs. ITS Committee Membership

Metro COG Standing Committees				
	TIM Membership		ITS Membership*	
Stakeholder Agency	**Existing**	**Proposed**	**Existing**	**Proposed**
Fargo Public Works	x	x	x	x
Fargo Engineering**	x		x	x
Fargo/Cass Emergency Mgmt.	x	x	x	
Fargo Fire Department	x	x	x	
Fargo Police Department	x	x	x	
Moorhead Engineering Department **	x	x	x	
Moorhead Police Department	x	x	x	
Moorhead Fire Department	x	x	x	
Dilworth Police/Fire Department	x	x		
Dilworth Admin./Planning	x	x	x	x
West Fargo Police Department	x	x		
West Fargo Fire Department	x	x		
West Fargo Public Works**	x	x	x	x
Cass County Sheriff	x	x		
Cass County Highway	x	x	x	x
Clay County Highway	x	x		x
Clay County Emergency Mgmt.	x	x	x	
MN Highway Patrol**	x	x		x
ND State Patrol**	x	x		x
Red River Regional Dispatch Center**	n/a	x	x	x
Mn/DOT District 4**	x	x	x	x
NDDOT District**	x	x	x	x
NDDOT Central Office**			x	x
FM Ambulance	x	x	x	
Metropolitan Area Transit (MAT)**			x	x

**As modified January 2009 by the Metro COG Policy Board*
***Member of Metropolitan Traffic Operations Working Group (formed October 2009)*

H. Emergency Alternate Routes

An emergency alternate route may be used to temporarily divert traffic around an incident (e.g., traffic incident, natural disaster, special event, abnormal congestion) occurring on an Interstate that could cause significant delays. Emergency alternate routes should only be implemented when the roadway is fully blocked and when other methods of moving traffic are exhausted. The purpose of an emergency alternate route is to increase safety for both motorists and on-scene responders. Implementation of an emergency alternate route is a highly-involved process requiring early planning to ensure successful coordination of stakeholders and resources. NDDOT's moveable median barrier on I-29 between 7th Avenue and 12th Avenue is an example of existing infrastructure that could be used in an emergency situation to implement an alternate route.

Identification of Routes:

The Regionally Significant Transportation Infrastructure (RSTI) network provides a number of routes that should be considered as emergency alternate routes for incidents on either I-29 or I-94. In addition, the proposed beltway alignments should also be considered as routes. Using local knowledge of the study area, as well as criteria such as roadway geometry, available capacity, weight restrictions, etc., stakeholders would agree on an emergency alternate route for each segment of Interstate in the Fargo-Moorhead metropolitan area. Potential stakeholders in this process include the State Patrol, county sheriff, local fire, public works, law enforcement, emergency medical responders, and towing and recovery specialists. Stakeholders should also meet periodically to update the routes based on construction activity, recent roadway improvements (ITS devices, traffic signals, etc.), increased congestion on the routes, etc.

Operations Guides:

As part of the emergency alternate route identification process, an emergency alternate route operations guide would be developed. The Operations Guide graphically illustrates the emergency alternate route for each freeway segment and identifies time critical notifications and actions for agencies to take in order to implement the route. The Guide also clearly establishes what criteria must be met in order to implement the emergency alternate routes. The Guides would either be printed as hard-copies and placed in emergency responders' vehicles or be produced as an interactive e-guide that could be accessed from a laptop computer in the field. The Operations Guides, which are only advisory in nature, provide practical information that can be readily used by a variety of users, some of which may have minimal experience implementing an emergency alternate route or may be unfamiliar with the geographic area (i.e., a State Patrol trooper who normally is in another part of the state).

A draft example of an emergency alternate route for the I-29 corridor is displayed in Figure 13. It depicts the alternate route for diverting traffic if an incident occurs on southbound I-29 between Exits 69 and 67 in Fargo. The map shows the traffic control devices, location of closure posts, and the location and messages to be displayed on DMSs, which provide advance warning to motorists upstream of an incident. After the map of each individual route, emergency contact information and responsibilities for responding agencies are listed as part of the guide (see Figure 14). In addition, a description of the emergency alternate route is provided to assist dispatchers and the media in distributing this information to motorists.

