430 IACC Building - Fargo, ND 58105
Tel 701-231-8058 - Fax 701-231-6265
www.atacenter.org - www.ugpti.org

Fargo-Moorhead Council of Governments
Case Plaza Suite 232 1 2nd St N
Fargo, ND 58102
www.fmmetrocog.org

Fargo-Moorhead Regional ITS Architecture Update

Version 2.0

Final Report

December 2007

Fargo-Moorhead Regional ITS Architecture
Version 2.0

Final Report

December 2007

The information contained in this report was obtained through extensive input from various stakeholders in the Fargo-Moorhead region. The contents of the report were written by a research team from the Advanced Traffic Analysis Center of the Upper Great Plains Transportation Institute at North Dakota State University which facilitated the development of the Regional Architecture.

Report Prepared by:

Ayman Smadi
Mohammad Smadi

Advanced Traffic Analysis Center
Upper Great Plains Transportation Institute
North Dakota State University
Fargo, North Dakota 58105

ACRONYMS

AVL	Automated Vehicle Location
CCTV	Closed Circuit Television
Dist	District
DMS	Dynamic Message Sign
DOT	Department of Transportation
EAS	Emergency Alert System
EOC	Emergency Operations Center
EV	Emergency Vehicle
FD	Fire Department
FHWA	Federal Highway Administration
ISP	Information Service Provider
ITS	Intelligent Transportation Systems
MAT	Metro Area Transit
MCO	Maintenance and Construction Operations
MnDOT	Minnesota Department of Transportation
MSP	Minnesota State Petrol
NDDOT	North Dakota Department of Transportation
NDHP	North Dakota Highway Patrol
OEM	Office of Emergency Management
PD	Police Department
PW	Public Works
RA	Regional Architecture
TOC	Traffic Operations Center

Standards

ASTM	American Society for Testing and Materials
IEEE	Institute of Electrical and Electronic Engineers
ISO	International Organization for Standardization
ITE	Institute of Transportation Engineers
NTCIP	National Transportation Communications for ITS Protocol
SAE	Society of Automotive Engineers

Market Packages

AD	Archived Data
APTS	Advanced Public Transportation Systems
ATMS	Advanced Traffic Management Systems
EM	Emergency Management
MCO	Maintenance and Construction Operations

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Fargo-Moorhead Regional Intelligent Transportation Systems (ITS) Architecture was prepared under the leadership of the Fargo-Moorhead Council of Governments (F-M COG). The goal of the F-M regional architecture (RA) is to guide the implementation of ITS systems in the F-M region and coordinate funding, deployment, information sharing, and operations of ITS systems in the region. The main ITS goal areas for the F-M region include enhanced traveler safety; effective traffic and transit management; coordinated incidents management; and enhanced traveler information. A 15-year planning horizon was considered in the RA development.

The development of the RA was facilitated by the Advanced Traffic Analysis Center (ATAC) of the Upper Great Plains Transportation Institute at North Dakota State University. A partnership agreement was established between ATAC Fargo-Moorhead Council of Governments for supporting the RA development and maintenance.

The RA development process primarily followed the FHWA guidelines, with some modifications to reflect the unique characteristics of the region. The process made use of completed ITS planning efforts in the region and used the output of those efforts as a starting point for identifying regional needs and ITS services.

The F-M region is a rapidly growing area which continues to experience increased economic activity, serving as a business and cultural center for the vastly rural surrounding region. Therefore, an efficient transportation system is crucial for supporting mobility needs of individuals and businesses in the region.

The geographical boundaries used for purposes of developing the F-M RA were primarily based on the F-M COG's metropolitan boundaries. Major jurisdictions include:

1. City of Fargo, North Dakota
2. City of Moorhead, Minnesota
3. City of West Fargo, North Dakota
4. City of Dilworth, Minnesota
5. Cass County, North Dakota
6. Clay County, Minnesota

In addition to these jurisdictions, the RA recognized interfaces with statewide architectures in North Dakota and Minnesota. Therefore, the North Dakota Department of Transportation (NDDOT), the Minnesota Department of Transportation (MnDOT), and the Federal Highway Administration (FHWA) were active participants in the RA development.

The RA development was guided by various regional stakeholders who were categorized into three groups:

1. Project Advisory Group: guide overall project in the region
    a. Two representative from the MPO
    b. FHWA Division Office, Bismarck, North Dakota
    c. NDDOT
    d. MnDOT
2. Technical Steering Committee: provide technical information on existing and planned system and provide input on the architecture development
    a. City engineering and planning staff
    b. Transit staff
    c. MPO planning staff
    d. County engineering/planning staff
    e. Agency Information Technology technical staff
    f. State DOT district engineering staff
    g. FHWA representative
    h. Law enforcement (police and fire)
    i. Other agencies responsible for system operating/maintenance
3. Local Stakeholders: stakeholders not likely to own/operate ITS systems
    a. Elected official for supporting deployment and funding systems
    b. Event centers
    c. Colleges
    d. Airports
    e. Emergency Medical Services

A system inventory was updated to account for existing and planned ITS systems. The majority of these systems may be classified into the following service areas: traffic and travel management, transit management, maintenance and construction management, and transit management. The inventory identified systems and their functions by agency and jurisdiction.

ITS user services for the region were identified from previous ITS plans as well as input from regional stakeholders. The National ITS Architecture was used to map these services and to develop market packages in support of these services. ITS Market Packages were used extensively in the F-M RA development since they provided an easy to use tool for discussions with stakeholders. They also provided an effective entry point for Turbo Architecture. A total of 26 Market Packages were identified for the F-M area. The Market Packages were also used to survey roles and responsibilities for each system. System interconnections and relevant information flows were identified for major ITS systems in the region. These systems include: traffic management, transit management, emergency management, and maintenance and construction management.

Based on potential information flows, access sharing, and funding partnerships potential agency agreements were identified. The format for each agreement includes the purpose, entities included, and items covered. Seven potential agreements were identified for the F-M region and they include regional traffic control, incident management, roadway closure, 911 coordination, emergency routing, work zone management, and traffic enforcement.

In concert with the RA update, the F-M COG is also conducting an ITS deployment plan to be completed in first quarter 2008. The aim of the deployment plan is to move forward towards implementation of key priority ITS user services in the region.

ARCHITECTURE UPDATE SUMMARY

The regional architecture (RA) is a live document that needs to be maintained regularly to reflect the most up-to-date ITS picture in the region and to continue to meet federal requirements. The F-M COG has been designated with the role of maintaining and updating the F-M Regional ITS Architecture as needed.

Reasons for updating the RA include:

- The planning of major ITS projects
- Changes in the status of major ITS projects
- Changes in the region's stakeholders
- Changes in the region's ITS needs
- Changes in the National ITS Architecture

The F-M RA specified an update cycle of two years, the original report was completed in early 2005 and first update was completed in late 2007. This section describes changes in the Fargo-Moorhead region as they pertain to ITS functions in the area. At the end of each area is a list of market packages impacted by these changes, please refer to the market package in Appendix A to see the graphics with changes in subsystems and flows. Appropriate changes have been made to corresponding sections in the report body, updated information flow diagrams and an updated Turbo Architecture database are also available for download from the FM RA website:
http://www.atacenter.org/regional/fargomhd/docs.php

Transit Management

Updates

- New facility:
    - Security system, improved communication with one building shared by Fargo and Moorhead transit
    - Fiber link to the city network
    - Para-transit dispatch, fixed-route still at downtown garage
    - Data dump now at one location
- GPS/AVL:
    - Antennas on busses identify locations of fair activity: swiping of card, inserting token
    - GPS data for ridership at stops that have a MAT sign (have to be pre-programmed)
    - Working on AVL for NDSU
    - Setup tracking, web based
- Transit Signal Priority:
    - To be implemented on Route 11 (Broadway Main Ave to 32nd Ave N)
    - Would like to see it at the GTC for busses entering and exiting the garage
    - Rail disturbs the operation on some routes and TSP might be needed

- Transit Traveler Information
  - Plans for real time arrival information display at NDSU Memorial Union stop
- Security cameras on board all busses, Fargo and Moorhead
  - Can push a panic button to mark a spot on the video, it provides direct access to the spot and write-protects it
- Drivecam system installed on all busses, and has proven to be helpful
- Emergencies:
  - Generator power backup
  - The new facility is one of the city's command posts for emergencies

Architecture changes

- APTS01 Transit Vehicle Tracking
- APTS07 Multi-modal Coordination
- APTS08 Transit Traveler Information

Traffic Management

Updates

- Moorhead
  - City of Moorhead now operates a dozen signals
  - Sonem emergency vehicle preemption
  - Advanced Railroad Preemption
    - Along Main, Center, and 1st avenues
    - Quiet zone project
  - Software for signals connected via modem with MnDOT master controller.
  - Ability to do counts at some intersections (FM COG)
  - No plans for actuated signals
  - Possible future project: actuated left turns
  - Annual construction plan posted on website
  - Planned active speed monitoring
- Fargo
  - School flashers: programmable for time and controlled from the signal shop
  - Transit signal priority, route 11
- West Fargo
  - City of West Fargo operates 14 signals
  - Several intersections with Autoscope cameras and Sonem preemption
  - Radio communication with 2 of the cameras is available
  - 13-14 speed active monitoring in school zones
- NDDOT
  - Permanent DMS on I-29 and 7th Ave N NB
  - 4 PTZ cameras
  - Several Video Detection Cameras and Traffic Data cameras
  - ATR on I-29
  - I-29 website, video snapshots and project information

Architecture Changes

- ATMS01 Network Surveillance
- ATMS03 Surface Street Control
- ATMS06 Traffic Information Dissemination
- ATMS07 Regional Traffic Management
- ATMS08 Traffic Incident Management System
- ATMS13 Standard Railroad Grade Crossing
- ATMS19 Speed Monitoring

Maintenance and Construction Management

Updates

- NDDOT
    - Red River Bridge anti-icing system operational
    - AVL on 5 out of 17 plow trucks
- West Fargo
    - I-94 and 9th St interchange anti-icing system planned
- Fargo
    - 3-5 new treatment trucks this winter season
        - Will be used for anti-icing operations
        - Will have AVL and tracking abilities
    - New supervisor trucks
        - Equipped with temperature probes and infrared sensors
        - Will be used for decision making for sanding and chemical application
    - Video images access from I-94 Red River bridge anti-icing system
    - Plans to add AVL to the whole maintenance fleet
    - Anti-icing system planned for 12th Ave N bridge, plumbing going in when the bridge is redone (slated for 2009)
- Moorhead
    - No change

Architecture Changes

- MC01 Maintenance and Construction Vehicle and Equipment Tracking
- MC05 Roadway Automated Treatment

Emergency Management

Updates

- Digital Radio project slated for completion in December 2007
    - AVL on Fargo FD major apparatus already exists
    - AVL on other emergency vehicles planned (Fargo PD, Moorhead PD, and Moorhead FD)
    - Electronic dispatch for all emergency management agencies in the region
- Metro COG emergency planning activities

Architecture Changes

- EM01 Emergency Call-Taking and Dispatch
- EM08 Disaster Response and Recovery
- EM09 Evacuation and Reentry Management
- EM10 Disaster Traveler Information

Data Archival

Updates

- FM COG coordinating an effort to collect traffic volume/count data at signalized intersections using existing loops and cameras. Data are being archived at ATAC and will support the Regional Travel Model as well as operational analysis

Architecture Changes

- AD2 ITS Data Warehouse

1.0 INTRODUCTION

This document summarizes the results of the regional Intelligent Transportation architecture development for the Fargo-Moorhead Area. Intelligent Transportation Systems (ITS) refer to integrated applications of sensing, communications, computer processing, and electronics to enhance the transportation systems. The regional architecture (RA) provides a tool to guide future ITS planning, define system requirements, coordinate agency roles and integrate functions across jurisdictional lines.