Figure 13. Example of an Emergency Alternate Route along I-29

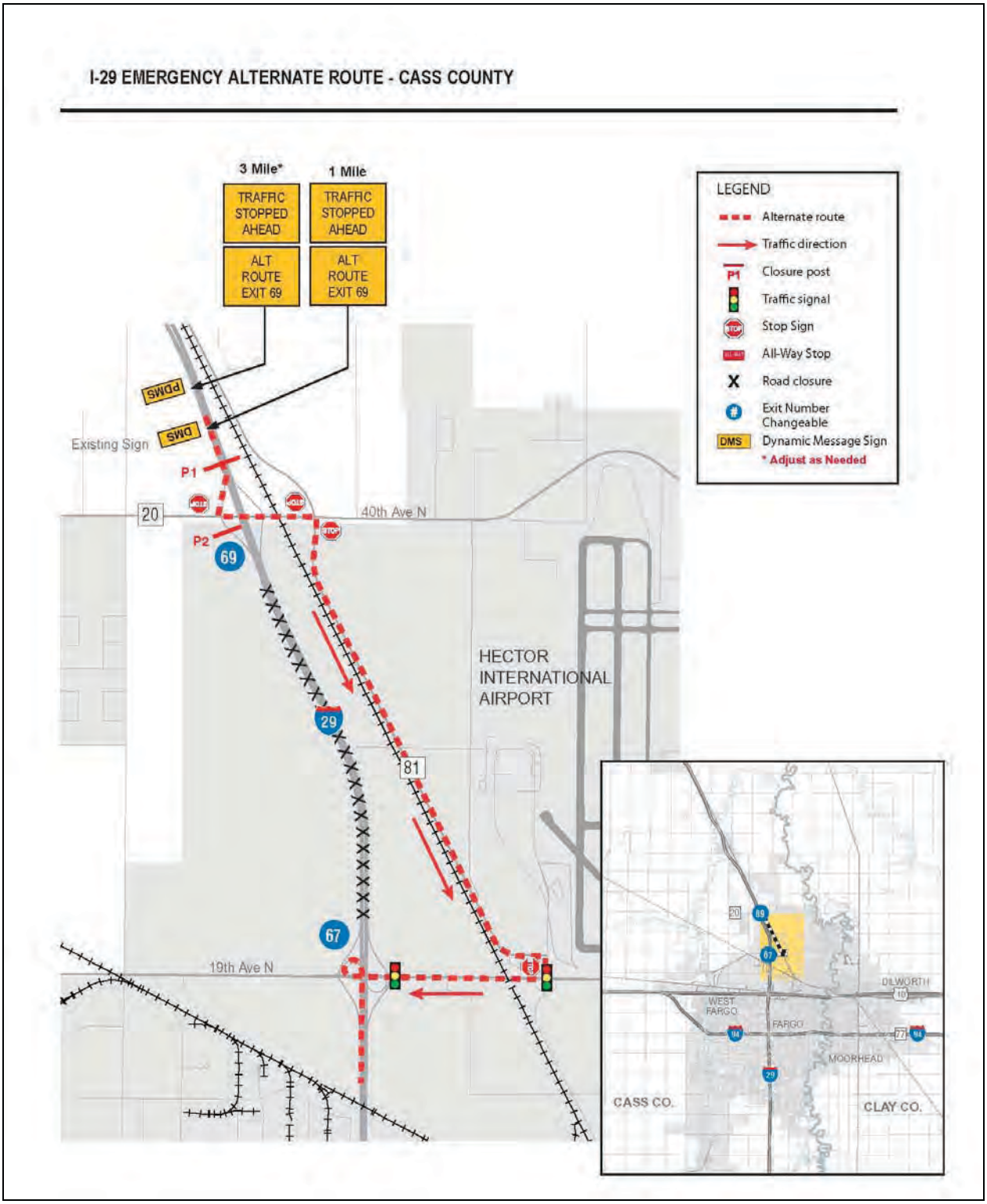
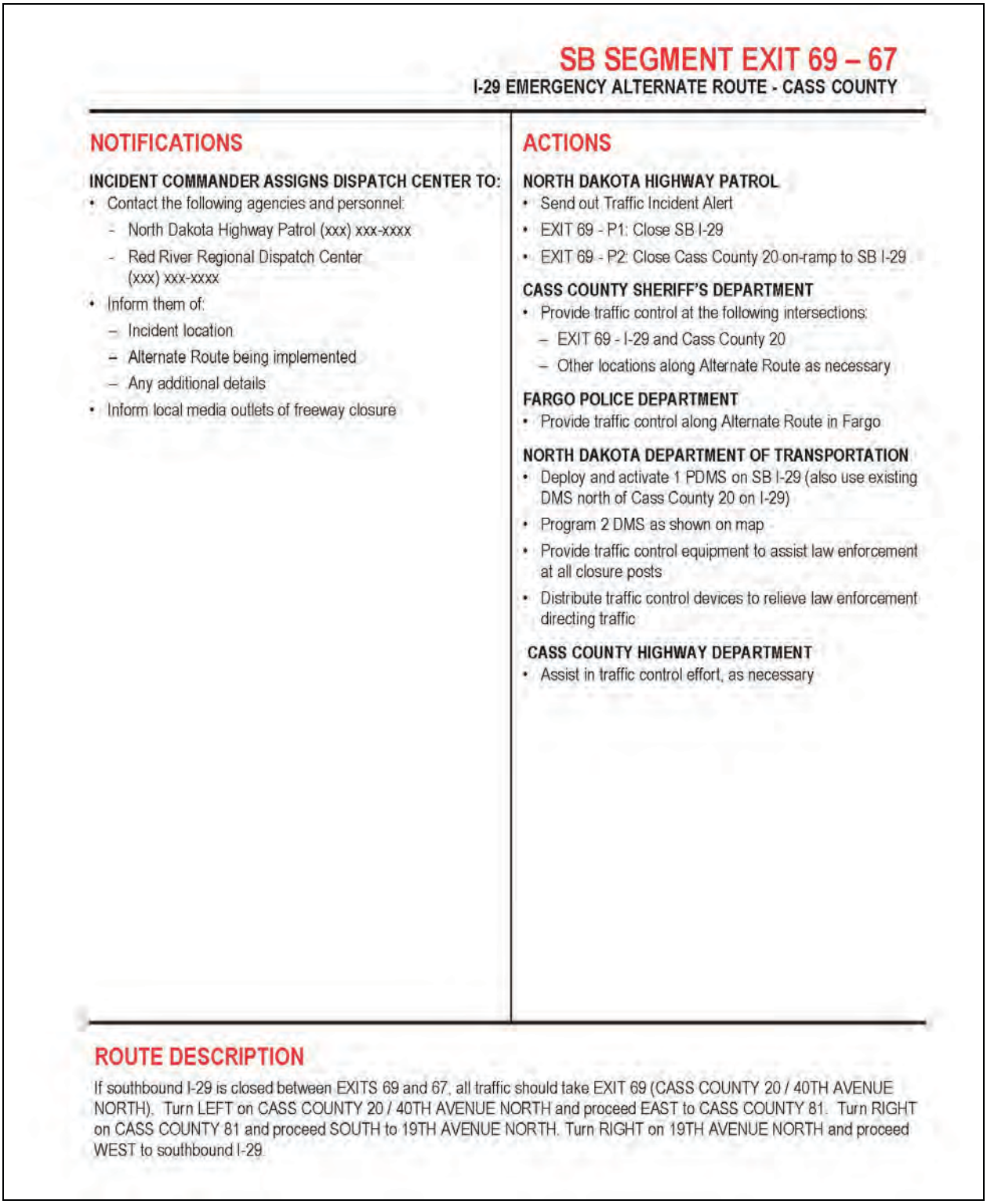


Figure 14. Example of an I-29 Emergency Alternate Route Actions and Notifications Page



SB SEGMENT EXIT 69 – 67

I-29 EMERGENCY ALTERNATE ROUTE - CASS COUNTY

NOTIFICATIONS

INCIDENT COMMANDER ASSIGNS DISPATCH CENTER TO:

- Contact the following agencies and personnel:
  - North Dakota Highway Patrol (xxx) xxx-xxxx
  - Red River Regional Dispatch Center (xxx) xxx-xxxx
- Inform them of:
  - Incident location
  - Alternate Route being implemented
  - Any additional details
- Inform local media outlets of freeway closure

ACTIONS

NORTH DAKOTA HIGHWAY PATROL

- Send out Traffic Incident Alert
- EXIT 69 - P1: Close SB I-29
- EXIT 69 - P2: Close Cass County 20 on-ramp to SB I-29

CASS COUNTY SHERIFF'S DEPARTMENT

- Provide traffic control at the following intersections:
  - EXIT 69 - I-29 and Cass County 20
  - Other locations along Alternate Route as necessary

FARGO POLICE DEPARTMENT

- Provide traffic control along Alternate Route in Fargo

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

- Deploy and activate 1 PDMS on SB I-29 (also use existing DMS north of Cass County 20 on I-29)
- Program 2 DMS as shown on map
- Provide traffic control equipment to assist law enforcement at all closure posts
- Distribute traffic control devices to relieve law enforcement directing traffic

CASS COUNTY HIGHWAY DEPARTMENT

- Assist in traffic control effort, as necessary

ROUTE DESCRIPTION

If southbound I-29 is closed between EXITS 69 and 67, all traffic should take EXIT 69 (CASS COUNTY 20 / 40TH AVENUE NORTH). Turn LEFT on CASS COUNTY 20 / 40TH AVENUE NORTH and proceed EAST to CASS COUNTY 81. Turn RIGHT on CASS COUNTY 81 and proceed SOUTH to 19TH AVENUE NORTH. Turn RIGHT on 19TH AVENUE NORTH and proceed WEST to southbound I-29.

Partnership Agreements:

In some instances, a city, county, or other local route may be recommended for use as an emergency alternate route because it can minimize delay for the motorist versus the nearest available state route. Under these instances, a partnership agreement should be drafted between the local municipality and the state that allows the use of a local roadway to divert Interstate traffic during emergency situations only. The partnership agreement could include items such as cost-sharing or maintenance considerations if local roads are damaged while being used as the emergency alternate route. Once identified, local roads selected as emergency alternate routes should be considered as strong candidates for long-term improvement.

Static and Dynamic Trailblazing Signs:

Static signing, shown Figure 15, can help guide motorists along the emergency alternate route. Static signing reduces the amount of staff and resources needed during emergency alternate route implementation. In addition to static signing, dynamic message signs, if properly placed, can also relay messages to motorists. Some of the suggestions in the ITS Recommendations chapter of this report propose the placement of dynamic message signs in locations that are upstream of potential diversion points for emergency alternate routes.

Figure 15. Static Signing Directing Motorists along an Emergency Alternate Route

I. Performance Measures

Performance measures are an important tool in assessing traffic incident management efforts. Quantitative data can be collected and tracked, and then compared against pre-established goals. In addition, various time periods can be compared against one another to assess if progress is being made toward a specific goal. Performance measures help determine the effectiveness of new initiatives, identify weaknesses in the response, and help direct future funding and/or programs. Finally, performance measures can help to document the benefits of incident management efforts such as an estimated reduction in secondary crashes, driver delay time, vehicle operation hours, fuel consumption, and vehicle emissions.

When properly tracked, performance measure information can be combined to improve overall incident response. For instance, patrol vehicles can be redistributed to freeway segments with high incident frequency or areas with poor response times. A second example could come from tracking the types of messages placed on DMSs. It could be discovered that certain types of incidents are not being reported to the public via DMSs and a change in procedure may result. As recommended previously, performance measures would be an appropriate meeting agenda item for the Metro COG Traffic Incident Management Committee, if it is created.

A relatively large amount of data is required to track the performance measures described below. Some of the data can be tracked by the Red River Regional Dispatch Center (RRRDC), while other information may need to be logged by responders. A record keeping system that is integrated and coordinated across response agencies will help in this data collection effort. As the TOC concept evolves in the metropolitan area, it will become easier to track, collect, and interpret the data.