The Fargo-Moorhead Regional Intelligent Transportation Systems (ITS) Architecture was prepared under the leadership of the Fargo-Moorhead Council of Governments (F-M COG). The goal of the F-M regional architecture (RA) is to guide the implementation of ITS systems in the F-M region and coordinate funding, deployment, information sharing, and operations of ITS systems in the region. The main ITS goal areas for the F-M region include enhanced traveler safety; effective traffic and transit management; coordinated incident management; and enhanced traveler information. A 15-year planning horizon was considered in the RA development.

The development of the RA was facilitated by the Advanced Traffic Analysis Center (ATAC) of the Upper Great Plains Transportation Institute at North Dakota State University. ATAC also facilitated the first RA update completed in 2007.

1.1 Report Organization

The F-M RA Report is organized into several main sections to facilitate the report use. In addition, an electronic file has been prepared using Turbo Architecture 4.0 in order to access the architecture and make changes or future updates.

Below is a listing of the remaining sections of this report and a brief description of each section:

2	Scope and Region	Identifies the geographical and architecture scope
3	Stakeholders	Agencies participating in the architecture
4	System Inventory	Existing and planned ITS systems
5	Needs and ITS Services	ITS user services and market packages
6	Operational Concept	Roles and responsibilities of participating agencies
7	Potential Agreements	Regional agreements to facilitate integration
8	Functional Requirements	High-level description of what the systems will do
9	Interface Requirements	Shows systems interconnections and information flows
10	ITS Standards	Brief discussion of applicable ITS standards
11	Sequence of Projects	Time-frame for ITS projects
	Appendix A	Market Packages and Information Flows
	Appendix B	Functional Requirements

2.0 REGION AND SCOPE

This section describes the geographical characteristics of the F-M region. It also discusses the scope of the regional architecture (RA), providing a high-level outline of the range of ITS services and systems used.

2.1 Geographical Boundaries

The geographical areas included in the F-M RA primarily consisted of the F-M COG's metropolitan boundaries, which are also included in the F-M COG's transportation planning activities. Figure 1 shows a map of the region. Major jurisdictions within the region include:

1. City of Fargo, North Dakota
2. City of Moorhead, Minnesota
3. City of West Fargo, North Dakota
4. City of Dilworth, Minnesota
5. Cass County, North Dakota
6. Clay County, Minnesota

In addition, the North Dakota Department of Transportation (NDDOT) is responsible for operating and maintaining the state system within Fargo, including sections of two major Interstate highways (I-29 and I-94). The NDDOT also operates several traffic signals, primarily located at Interstate ramps. Similarly, the Minnesota Department of Transportation (MnDOT) is responsible for operating the state system on the Minnesota side as well as traffic signal operations in Moorhead and Dilworth.

2.2 Scope of the RA

The scope of the F-M RA may be defined using broad ITS user services targeted for deployment within the region. The delineation of relevant ITS user services assisted in identifying relevant stakeholders and corresponding systems to be included in the RA. The range of ITS user services included the following:

1. Travel and Traffic Management
    a. Traffic control
    b. Traveler information
    c. Traffic surveillance
2. Public Transportation Management
    a. Fleet management (real-time information)
3. Incident Management
    a. Incident response coordination (integrated communications)
4. Information Management
    a. Data archival and analysis services
5. Maintenance and Construction Management
    a. Automated treatment (anti-icing systems)
    b. Winter maintenance
    c. Work zone and road closure management

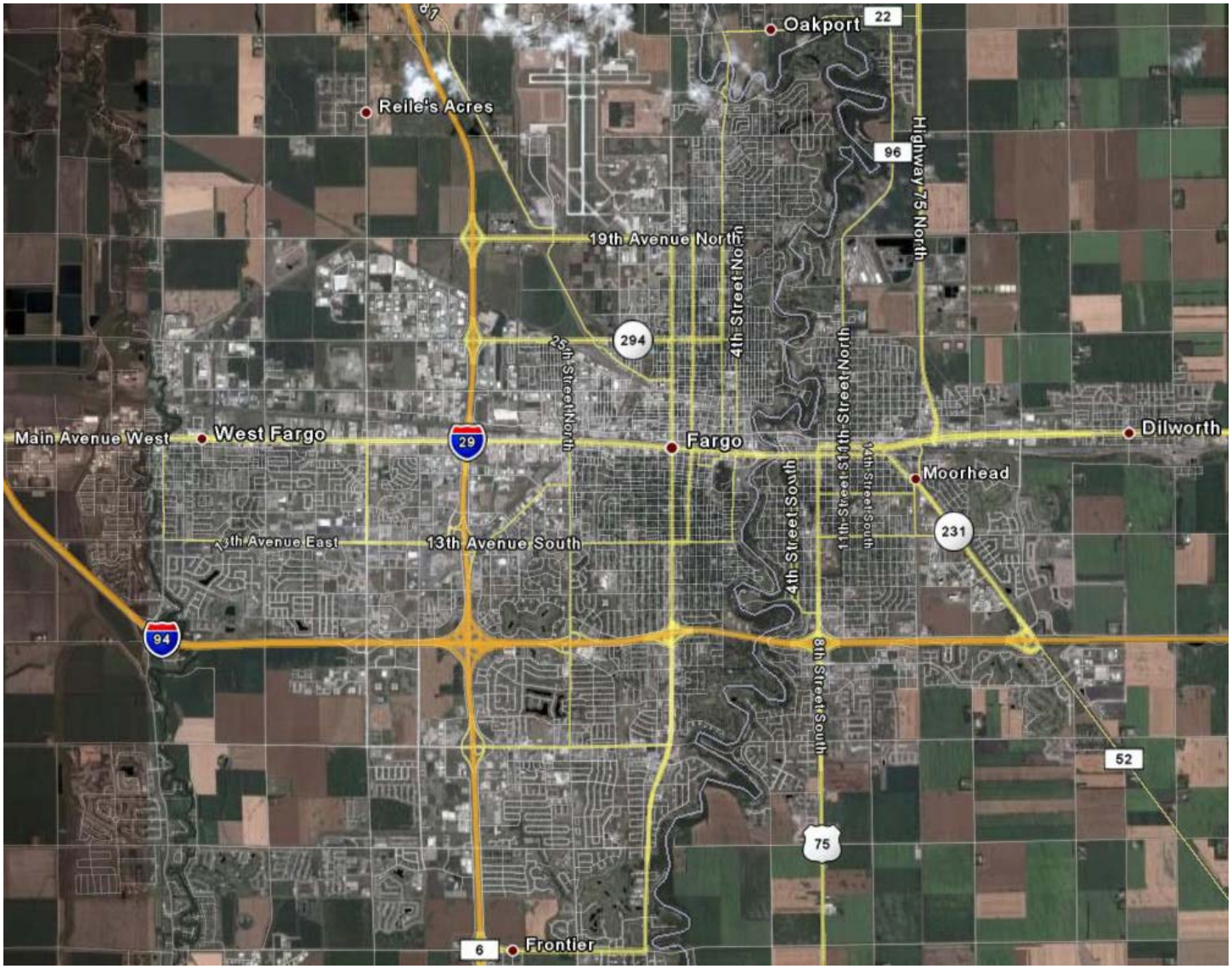


Figure 1 Map of the Fargo-Moorhead Region (Google Earth)

3.0 STAKEHOLDERS

The development of the F-M RA was guided by several stakeholder groups. An ITS Architecture Core Group had the primarily role of supporting the RA development, providing needed data, and reviewing architecture relationships. This group mainly of representatives from agencies who currently (or will) own, operate, or maintain ITS in the F-M area. Other stakeholders in the region were involved in identifying regional needs, developing roles and responsibilities, and supporting the RA (Table 3.1). Table 3.2 lists stakeholders mapped to the F-M RA and identifies corresponding ITS elements.

Table 3.1 Fargo Moorhead Regional Stakeholders

Name		Organization	Telephone
Anderson	Greg	Moorhead Police Department	(701) 299-5117
Benning	Paul	ND DOT Local Governments	(701) 328-2217
Bergquist	Bill	Clay County Sheriff	(218) 299-5151
Berndt	Keith	Cass County Engineering	(701) 282-2047
Bommelman	Julie	Fargo Transit	(701) 241-8140
Bright	Robert	Metro COG	(701) 232-3242 ext. 32
Brungardt	Chris	West Fargo Public Works	(701) 282-2408
Busek	Steve	FHWA, ND Division	(701) 250-4343 ext.112
Colvin	Kathy	RRRDC	(701) 451-7684
Dahle	Todd	Fargo Police Department	(701) 241-1401
Gilbertson	Troy	NDDOT-Fargo Division	(701) 241-8900
Gorden	Jeremy	Fargo Traffic Engineering	(701) 241-1529
Hentges	Bruce	MN State Patrol	(218) 847-1527
Hewitt	Joel	Moorhead Fire Department	(218) 299-5432
Johnson	Mark	FHWA, ND Division	(701) 250-4343 ext. 105
Kline	Wade	Metro COG	(701) 232-3242 ext. 34
Landstrom	Lyle	NDDOT-Fargo Division	(701) 239-8972
Laney	Paul	Cass Co Sheriff's Department	(701) 241-5800
Martin	Chad	Moorhead Public Works	(218) 299-5421
Miller	David	Dilworth Police Department	(218) 287-2666
Prochniak	Jim	NDHP	(701) 239-8960
Redig	Dennis	MnDot-District 4	(218) 846-3600
Reitan	Mike	West Fargo Police Department	(701) 282-4154
Rogness	Dave	Cass Co Emergency Management	(701) 239-6790
Schuh	Larry	Fargo Fire Department	(701) 241-8129
Swenson	Tom	MnDot-District 4	(218) 846-3600
VanBeek	Lori	Moorhead Transit	(218) 299-5370
Weigel	Al	Fargo Public Works	(701) 241-1453
Zimmerman	Bob	City of Moorhead Engineering	(218) 299-5390