Performance measures that should be considered include:

General Information:

1. Total number of traffic incidents
2. Total number of emergency responders used and agency
3. Type of equipment used, including ITS devices
4. Location of incident (including name of roadway, nearest interchange/cross street, and location of incident such as on-ramp, mainline, etc.)
5. Distance traveled for emergency responders
6. General log of events
7. General customer service (if surveys are taken of general public)

Response and Clearance Times:

8. Detection time (time from incidence occurrence to when it is reported to dispatch)
9. Response time (time from when incident reported until a responder is on the scene)
10. Lane blockage time (time from when a lane or entire roadway is blocked until it is reopened)
11. Clearance time (time from when personnel arrive on scene until traffic completely recovers after the incident)
12. Incident duration (time from incident occurrence to when emergency response vehicles leave the scene)

Emergency Alternate Route Measurements:

13. Total number of times an emergency alternate route is used
14. Length of time the emergency alternate route is used (hours)

Traveler Information Measurements:

15. Total number of public safety alerts, press releases, etc.
16. DMS usage and type of use (e.g., special event, traffic incident, weather, Amber Alert)
17. Number of hits to 511 website or number of times 511 called

VIII. NEXT STEPS

This chapter describes the next steps and recommendations that Metro COG should take in subsequent. While it is not an exhaustive list of every recommendation proposed in this report, it does prioritize the near term efforts that should be undertaken by Metro COG. Many of these recommendations are cost-effective solutions to address traffic incident management issues at a fraction of the cost of large capital improvement projects. The list of action items below is broken out by chapter.

RSTI Network:

1. Add the revised RSTI network to the Long-Range Transportation Plan update.

2. Consider the RSTI network when completing short- and long-range project design/programming, future system functional classification changes, or jurisdictional changes.

Beltway Vision, Design Parameters, and Conceptual Alignments:

3. Conduct corridor studies, by key beltway segment, to document the rationale for the selection of a preferred long-term beltway route and to identify specific beltway improvements and priorities. As part of this documentation, conduct a benefit-cost analysis on whether to build critical links of the beltway compared to the entire route.

4. Include this beltway analysis in the Long-Range Transportation Plan update, coordinate the beltway program with RSTI corridor planning, and consider this work during short and long-range project design/programming, future system functional classification, or jurisdictional changes.

5. Continue improvements to the interim beltway infrastructure so as to extend the life of this system, and provide ample time to preserve the ultimate beltway alignment.

6. Reach a consensus on key intergovernmental beltway issues (e.g., 76th Avenue South Red River bridge crossing, Harwood urban area safety, "I-94 Connector," etc.).

7. As the Red River Diversion is planned and constructed, secure funds to accommodate both beltway and flood mitigation projects.

Capital Improvement Cost Estimates:

8. Include the proposed capital improvement projects in the Long-Range Transportation Plan update. Prioritize the projects and pursue available funding opportunities.

ITS Recommendations:

9. Incorporate ITS recommendations in the Fargo-Moorhead Metro ITS Plan update.

10. Secure funds for short-term recommendations at strategic locations. These ITS improvements include:
    - DMSs
    - Flooding/pavement condition monitors
    - Video integration/sharing
    - TOC deployment and video management platform selection
    - Vehicle detection (e.g., Autoscope, loop detectors)
    - At-grade train detectors
    - Fiber optic network extensions
    - Surveillance (e.g., CCTV)

11. Finalize the process of sharing video feeds between NDDOT and the City of Fargo (i.e., connect fiber optic cable networks, install software, sign memorandum of understanding, etc.).

Agency Coordination, Planning, and Response Recommendations:

12. Continue working with stakeholders towards the development of a TOC.

13. Re-establish the Metro COG Traffic Incident Management Committee, which will include stakeholders from emergency management, law enforcement, fire, and highway staff.

14. Using the Traffic Incident Management Committee, select and implement some of the highest priority recommendations proposed in this study, whether it is development of an emergency alternate route operations guide, creation of an after-action report form, or other recommendations.

15. Prioritize recommended traffic incident management performance measures based on usefulness and ease of obtaining information. Begin tracking identified performance measures and work with stakeholders to determine how to collect data for other measures.