Table 3.2 Fargo-Moorhead ITS Stakeholders		
Stakeholder	**Description**	**Associated ITS Elements**
ATAC	Advanced Traffic Analysis Center at North Dakota State University	ATAC data warehouse
County Sheriffs	Cass County and Clay County Sheriff Departments	County Sheriff Vehicles
Fargo Engineering	City of Fargo Engineering Department	Fargo TOC Fargo Engineers Fargo TOC Roadside Equipment
Fargo FD	Fargo Fire Department	Fargo FD Vehicles
Fargo PD	Fargo Police Department	Fargo PD Vehicles
Fargo PW	Fargo Public Works Department	Fargo PW Operations Center Fargo PW Personnel Fargo PW Roadside Equipment Fargo PW Vehicle
FM Ambulance	Ambulance service for the Fargo Moorhead area	FM Ambulance Vehicles
FM Event Venus	Fargodome Fargo Civic Center	Event Promoters
FM Emergency Mgmt	Cass and Clay counties Emergency Management Centers	FM EOC
MAT	Fargo-Moorhead Metro Area Transit	MAT Bus Drivers GTC MAT Vehicles MAT Kiosks MAT Traveler Card MAT Operators
MnDOT D4	MnDOT District 4	MnDOT D4 TOC MnDOT D4 Personnel MnDOT D4 TOC Roadside Equipment MnDOT D4 Maintenance Vehicles
Moorhead FD	Moorhead Fire Department	Moorhead FD Vehicles
Moorhead PD	Moorhead Police Department	Moorhead PD Vehicles
Moorhead PW	Moorhead Public Works	Moorhead Public Works Operations Center Moorhead PW Vehicles Moorhead PW Roadside Equipment Moorhead PW Personnel
MSP DL	Minnesota State Patrol Detroit Lakes District	MSP DL Vehicles MSP DL District
ND Division of Emergency Management	North Dakota Division of Emergency Management	State Radio
NDDOT	NDDOT Fargo District	NDDOT TOC Roadside Equipment NDDOT TOC NDDOT TOC Personnel NDDOT TOC Maintenance Vehicles
NDHP	North Dakota Highway Patrol - Fargo	NDHP Vehicles

RRRDC Regional Partners Moorhead PD County Sheriffs Fargo PD Fargo FD FM Ambulance Moorhead FD	Red River Regional Dispatch Center	RRRDC Operators RRRDC

4.0 SYSTEM INVENTORY

This section summarizes the results of the system inventory process for the F-M RA. Information developed for the inventory was obtained through extensive input from stakeholders. Survey instruments, interviews, and small group meetings were used to obtain and verify the inventory information. Follow up interviews were conducted to identify changes for the RA update.

To facilitate the inventory process, the types of systems to be included in the inventory were defined using the National ITS Architecture. More emphasis was placed on the Physical Architecture since it contains most of the ITS hardware. However, additional information about the services provided by various physical ITS entities was also collected. Further, systems were categorized into existing or planned, with planned referring to systems, components, or services which have been identified for future deployment in the region.

Using the Physical Architecture, four types of entities were identified for the F-M region:

1. Centers
2. Field Devices
3. Vehicles
4. Communications

These entities are explained in greater details in the following subsections. A summary of the F-M area ITS inventory as coded in the Turbo Architecture database is provided in section 4.5.

4.1 F-M Centers

These are the locations where functions are performed (i.e., process information, issue control commands, and produce output information). There are 10 possible centers in the National ITS Architecture that provide management, administrative, and support functions for the transportation system. The center subsystems each communicate with other centers to enable coordination between modes and across jurisdictions. Out of the 10 possible centers, six were found to apply to the F-M RA. A representation of the F-M area Physical Architecture is shown in Figure 2.

4.1.1 Traffic Management Center

The Traffic Management Center (subsystem) monitors and controls traffic and the road network. It communicates with the Roadway Subsystem to monitor and manage traffic flow and monitor the condition of the roadway, surrounding environmental conditions, and field equipment status.

Traffic management activities within the F-M area have increased over the last few years. However these activities are partial to the main corridors in the area. Below are specific traffic management systems within the F-M area classified by agency.

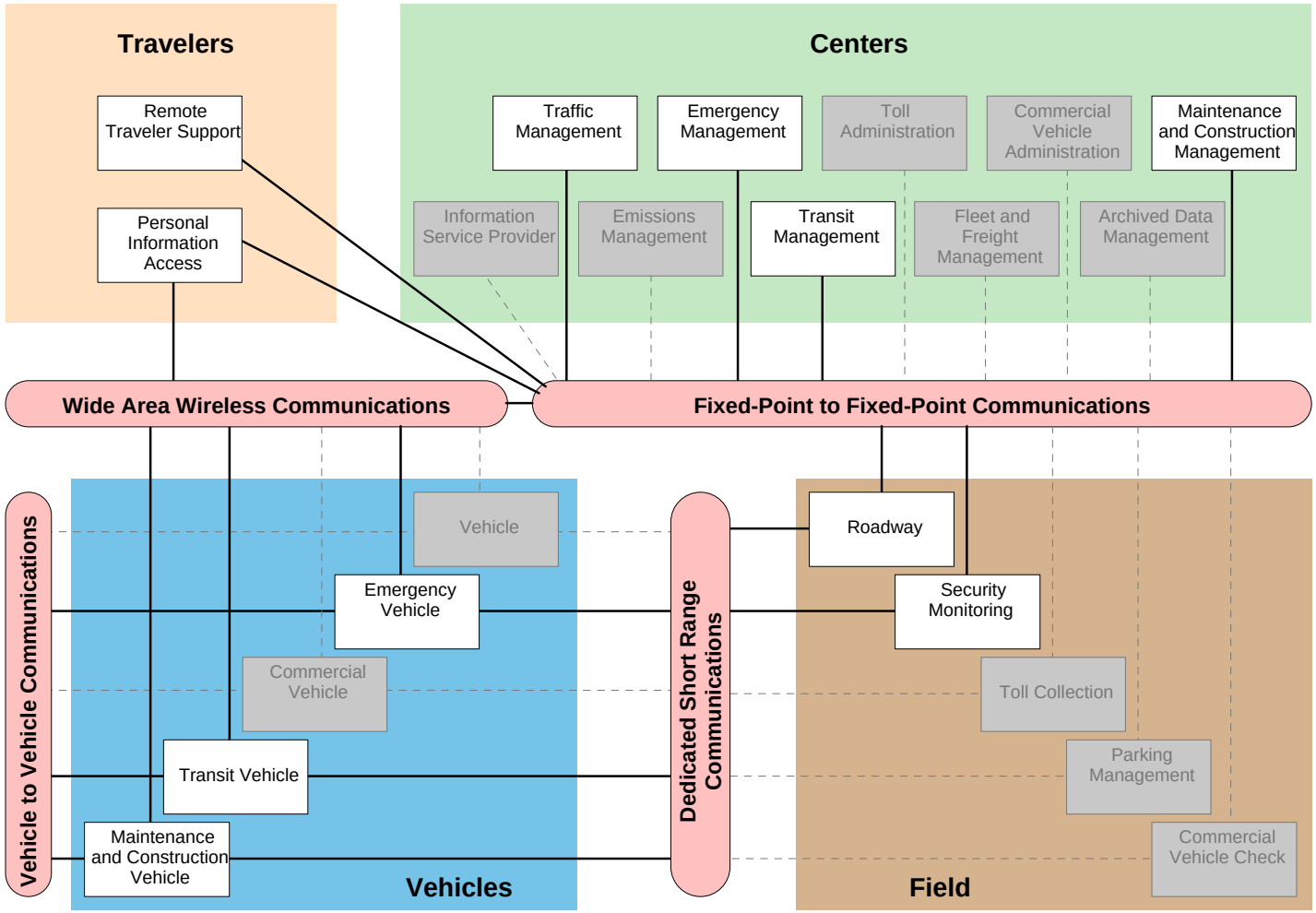


Figure 2 Fargo-Moorhead Physical Architecture

NDDOT Traffic Operations Center (TOC)

The NDDOT Fargo District has been actively deploying ITS technologies along the two major Interstate segments of I-29 and I-94 in Fargo. The District has been planning for the TOC to serve as a focal point for collecting information about system operations, actively managing the system, and coordinating traffic operations and information with the City of Fargo. Currently the TOC receives information from video camera on I-29 and I-94 and handles traffic signal operations for Interstate ramps in the Fargo area. It can also broadcast traveler information via permanent and portable dynamic message signs (DMS), local media, and a traveler information web page.

City of Fargo Traffic Signal System

The City of Fargo maintains a modern traffic signal control system which consists of approximately 180 signals. Most of these signals have communication capabilities using dial-up modems as well as fiber and twisted pair for closed-loop systems. The city uses software to facilitate effective traffic signal control management, facilitate traffic data collection, and support traffic flow analysis.

4.1.2 Emergency Management Center

The Red River Regional Dispatch Center (RRRDC) is among the few examples nationwide of coordinated dispatch centers. The RRRDC provides dispatch services to the cities of Fargo and Moorhead, as well as Cass and Clay Counties. It also coordinates emergency management with the North Dakota Highway Patrol (NDHP), the Minnesota State Patrol (MPS), and other local law enforcement. The RRRDC is located in a state-of-the-art facility which contains secure communications, computer-aided dispatch, and other support systems.

In addition to the RRRDC, each jurisdiction within the F-M area maintains an Emergency Operations Center (EOC). The EOC brings together law enforcement, fire, emergency management, and public works agencies to coordinate emergencies. These EOCs currently rely on traditional phone line communications for sharing information, i.e., they have little or no ITS. The F-M COG is in the process of integrating emergency planning into their transportation master plan and within the process ITS has been identified as a valuable asset and appropriate emergency management market packages were incorporated into the RA in this update.

4.1.3 Maintenance and Construction Management Center

Currently there are four entities which handle Maintenance and Construction Management (MCO) in the F-M area, including: Fargo Public Works, Moorhead Public Works, NDDOT, and MnDOT. The NDDOT will in the future coordinate its MCO activities through the TOC. It has the most significant equipment and systems in place to allow for MCO. NDDOT partnered with MnDOT and jointly deployed an automated anti-icing system on the Red River Bridge on I-94. Other agencies are adding fleet management capabilities.

4.1.4 Information Service Provider

Functions associated with an Information Service Provider (ISP) are currently provided through multiple agencies in the F-M region. The NDDOT TOC is planned to coordinate traveler information dissemination especially for the freeway system. This includes providing video snapshots at key locations and issuing road condition advisories for winter weather conditions.

4.1.5 Transit Management Center

The Metro Area Transit (MAT) provides public transportation services for the cities of Fargo and Moorhead. MAT operates several fixed routes in Fargo and Moorhead in addition to paratransit services. The Ground Transportation Center in Fargo provides the majority of support and management services, including a wireless system for downloading fare-box and bus data. MAT makes use of an automated fare box system which provides enhanced management capabilities, including revenue analysis, ridership analysis, and in the future planned GPS bus location for certain routes.

4.1.6 Archived Data Management Center

Several agencies currently collect data from ITS sensors. However, there currently is no single center for archiving or processing these data. The Advanced Traffic Analysis Center (ATAC) at North Dakota State University has been designated as the future Data Warehouse entity for the F-M area. A fiber optics communication link between the City of Fargo and ATAC exists to facilitate data transfer and access however data is only transferred manually at this point.

4.2 F-M Field Devices

This type of physical entities refers to field devices used to support ITS systems. The majority of field devices in the F-M area may be classified under the Roadway Subsystem. Below is a listing of these devices by agency.

4.2.1 NDDOT Field Devices

1. Sensors
    a. Weather
        i. RWIS and Surface sensors located on I-94
2. Traffic
    a. Video traffic detectors
    b. Loop detectors
3. Surveillance/monitoring
    a. Several PTZ video cameras
4. Control devices
    a. Traffic signal controllers
5. Warning/advisory devices
    a. Permanent DMS on I-29 7th Ave N and 52nd Ave S (planned)
    b. Portable DMS where needed
6. Roadway treatment devices
    a. Red River Bridge automated anti-icing system

b. 12th Ave N Bridge (planned)

4.2.2 City of Fargo and City of West Fargo Field Devices

1. Sensors
    a. Traffic
    b. Video traffic detectors
    c. Loop detectors
2. Control devices
    a. Traffic signal controllers
3. Surveillance/monitoring
    a. City of Fargo is rolling out 15 PTZ video cameras in 2008

4.2.3 City of Moorhead/MnDOT Field Devices

1. Sensors
    a. Traffic
        i. Loop detectors
    b. Other
        i. Radar train detector for supporting Moorhead Area Train Detection and Traffic Control System
2. Control devices
    a. Traffic signal controllers
3. Warning/advisory devices
    a. Permanent DMS on I-94 and Hwy 336

4.3 F-M Vehicles

There are three types of vehicles included in the F-M RA. Only vehicles with existing or planned ITS capabilities are included, i.e., vehicles with advanced communications, navigations, monitoring, and control systems.

1. Emergency Vehicle for Fargo, Moorhead, Cass County, and Clay County
    a. Fire (planned)
    b. Law enforcement (existing plus planned)
    c. Ambulance (planned)
2. Transit Vehicle
    a. MAT buses with electronic fare box (existing)
3. MCO vehicles for NDDOT and Fargo
    a. Snowplows equipped with AVL (existing plus planned)

4.4 F-M Communication Infrastructure

Below is a brief description of existing and planned communication infrastructure in the F-M area. It should be noted that this infrastructure has been agency-specific so far with little integration. However, more integration activities are expected in the future as the F-M RA is implemented.

1. Fiber
    a. I-29 and I-94 (NDDOT)

    b. Arterial network (Fargo)
2. Phone drops (dial-up)
    a. Fargo traffic signals
    b. Moorhead traffic signals
3. Wireless/cellular
    a. Moorhead train detection system
    b. NDDOT portable DMS

4.5 Summary of F-M ITS Inventory

Entity	Element Name	Status	Element Description	Stakeholder Name
Alerting and Advisory Systems	State Radio	Existing	ND State Radio	ND Division of Emergency Management
Archived Data Management	ATAC data warehouse	Planned	Advanced Traffic Analysis Center	ATAC
Basic Vehicle	Basic Vehicle	Existing	Terminator	
Driver	Driver	Existing	Terminator	
Emergency Management	RRRDC	Existing	Red River Regional Dispatch Center	RRRDC Regional Partners
	State Radio	Existing	ND State Radio	ND Division of Emergency Management
	MSP DL District	Existing	Minnesota State Patrol Detroit Lakes district	MSP DL
	FM Emergency Management	Existing	Cass and Clay counties Emergency Operations Centers	FM Emergency Mgmt
Emergency System Operator	RRRDC Operators	Existing	RRRDC Operators	RRRDC Regional Partners
Emergency Vehicle Subsystem	FM Ambulance Vehicles	Existing	FM Ambulance vehicles	FM Ambulance
	Fargo PD Vehicles	Existing	Fargo Police Department Vehicles	Fargo PD
	Moorhead PD Vehicles	Existing	Moorhead Police Department Vehicles	Moorhead PD
	County Sheriff Vehicles	Existing	Cass and Clay county sheriff vehicles	County Sheriffs
	NDHP Vehicles	Existing	NDHP vehicles	NDHP
	MSP DL Vehicles	Existing	Minnesota State Patrol Detroit Lakes district vehicles	MSP DL
	Fargo FD Vehicles	Existing	Fargo Fire Department vehicles	Fargo FD
	Moorhead FD Vehicles	Existing	Moorhead Fire Department vehicles	Moorhead FD
Event Promoters	Event Promoters	Existing	Fargo Dome, Civic Center, other venues	FM Event Venus
Maintenance and Construction Center Personnel	NDDOT TOC Personnel	Existing	NDDOT traffic/maintenance and construction engineers	NDDOT
	MnDOT D4 Personnel	Existing	MnDOT traffic/maintenance and construction engineers	MnDOT D4
	Fargo PW Personnel	Existing	Fargo Public Works operations personnel	Fargo PW
	Moorhead PW Personnel	Existing	Moorhead Public Works operations personnel	Moorhead PW

Maintenance and Construction Management	Fargo PW Operations Center	Existing	Fargo Public Works	Fargo PW
	NDDOT TOC	Existing	NDDOT Traffic Operations Center. Handles freeway management and maintenance and construction functions	NDDOT
	MnDOT D4 TOC	Existing	MnDOT District 4 Traffic Operations Center	MnDOT D4
	Moorhead PW Operations Center	Existing	Moorhead Public Works	Moorhead PW
Maintenance and Construction Vehicle	Fargo PW Vehicle	Existing	Fargo Public Works vehicles, snow plows, and other maintenance vehicles	Fargo PW
	Moorhead PW Vehicles	Existing	Moorhead Public Works vehicles, snow plows, and other maintenance vehicles	Moorhead PW
	MnDOT D4 Maintenance Vehicles	Existing	MnDOT D4 snow plows and other maintenance vehicles	MnDOT D4
	NDDOT TOC Maintenance Vehicles	Existing	NDDOT snow plows and other maintenance vehicles	NDDOT
Media	Media	Existing	Terminator	
Other Roadway	Other Roadway	Existing	Terminator	
Pedestrians	Pedestrians	Existing	Terminator	
Personal Information Access	User Personal Computing Devices	Planned	User Personal Computing Devices	
Remote Traveler Support	MAT Kiosks	Planned	MAT Kiosks	MAT
Roadway Subsystem	NDDOT TOC Roadside Equipment	Existing	NDDOT roadside monitoring and control equipment	NDDOT
	Fargo TOC Roadside Equipment	Existing	Fargo roadside monitoring and control equipment	Fargo Engineering
	MnDOT D4 TOC Roadside Equipment	Existing	MnDOT D4 traffic sensors and control devices	MnDOT D4
	Fargo PW Roadside Equipment	Planned	Fargo Public Works roadside equipment	Fargo PW
	Moorhead PW Roadside Equipment	Planned	Moorhead Public Works roadside equipment	Moorhead PW
Traffic	Traffic	Existing	Terminator	

Traffic Management	Fargo TOC	Existing	Fargo Surface Street Traffic Management Center	Fargo Engineering
	NDDOT TOC	Existing	NDDOT Traffic Operations Center. Handles freeway management and maintenance and construction functions	NDDOT
	MnDOT D4 TOC	Existing	MnDOT District 4 Traffic Operations Center	MnDOT D4
Traffic Operations Personnel	Fargo Engineers	Existing	Fargo TOC Engineers	Fargo Engineering
	NDDOT TOC Personnel	Existing	NDDOT traffic/maintenance and construction engineers	NDDOT
	MnDOT D4 Personnel	Existing	MnDOT traffic/maintenance and construction engineers	MnDOT D4
Transit Management	GTC	Existing	Fargo-Moorhead Metropolitan Area Transit's Ground Transportation Center	MAT
Transit System Operators	MAT Operators	Existing	MAT Personnel	MAT
	MAT Bus Drivers	Existing		MAT
Transit Vehicle Subsystem	MAT Vehicles	Existing	MAT buses	MAT
Traveler	Traveler	Existing	MAT users	
Traveler Card	MAT Traveler Card	Existing	MAT fare cards	MAT

5.0 NEEDS AND SERVICES

This section describes the ITS user services selected for the F-M area. These services were identified from previous ITS planning efforts and from stakeholders input throughout the RA development. To facilitate the discussions with the stakeholders, the results from the inventory were used to identify corresponding ITS user services from the National Architecture. Additional ITS user services were added to address current and future regional needs and priorities. The list of user services was revisited and updated for the RA maintenance completed in 2007.

5.1 Needs

The process of identifying the F-M regional needs consisted of 1) using output from the Fargo-Moorhead Metropolitan ITS Plan, 2) updating ITS project deployment since the plan was developed in 1998, and 3) seeking input from stakeholders on additional needs or issues. Stakeholders were extensively involved in updating the status of ITS projects identified in the ITS plan as well as identify new projects and applications given their experience over the past five years since the plan was developed.

Generally, the F-M area enjoys a well-developed transportation system which supports the mobility needs of individuals and businesses in the area. Several major transportation projects which greatly expanded the system's capacity have either been completed over the last few years or are currently underway. These projects came in response to the significant growth in the area and local agencies' plan to respond to future demands.

F-M regional transportation needs relevant to the RA development may be classified into the following major areas:

1. Improve traffic operations and safety
    a. Peak-period traffic management
    b. Incident traffic management
    c. Special events traffic management
    d. Work-zone and road construction management
    e. Winter weather impact management
2. Enhance tools for system monitoring and management
    a. Better system performance data
3. Enhance traveler information and customer service
4. Enhance transit operations to improve service and increase transit use
5. Coordinate emergency and security management

5.2 Services

Potential F-M ITS services were identified by mapping regional transportation needs to the National ITS Architecture. Stakeholders assisted in customizing potential ITS User Services and corresponding market packages to reflect regional needs. Subsection 5.2.1

provides a summary of the ITS User Services identified for the F-M area while Subsection 5.2.2 outlines the F-M area's Market Packages.

5.2.1 F-M ITS User Services

1. Travel and Traffic Management

1.1.Pre-trip Travel Information: Assist travelers in making mode choices, travel time estimates, and route decisions prior to trip departure. Pre-trip information can be provided via web, information hot lines (511), etc.

1.2. En-route Driver Information: Provide information, such as alternative routes to destination, to vehicle drivers while en-route.

1.6. Traffic Control: Provide functions to efficiently manage the movement of traffic on streets and highways.

1.7. Incident Management: Identify incidents, such as flooded underpasses, icy bridges, special events (4th of July) etc., formulate response actions, and support initiation and ongoing coordination of response actions.

1.10. Highway Rail Intersection: Control highway and rail traffic in at-grade HRIs

2. Public Transportation Management

2.1. Public Transportation Management: Provide automatic vehicle tracking and guiding, in-vehicle personnel management, dynamic transit vehicle scheduling.

2.2. En-route Transit Information: Provide travelers with real-time transit and high-occupancy vehicle information allowing travel alternatives to be chosen once the traveler is en-route.

2.4. Public Travel Security: Create a secure environment for public transportation patrons and operators.

5. Emergency Management

5.1. Emergency Notification and Personal Security: Notify appropriate emergency response personnel regarding the need for assistance due to emergency or non emergency situation.

5.2. Emergency Vehicle Management: Include an emergency vehicle management system which provides vehicle location and advanced communications.

5.3. Disaster Response and Recovery: Enhance the ability of the transportation system to respond to disasters.

7. Information Management

7.1. Archived Data Function: Control the archiving and distribution of ITS data.

8. Maintenance and Construction Management

8.1. Maintenance and Construction Operations: Provide functions to support monitoring, operating, maintaining, improving and managing physical roadway conditions, such as, icy bridges.

5.2.2 F-M Market Packages

The following Market Packages were identified for the F-M region in order to support its needs and services. The descriptions are based on information from the National ITS Architecture. The status of each Market Package in the F-M area is also indicated (i.e., existing or planned. Market Packages with an Existing followed by the * indicates there are portions of the Market Package already deployed in the F-M area but additional portions are planned for deployment. Customized F-M Market Packages and associated Information Flows are shown in more detail in Appendix A.

ATMS01: Network Surveillance (Existing *)

This market package includes traffic detectors, other surveillance equipment, supporting field equipment, and fixed-point to fixed-point communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Subsystem). The data generated by this market package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning.

ATMS03: Surface Street Control (Existing *)

This market package provides the central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management. Traffic signal control systems represented by this market package range from fixed-schedule control systems to fully traffic-responsive. Additionally, general advisory and traffic control information can be provided to the driver while en route. Systems that achieve coordination across jurisdictions by using a common time-base or other strategies that do not require real time coordination would be represented by this package. This market package is consistent with typical urban traffic signal control systems.

ATMS04: Freeway Control (Existing *)

This market package provides the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways. This package is consistent with typical urban traffic freeway control systems. It incorporates the instrumentation included in the Network Surveillance Market Package to support freeway monitoring and adaptive strategies as an option. This market package also includes the capability to utilize surveillance information for detection of incidents. Typically, the processing would be performed at a traffic management center; however, developments might allow for point detection with

roadway equipment. Additionally, this market package allows general advisory and traffic control information to be provided to the driver while en route.

ATMS06: Traffic Information Dissemination (Existing *)

This market package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, incident information, emergency alerts and driver advisories. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media, Transit Management, Emergency Management, and Information Service Providers. A link to the Maintenance and Construction Management subsystem allows real time information on road/bridge closures due to maintenance and construction activities to be disseminated.

ATMS07: Regional Traffic Control (Planned)

This market package provides for the sharing of traffic information and control among traffic management centers to support a regional traffic control strategy. This market package advances the Surface Street Control and Freeway Control Market Packages by adding the communications links and integrated control strategies that enable integrated inter-jurisdictional traffic control. Several levels of coordination are supported from sharing of information to sharing of control between traffic management centers.

ATMS08: Traffic Incident Management System (Planned)

This market package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. It includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as event promoters. This market package supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between center subsystems. Incident response also includes presentation of information to affected travelers. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds.

ATMS13: Standard Railroad Grade Crossing (Existing *)

This market package manages highway traffic at highway-rail intersections (HRIs) where speeds are below 80 mph, using passive and active warning systems. Traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by wayside equipment of an approaching train. The equipment at the

HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities.

ATMS19: Speed Monitoring (Existing *)

This market package monitors the speeds of vehicles traveling through a roadway system. If the speed is determine to be excessive, roadside equipment can suggest a safe driving speed. Environmental conditions may be monitored and factored into the safe speed advisories that are provided to the motorist. This service can also support notifications to an enforcement agency to enforce the speed limit on a roadway system.

MC01: Maintenance and Construction Vehicle and Equipment Tracking (Existing *)

This market package will track the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities. These activities can include ensuring the correct roads are being plowed and work activity is being performed at the correct locations.

MC05: Roadway Automated Treatment (Existing)

This market package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments include fog dispersion, anti-icing chemicals, etc. The market package includes the environmental sensors that detect adverse conditions, the automated treatment system itself, and driver information systems (e.g., dynamic message signs) that warn drivers when the treatment system is activated.

MC06: Winter Maintenance (Existing)

This market package supports winter road maintenance including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and other snow and ice control activities. This package monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities, determine the appropriate snow and ice control response, and track and manage response operations.

MC08: Work Zone Management (Planned)

This market package directs activity in work zones, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traffic management centers) for better coordination management. Work zone speeds and delays are provided to the motorist prior to the work zones.

APTS01: Transit Vehicle Tracking (Planned)

This market package monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real time schedule adherence and update the transit system's schedule in real-time. A two-way wireless communication link with the Transit Management Subsystem is used for relaying vehicle position and control measures. The Transit Management

Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider.

APTS02: Transit Fixed-Route Operations (Existing *)

This market package performs vehicle routing and scheduling, as well as automatic operator assignment and system monitoring for fixed-route and flexible-route transit services. This service determines current schedule performance using AVL data and provides information displays at the Transit Management Subsystem. Static and real time transit data is exchanged with Information Service Providers where it is integrated with data from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic schedules.

APTS04: Transit Fare Collection Management (Existing)

This market package manages passenger loading and fare payments onboard transit vehicles using electronic means. It allows transit users to use a traveler card or other electronic payment device. Sensors mounted on the vehicle permit the operator and central operations to determine vehicle loads, and readers located onboard the transit vehicle allow electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem.

APTS05: Transit Security (Existing)

This market package provides for the physical security of transit passengers and transit vehicle operators. Onboard equipment (video, audio equipment, and/or event recorder systems) is deployed to perform surveillance and sensor monitoring in order to warn of potentially hazardous situations.. Transit user or transit vehicle operator activated alarms are provided onboard. Public areas and non-public transit facilities are also monitored. Onboard alarms, activated by transit users or transit vehicle operators are transmitted to both the Emergency Management Subsystem and the Transit Management Subsystem.

APTS09: Transit Signal Priority (Existing*)

This market package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading the overall performance of the traffic network. Local coordination between the transit vehicle and the intersection for signal priority is also supported by this package.

APTS10: Transit Passenger Counting (Existing)

This market package counts the number of passengers entering and exiting a transit vehicle using sensors mounted on the vehicle and communicates the collected passenger data back to the management center. The collected data can be used to calculate reliable ridership figures and measure passenger load information at particular stops.

EM01: Emergency Call-Taking and Dispatch (Existing)

This market package provides basic public safety call-taking and dispatch services. It includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Subsystems supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Subsystem and an Emergency Vehicle supports dispatch and provision of information to responding personnel.

EM02: Emergency Routing (Existing)

This market package supports automated vehicle location and dynamic routing of emergency vehicles. Traffic and road conditions are provided to enhance emergency vehicle routing. Special priority can be coordinated to improve the safety and time-efficiency of responding vehicles. The Emergency Management Subsystem provides the routing for the emergency fleet based on real-time conditions and has the option of requesting a route from the Traffic Management subsystem. The Emergency Vehicle may also be equipped with dedicated short-range communications for local signal preemption.

EM06: Wide-Area Alert (Existing)

This market package uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather events, civil emergencies, and other situations that pose a threat to life and property. The alert includes information and instructions for transportation system operators and the traveling public, improving public safety and enlisting the public's help in certain scenarios. ITS technologies supplement and support other emergency and homeland security alert systems such as the Emergency Alert System (EAS). When an emergency situation is reported and verified and the terms and conditions for system activation are satisfied, a designated agency broadcasts emergency information to traffic agencies, transit agencies, information service providers, toll operators, and others that operate ITS systems. The ITS systems, in turn, provide the alert information to transportation system operators and the traveling public using ITS technologies such as dynamic message signs, highway advisory radios, in-vehicle displays, transit displays, 511 traveler information systems, and traveler information websites.

EM08: Disaster Response and Recovery (Planned)

This market package enhances the ability of the surface transportation system to respond to and recover from disasters. It addresses the most severe incidents that require an extraordinary response from outside the local community. All types of disasters are addressed including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and national security emergencies such as nuclear, chemical, biological, and radiological weapons attacks).

The market package supports coordination of emergency response plans, including general plans developed before a disaster as well as specific tactical plans with short time horizon that are developed as part of a disaster response. The market package provides enhanced access to the scene for response personnel and resources, provides better information about the transportation system in the vicinity of the disaster, and maintains situation awareness regarding the disaster itself. In addition, this market package tracks and coordinates the transportation resources - the transportation professionals, equipment, and materials - that constitute a portion of the disaster response.

The market package identifies the key points of integration between transportation systems and the public safety, emergency management, public health, and other allied organizations that form the overall disaster response. In this market package, the Emergency Management subsystem represents the federal, regional, state, and local Emergency Operations Centers and the Incident Commands that are established to respond to the disaster. The interface between the Emergency Management Subsystem and the other center subsystems provides situation awareness and resource coordination among transportation and other allied response agencies. In its role, traffic management implements special traffic control strategies and detours and restrictions to effectively manage traffic in and around the disaster. Maintenance and construction provides damage assessment of road network facilities and manages service restoration. Transit management provides a similar assessment of status for transit facilities and modifies transit operations to meet the special demands of the disaster. As immediate public safety concerns are addressed and disaster response transitions into recovery, this market package supports transition back to normal transportation system operation, recovering resources, managing on-going transportation facility repair, supporting data collection and revised plan coordination, and other recovery activities.

EM09: Evacuation and Reentry Management (Planned)

This market package supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. The market package addresses evacuations for all types of disasters, including disasters like hurricanes that are anticipated and occur slowly, allowing a well-planned orderly evacuation, as well as disasters like terrorist acts that occur rapidly, without warning, and allow little or no time for preparation or public warning.

This market package supports coordination of evacuation plans among the federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation. All affected jurisdictions (e.g., states and counties) at the evacuation origin, evacuation destination, and along the evacuation route are informed of the plan. Information is shared with traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. Reversible lanes, shoulder use, closures, special signal control strategies, and other special strategies may be implemented to maximize capacity along the evacuation routes. Transit resources play an important role in

an evacuation, removing many people from an evacuated area while making efficient use of limited capacity. Additional shared transit resources may be added and managed in evacuation scenarios. Resource requirements are forecast based on the evacuation plans, and the necessary resources are located, shared between agencies if necessary, and deployed at the right locations at the appropriate times.

EM10: Disaster Traveler Information (Planned)

This market package uses ITS to provide disaster-related traveler information to the general public, including evacuation and reentry information and other information concerning the operation of the transportation system during a disaster. This market package collects information from multiple sources including traffic, transit, public safety, emergency management, shelter provider, and travel service provider organizations. The collected information is processed and the public is provided with real-time disaster and evacuation information using ITS traveler information systems.

A disaster will stress the surface transportation system since it may damage transportation facilities at the same time that it places unique demands on these facilities to support public evacuation and provide access for emergency responders. Similarly, a disaster may interrupt or degrade the operation of many traveler information systems at the same time that safety-critical information must be provided to the traveling public. This market package keeps the public informed in these scenarios, using all available means to provide information about the disaster area including damage to the transportation system, detours and closures in effect, special traffic restrictions and allowances, special transit schedules, and real-time information on traffic conditions and transit system performance in and around the disaster.

This market package also provides emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times, and instructions are provided. Available evacuation routes and destinations and current and anticipated travel conditions along those routes are provided so evacuees are prepared and know their destination and preferred evacuation route. Information on available transit services and traveler services (shelters, medical services, hotels, restaurants, gas stations, etc.) is also provided. In addition to general evacuation information, this market package provides specific evacuation trip planning information that is tailored for the evacuee based on origin, selected destination, and evacuee-specified evacuation requirements and route parameters.

AD2: ITS Data Warehouse (Planned)

This market package includes all the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests

additional on-line analysis and data mining features that are also included in this market package in addition to the basic query and reporting user access features offered by the ITS Data Mart.

6.0 OPERATIONAL CONCEPT

This section discusses the roles and responsibilities of stakeholders in the implementation and operation of the regional systems identified in the F-M RA. The operational concept outlines these roles and responsibilities for specific scenarios, e.g., traffic incidents, major winter storm, floods, etc. In addition to providing a snapshot of how things are done for a certain scenario, the operational concept explores additional integration opportunities in the region with particular focus on stakeholder involvement.

The roles and responsibilities discussion under the operational concept may be categorized into implementation roles and operational roles. Implementation roles include project development, coordination, funding, and future maintenance. Operational roles focus on the technical aspects of how ITS services are performed and explore information sharing amongst the various stakeholders.

The set of Market Packages for the F-M area was the vehicle used for facilitating the operational concept development. Using Market Package graphics, stakeholders were able to identify their roles for given events, current links with other stakeholders, and additional links and/or coordination that could be achieved.

The mechanism for obtaining stakeholders' input relied on using small groups of stakeholders relevant to each Market Package. Once the small group discussions were completed, the results (i.e., customized Market Packages) were presented to all the stakeholders participating in the RA development.

After the Market Packages were approved by the stakeholders, relevant changes were entered into Turbo Architecture. Turbo was used to generate the operational concept for each Market Package based on National ITS Architecture conventions. The operational concept report generated by Turbo focuses on roles and responsibilities pertaining to system operations and does not include implementation roles.

The following two subsections outline the roles and responsibilities developed for the F-M area. Subsection 6.1 shows implementation roles and responsibilities, arranged by Market Package. Subsection 6.2 summarizes operational roles and responsibilities, organized by stakeholders.

6.1 Implementation Roles

Market Packages	Stakeholders with Implementation Roles
Network Surveillance	NDDOT, Fargo, Moorhead
Surface Street Control	Fargo Engineering, Moorhead Engineering, MnDOT, NDDOT
Freeway Control	NDDOT
Traffic Information Dissemination	NDDOT
Regional Traffic Control	Fargo Engineering, Moorhead Engineering, MnDOT, NDDOT
Traffic Incident Management System	NDDOT, MnDOT
Standard Railroad Grade Crossing	Fargo Engineering, Moorhead Engineering, MnDOT
Speed Monitoring	NDDOT
Roadway Automated Treatment	Fargo PW, Moorhead PW, MnDOT, NDDOT
Winter Maintenance	Fargo PW, Moorhead PW, MnDOT, NDDOT
Work Zone Management	Fargo PW, NDDOT
Transit Vehicle Tracking	MAT
Transit Fixed-Route Operations	MAT
Transit Fare Collection Management	MAT
Transit Security	MAT
Transit Signal Priority	MAT, Fargo Engineering
Transit Passenger Counting	MAT
Emergency Call-Taking and Dispatch	RRRDC
Emergency Routing	Fargo Engineering, Moorhead Engineering, MnDOT, NDDOT
Disaster Response and Recovery	FM Emergency Management, RRRDC, ND Division of Emergency Management
Evacuation and Reentry Management	FM Emergency Management, RRRDC, ND Division of Emergency Management
Disaster Traveler Information	NDDOT, MnDOT, Fargo PW
Wide-Area Alert	Fargo PD, Moorhead PD, NDHP, MSP, RRRDC
ITS Data Warehouse	ATAC, Fargo Engineering, NDDOT

6.2 Operational Roles and Responsibilities

Responsibility Area	Stakeholder	Roles
Archived Data Systems	ATAC	1. Perform studies 2. Provide access to data 3. Store data
	Fargo Engineering	Collect and provide data to ATAC for archival
	NDDOT	Collect and provide data for archiving
Emergency Management	County Sheriffs	1. Coordinate with other law enforcement agencies 2. Respond to events in county jurisdictions
	Fargo PD	1. Coordinate with other law enforcement agencies 2. Respond to emergencies
	Moorhead PD	1. Coordinate with other law enforcement agencies 2. Respond to emergencies
	ND Division of Emergency Management	Issue Amber Alerts
	NDHP	Coordinate Amber Alert efforts
	RRRDC Regional Partners	1. Coordinate with NDHP, West Fargo PD, and other agencies 2. Provide 9-1-1 services for the Fargo-Moorhead area 3. Provide dispatch for Fargo, Moorhead, Cass and Clay counties
Freeway Management	MnDOT D4	Manage traffic operations on Minnesota's state system
	NDDOT	Manage traffic operations on North Dakota's state system
Incident Management	County Sheriffs	Respond to incidents on county road system
	Fargo Engineering	Develop, maintain, and apply incident signal plans
	Fargo PD	1. Direct traffic on city streets 2. Respond to incidents 3. Send information out to media
	Fargo PW	Provide resources
	FM Event Venus	Provide event plans
	MnDOT D4	1. Provide resources 2. Provide surveillance images to MSP
	Moorhead PD	1. Direct traffic on city streets 2. Respond to incidents 3. Send information out to media
	Moorhead PW	Provide resources
	MSP DL	1. Coordinate with other law enforcement and emergency management agencies 2. Respond to incidents on MN state system

	NDDOT	1. Broadcast traveler information 2. Provide resources 3. Provide surveillance images to NDHP
	NDHP	1. Coordinate with other law enforcement and emergency management agencies 2. Respond to incidents on ND state system
	RRRDC Regional Partners	1. Coordinate response 2. Provide dispatch and communications
	FM Emergency Management	Coordinate disaster response and evacuation
Maintenance and Construction	Fargo PW	1. City system road maintenance
		2. Provide maintenance information
		3. Winter maintenance (snow plow operations, sanding, anti icing) on Fargo city system
	MnDOT D4	1. Provide maintenance information 2. Roadway maintenance on MN state system 3. Winter maintenance (snow plow operations, sanding, anti-icing) on MN state system
	Moorhead PW	1. Moorhead city system road maintenance 2. Provide maintenance information 3. Winter maintenance (snow plow operations, sanding, anti icing) on Moorhead city system
	NDDOT	1. Provide maintenance information 2. Roadway maintenance on ND state system 3. Winter maintenance (snow plow operations, sanding, anti-icing) on ND state system
Surface Street Management	Fargo Engineering	1. Design, operate, and maintain signal control in Fargo city system 2. Coordinate with NDDOT and Moorhead
	MnDOT D4	Design, operate, and maintain signal control in Moorhead
	Moorhead Engineering	Coordinate activities with MnDOT
	NDDOT	Signal control at freeway exit ramps
Transit Services	MAT	Operate transit fixed route in Fargo, Moorhead, and West Fargo
Traveler Information	NDDOT	Provide Interstate road conditions

7.0 AGREEMENTS

This section briefly outlines potential agreements needed to support the F-M RA. The process of identifying needed agreement relied on the Market Packages to identify potential roles and responsibilities as well as interfaces. Anytime agencies shared operations of a system or shared formal access to system control and data a potential agreement was flagged. Discussions with stakeholders helped in finalizing the list of agreements taking into consideration existing agreements with other agencies that they have in place as well as their own agency requirements.

The table on the following page shows a summary of potential agreements in the F-M region. The table provides the following information for each agreement:

1. Market Package
    a. The Market Package where the agreement is needed
2. Purpose
    a. Brief statement on what the agreement addresses
3. Stakeholders
    a. List the stakeholders (agencies) which would be included in the agreement
4. Issues
    a. List specific issues to be included in the agreement

(This space was intentionally left blank)

Market Packages	Purpose	Stakeholders	Issues
AD2-ITS Data Warehouse	Data use/storage	ATAC, NDDOT, Fargo	Security, resource sharing
ATMS01-Network Surveillance	Share data	Fargo Engineering Moorhead Public Works West Fargo Public Works NDDOT-Fargo District MnDOT-District 4	Access to sensors Access to databases Access to networks/servers
ATMS04-Freeway Control	I-94 traffic operations	NDDOT-Fargo District MnDOT-District 4	Shared use of devices Access to data Communications links
ATMS06-Traffic Information Dissemination	Coordinate traveler information	Fargo Engineering Fargo Public Works NDDOT-Fargo District MnDOT-District 4	Communications links Notification protocols
ATMS07-Regional Traffic Control	Sharing data (flow, video) Corridor operations	Fargo Engineering Moorhead Public Works West Fargo Public Works Dilworth NDDOT-Fargo District MnDOT-District 4	Communications links Hardware compatibility Operating standards

ATMS08-Traffic Incident Management	Incident traffic response Sharing data (flow, video)	Fargo Police Dept Moorhead Police Dept West Fargo Police Dept Dilworth Police Dept ND Highway Patrol MN State Patrol Cass Co. Sheriff Clay Co. Sheriff Joint Dispatch West Fargo Dispatch	Communications links Response protocols
EM01-Emergency Call-Taking and Dispatch	Coordinating 911 and dispatch	RRRDC participants	Joint facility/resources (existing)
EM02-Emergency Routing	Signal pre-emption	Fargo Engineering MnDOT-District 4 Joint Dispatch West Fargo Dispatch	Equipment compatibility (existing)
EM08 Disaster Response and Recovery EM09 Evacuation and Reentry Management EM10 Disaster Traveler Information	Disaster response	FM Emergency Mgmt. RRDC Participants ND Highway Patrol MN State Patrol NDDOT MnDOT ND State Emergency Mgmt.	Emergency plan coordination

8.0 FUNCTIONAL REQUIREMENTS

This section discusses detailed functional requirements for the user services and market packages identified for the F-M region. The requirements were selected from the National ITS Architecture template based on desired functions for each system. Turbo Architecture was used to build the functional requirements and produce a Functional Requirements Report.

The organization of the Functional Requirements Report produced by Turbo may be described as follows:

1. Element: Subsystems or Centers in the regional architecture
2. Entity:
3. Functional Area:
4. Requirements:
5. Status

Due to the length of the Functional Requirements Report, it is included in Appendix B. An example of the information provided in the report is provided below.

Fargo-Moorhead Regional ITS Architecture (Region)
Element: **Fargo Fire Department Vehicles**
Entity: **Emergency Vehicle Subsystem**
Functional Area: **On-board EV En Route Support**
On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, and signal preemption via short range communication directly with traffic control equipment at the roadside.

Requirement:	1	The emergency vehicle, including roadway service patrols, shall compute the location of the emergency vehicle based on inputs from a vehicle location determination function.	Planned
Requirement:	2	The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.	Planned
Requirement:	3	The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.	Planned
Requirement:	4	The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.	Planned
Requirement:	5	The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.	Existing
Requirement:	6	The emergency vehicle shall provide the personnel onboard with dispatch information, including incident type and location, and forward an acknowledgment from personnel to the center that the vehicle is on its way to the incident scene.	Planned

---

.

9.0 INTERFACE REQUIREMENTS

This section outlines the possible interconnects in the F-M RA. Interconnects simply imply which entities in the architecture are linked. However, the detailed information flows carried over these interconnects are shown in more detail in Appendix A.

Network Surveillance		
Fargo Engineers	Fargo TOC	Existing
Fargo TOC	Fargo TOC Roadside Equipment	Existing
Fargo TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned
Fargo TOC Roadside Equipment	Other Roadway	Existing
MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC Roadside Equipment	NDDOT TOC	Planned
MnDOT D4 TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC Roadside Equipment	Other Roadway	Planned
NDDOT TOC	NDDOT TOC Personnel	Existing
NDDOT TOC	NDDOT TOC Roadside Equipment	Existing
NDDOT TOC Roadside Equipment	Other Roadway	Planned
Surface Street		
Driver	Fargo TOC Roadside Equipment	Planned
Driver	MnDOT D4 TOC Roadside Equipment	Planned
Driver	NDDOT TOC Roadside Equipment	Planned
Fargo Engineers	Fargo TOC	Existing
Fargo TOC	Fargo TOC Roadside Equipment	Existing
Fargo TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned
Fargo TOC Roadside Equipment	Other Roadway	Planned
Fargo TOC Roadside Equipment	Pedestrians	Existing
MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC Roadside Equipment	NDDOT TOC	Planned
MnDOT D4 TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC Roadside Equipment	Other Roadway	Planned
MnDOT D4 TOC Roadside Equipment	Pedestrians	Existing

NDDOT TOC	NDDOT TOC Personnel	Existing
NDDOT TOC	NDDOT TOC Roadside Equipment	Existing
NDDOT TOC Roadside Equipment	Other Roadway	Planned
NDDOT TOC Roadside Equipment	Pedestrians	Existing
Freeway		
Driver	MnDOT D4 TOC Roadside Equipment	Planned
Driver	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC Roadside Equipment	NDDOT TOC	Planned
MnDOT D4 TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC Roadside Equipment	Other Roadway	Planned
NDDOT TOC	NDDOT TOC Personnel	Existing
NDDOT TOC	NDDOT TOC Roadside Equipment	Existing
NDDOT TOC Roadside Equipment	Other Roadway	Planned
Traffic Information Dissemination		
Basic Vehicle	Fargo TOC Roadside Equipment	Planned
Basic Vehicle	NDDOT TOC Roadside Equipment	Planned
Driver	Fargo TOC Roadside Equipment	Planned
Driver	MnDOT D4 TOC Roadside Equipment	Planned
Driver	NDDOT TOC Roadside Equipment	Planned
Fargo Engineers	Fargo TOC	Existing
Fargo PW Operations Center	Fargo TOC	Existing
Fargo PW Operations Center	NDDOT TOC	Planned
Fargo TOC	Fargo TOC Roadside Equipment	Existing
Fargo TOC	GTC	Planned
Fargo TOC	Media	Planned
Fargo TOC	MnDOT D4 TOC	Planned
Fargo TOC	NDDOT TOC	Planned
Fargo TOC	RRRDC	Existing
Fargo TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned
Fargo TOC Roadside Equipment	Other Roadway	Planned
GTC	NDDOT TOC	Existing
Media	MnDOT D4 TOC	Existing
Media	NDDOT TOC	Existing

MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC	MSP DL District	Planned
MnDOT D4 TOC	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC	RRRDC	Existing
MnDOT D4 TOC Roadside Equipment	NDDOT TOC	Planned
MnDOT D4 TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC Roadside Equipment	Other Roadway	Planned
NDDOT TOC	NDDOT TOC Personnel	Existing
NDDOT TOC	NDDOT TOC Roadside Equipment	Existing
NDDOT TOC	RRRDC	Existing
NDDOT TOC Roadside Equipment	Other Roadway	Planned
Regional Traffic		
Fargo Engineers	Fargo TOC	Existing
Fargo TOC	Fargo TOC Roadside Equipment	Existing
Fargo TOC	MnDOT D4 TOC	Planned
Fargo TOC	NDDOT TOC	Planned
MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC Roadside Equipment	NDDOT TOC	Planned
NDDOT TOC	NDDOT TOC Personnel	Existing
NDDOT TOC	NDDOT TOC Roadside Equipment	Existing
Traffic Incident Management		
County Sheriff Vehicles	RRRDC	Existing
Event Promoters	Fargo TOC	Planned
Event Promoters	NDDOT TOC	Planned
Fargo FD Vehicles	RRRDC	Existing
Fargo PD Vehicles	RRRDC	Existing
Fargo PW Operations Center	Fargo TOC	Existing
Fargo PW Operations Center	NDDOT TOC	Planned
Fargo PW Operations Center	RRRDC	Existing
Fargo TOC	Fargo TOC Roadside Equipment	Existing
Fargo TOC	Media	Planned
Fargo TOC	MnDOT D4 TOC	Planned
Fargo TOC	NDDOT TOC	Planned
Fargo TOC	RRRDC	Existing
Fargo TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned
Fargo TOC Roadside Equipment	Other Roadway	Planned
FM Ambulance Vehicles	RRRDC	Existing

GTC	RRRDC	Existing
Media	MnDOT D4 TOC	Existing
Media	NDDOT TOC	Existing
Media	RRRDC	Existing
MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC	RRRDC	Existing
MnDOT D4 TOC Roadside Equipment	NDDOT TOC	Planned
MnDOT D4 TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC Roadside Equipment	Other Roadway	Planned
Moorhead FD Vehicles	RRRDC	Existing
Moorhead PD Vehicles	RRRDC	Existing
Moorhead PW Operations Center	RRRDC	Existing
NDDOT TOC	NDDOT TOC Roadside Equipment	Existing
NDDOT TOC	RRRDC	Existing
NDDOT TOC Roadside Equipment	Other Roadway	Planned
RRRDC	RRRDC Operators	Existing
Speed Monitoring		
Driver	NDDOT TOC Roadside Equipment	Planned
Driver	West Fargo TOC Roadside Equipment	Existing
Highway Rail Intersection		
Driver	MnDOT D4 TOC Roadside Equipment	Planned
MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC Roadside Equipment	Pedestrians	Existing
Automated Treatment		
Driver	Fargo PW Roadside Equipment	Planned
Driver	Fargo TOC Roadside Equipment	Planned
Driver	MnDOT D4 TOC Roadside Equipment	Planned
Driver	Moorhead PW Roadside Equipment	Planned
Driver	NDDOT TOC Roadside Equipment	Planned
Fargo PW Operations Center	Fargo PW Roadside Equipment	Planned
Fargo PW Operations Center	Fargo TOC Roadside Equipment	Existing
Fargo PW Operations Center	NDDOT TOC Roadside Equipment	Existing
Fargo PW Roadside Equipment	Other Roadway	Planned
Fargo TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Planned

Fargo TOC Roadside Equipment	Other Roadway	Planned
MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC	NDDOT TOC Roadside Equipment	Existing
MnDOT D4 TOC Roadside Equipment	NDDOT TOC	Existing
MnDOT D4 TOC Roadside Equipment	NDDOT TOC Roadside Equipment	Existing
MnDOT D4 TOC Roadside Equipment	Other Roadway	Existing
Moorhead PW Operations Center	Moorhead PW Roadside Equipment	Planned
Moorhead PW Roadside Equipment	Other Roadway	Planned
NDDOT TOC	NDDOT TOC Personnel	Existing
NDDOT TOC	NDDOT TOC Roadside Equipment	Existing
NDDOT TOC Roadside Equipment	Other Roadway	Planned
Winter Maintenance		
Fargo PW Operations Center	Fargo PW Vehicle	Existing
Fargo PW Operations Center	GTC	Existing
Fargo PW Operations Center	NDDOT TOC	Planned
Fargo PW Operations Center	RRRDC	Existing
GTC	Moorhead PW Operations Center	Existing
GTC	NDDOT TOC	Existing
MnDOT D4 Maint Vehicles	MnDOT D4 TOC	Existing
MnDOT D4 TOC	RRRDC	Existing
Moorhead PW Operations Center	Moorhead PW Vehicles	Existing
Moorhead PW Operations Center	RRRDC	Existing
NDDOT TOC	NDDOT TOC Maint Vehicles	Existing
NDDOT TOC	RRRDC	Existing
MCO Management		
Maintenance and Construction Vehicle	Public Works	Planned
Work Zone Management		
Fargo PW Operations Center	Fargo PW Vehicle	Existing
Fargo PW Operations Center	Fargo TOC	Existing
Fargo PW Operations Center	Fargo TOC Roadside Equipment	Existing
Fargo PW Operations Center	GTC	Existing
Fargo PW Operations Center	Media	Existing
Fargo PW Operations Center	NDDOT TOC	Planned
Fargo PW Operations Center	NDDOT TOC Roadside Equipment	Existing
Fargo PW Operations Center	RRRDC	Existing
Fargo PW Vehicle	Fargo TOC Roadside Equipment	Planned
Fargo PW Vehicle	NDDOT TOC Roadside Equipment	Planned
Fargo TOC	Fargo TOC Roadside Equipment	Existing

Fargo TOC	MnDOT D4 TOC	Planned
Fargo TOC	NDDOT TOC	Planned
GTC	Moorhead PW Operations Center	Existing
GTC	NDDOT TOC	Existing
Media	MnDOT D4 TOC	Existing
Media	Moorhead PW Operations Center	Existing
Media	NDDOT TOC	Existing
MnDOT D4 Maint Vehicles	MnDOT D4 TOC	Existing
MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC	MSP DL District	Planned
MnDOT D4 TOC	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC	RRRDC	Existing
MnDOT D4 TOC Roadside Equipment	NDDOT TOC	Planned
Moorhead PW Operations Center	Moorhead PW Vehicles	Existing
Moorhead PW Operations Center	RRRDC	Existing
NDDOT TOC	NDDOT TOC Maint Vehicles	Existing
NDDOT TOC	NDDOT TOC Personnel	Existing
NDDOT TOC	NDDOT TOC Roadside Equipment	Existing
NDDOT TOC	RRRDC	Existing
Transit Vehicle Tracking		
MAT Vehicles	Existing	MAT Vehicles
Transit Fixed Route		
Fargo PW Operations Center	GTC	Existing
Fargo TOC	GTC	Planned
GTC	MAT Operators	Existing
GTC	MAT Vehicles	Existing
GTC	Moorhead PW Operations Center	Existing
GTC	NDDOT TOC	Existing
MAT Bus Drivers	MAT Vehicles	Existing
Transit Fare Collection Management		
GTC	MAT Kiosks	Planned
GTC	MAT Vehicles	Existing
MAT Kiosks	MAT Traveler Card	Planned
MAT Kiosks	Traveler	Planned
MAT Traveler Card	MAT Vehicles	Existing
MAT Vehicles	Traveler	Existing
Transit Security Management		
GTC	MAT Operators	Existing
GTC	MAT Vehicles	Existing
GTC	RRRDC	Existing

MAT Bus Drivers	MAT Vehicles	Existing
MAT Kiosks	Traveler	Planned
MAT Vehicles	Traveler	Existing
Transit Management		
Transit Management	Transit Vehicles	Existing
Transit Signal Priority		
Fargo TOC Roadside Equipment	MAT Vehicles	Existing
MAT Vehicles	MnDOT D4 TOC Roadside Equipment	Planned
MAT Vehicles	NDDOT TOC Roadside Equipment	Planned
Transit Passenger Counting		
GTC	MAT Operators	Existing
GTC	MAT Vehicles	Existing
MAT Vehicles	Traveler	Existing
Emergency Call Taking		
County Sheriff Vehicles	RRRDC	Existing
Fargo FD Vehicles	RRRDC	Existing
Fargo PD Vehicles	RRRDC	Existing
Fargo TOC	RRRDC	Existing
FM Ambulance Vehicles	RRRDC	Existing
GTC	RRRDC	Existing
MnDOT D4 TOC	MSP DL District	Planned
MnDOT D4 TOC	RRRDC	Existing
Moorhead FD Vehicles	RRRDC	Existing
Moorhead PD Vehicles	RRRDC	Existing
MSP DL District	MSP DL Vehicles	Existing
MSP DL District	RRRDC	Planned
MSP DL District	State Radio	Planned
NDDOT TOC	RRRDC	Existing
NDHP Vehicles	State Radio	Existing
Emergency Routing		
Fargo FD Vehicles	Fargo TOC Roadside Equipment	Existing
Fargo FD Vehicles	MnDOT D4 TOC Roadside Equipment	Existing
Fargo FD Vehicles	NDDOT TOC Roadside Equipment	Existing
Fargo TOC Roadside Equipment	FM Ambulance Vehicles	Existing
Fargo TOC Roadside Equipment	Moorhead FD Vehicles	Existing
FM Ambulance Vehicles	MnDOT D4 TOC Roadside Equipment	Planned
FM Ambulance Vehicles	NDDOT TOC Roadside Equipment	Existing
MnDOT D4 TOC Roadside Equipment	Moorhead FD Vehicles	Existing
Moorhead FD Vehicles	NDDOT TOC Roadside Equipment	Existing

Wide Area Alert		
Driver	Fargo TOC Roadside Equipment	Planned
Driver	MnDOT D4 TOC Roadside Equipment	Planned
Driver	NDDOT TOC Roadside Equipment	Planned
Fargo PW Operations Center	RRRDC	Existing
Fargo TOC	Fargo TOC Roadside Equipment	Existing
Fargo TOC	RRRDC	Existing
GTC	MAT Kiosks	Planned
GTC	MAT Vehicles	Existing
GTC	RRRDC	Existing
MAT Kiosks	Traveler	Planned
MnDOT D4 TOC	MnDOT D4 TOC Roadside Equipment	Existing
MnDOT D4 TOC	MSP DL District	Planned
MnDOT D4 TOC	NDDOT TOC Roadside Equipment	Planned
MnDOT D4 TOC	RRRDC	Existing
MnDOT D4 TOC Roadside Equipment	NDDOT TOC	Planned
MSP DL District	RRRDC	Planned
MSP DL District	State Radio	Planned
NDDOT TOC	NDDOT TOC Roadside Equipment	Existing
NDDOT TOC	RRRDC	Existing
RRRDC	State Radio	Existing
Traveler	User Personal Computing Devices	Planned
Disaster Response and Recovery		
BNSF	FM Emergency Management	Planned
BNSF	NDHP Fargo District	Planned
BNSF	RRRDC	Planned
BNSF	State Radio	Planned
Fargo PW Operations Center	FM Emergency Management	Planned
Fargo PW Operations Center	FM TOC	Planned
Fargo PW Operations Center	Moorhead PW Operations Center	Planned
Fargo PW Operations Center	NDDOT TOC	Planned
Fargo PW Operations Center	NDHP Fargo District	Planned
Fargo PW Operations Center	RRRDC	Existing
Fargo PW Operations Center	State Radio	Existing
FM Emergency Management	FM TOC	Planned
FM Emergency Management	GTC	Planned
FM Emergency Management	Moorhead PW Operations Center	Planned
FM Emergency Management	NDDOT TOC	Planned
FM Emergency Management	NDHP Fargo District	Planned
FM Emergency Management	RRRDC	Planned
FM Emergency Management	State Radio	Planned

FM TOC	GTC	Planned
FM TOC	Moorhead PW Operations Center	Planned
FM TOC	NDDOT TOC	Planned
FM TOC	NDHP Fargo District	Planned
FM TOC	RRRDC	Planned
FM TOC	State Radio	Planned
GTC	NDDOT TOC	Existing
GTC	NDHP Fargo District	Planned
GTC	RRRDC	Existing
GTC	State Radio	Existing
Moorhead PW Operations Center	NDDOT TOC	Existing
Moorhead PW Operations Center	NDHP Fargo District	Planned
Moorhead PW Operations Center	RRRDC	Existing
Moorhead PW Operations Center	State Radio	Planned
NDDOT TOC	NDHP Fargo District	Existing
NDDOT TOC	RRRDC	Existing
NDDOT TOC	State Radio	Existing
NDHP Fargo District	RRRDC	Planned
NDHP Fargo District	State Radio	Planned
RRRDC	State Radio	Existing
Evacuation and Reentry Management		
BNSF	FM Emergency Management	Planned
BNSF	NDHP Fargo District	Planned
BNSF	RRRDC	Planned
BNSF	State Radio	Planned
Fargo PW Operations Center	FM Emergency Management	Planned
Fargo PW Operations Center	MSP DL District	Existing
Fargo PW Operations Center	NDHP Fargo District	Planned
Fargo PW Operations Center	RRRDC	Existing
Fargo PW Operations Center	State Radio	Existing
FM Emergency Management	FM TOC	Planned
FM Emergency Management	GTC	Planned
FM Emergency Management	Moorhead PW Operations Center	Planned
FM Emergency Management	MSP DL District	Planned
FM Emergency Management	NDDOT TOC	Planned
FM Emergency Management	NDHP Fargo District	Planned
FM Emergency Management	RRRDC	Planned
FM Emergency Management	State Radio	Planned
FM TOC	GTC	Planned
FM TOC	MSP DL District	Planned
FM TOC	NDDOT TOC	Planned
FM TOC	NDHP Fargo District	Planned
FM TOC	RRRDC	Planned
FM TOC	State Radio	Planned

GTC	MSP DL District	Existing
GTC	NDDOT TOC	Existing
GTC	NDHP Fargo District	Planned
GTC	RRRDC	Existing
GTC	State Radio	Existing
Moorhead PW Operations Center	MSP DL District	Planned
Moorhead PW Operations Center	NDHP Fargo District	Planned
Moorhead PW Operations Center	RRRDC	Existing
Moorhead PW Operations Center	State Radio	Planned
MSP DL District	NDDOT TOC	Existing
MSP DL District	RRRDC	Existing
MSP DL District	State Radio	Existing
NDDOT TOC	NDHP Fargo District	Existing
NDDOT TOC	RRRDC	Existing
NDDOT TOC	State Radio	Existing
NDHP Fargo District	RRRDC	Planned
NDHP Fargo District	State Radio	Planned
RRRDC	State Radio	Existing
Disaster Traveler Information		
FM Emergency Management	Media	Planned
Media	MSP DL District	Planned
Media	NDHP Fargo District	Planned
Media	RRRDC	Existing
Media	State Radio	Planned
Traveler	User Personal Computing Devices	Planned

10.0 ITS STANDARDS

This section identifies applicable ITS Standards identified for the F-M RA. It should be noted that the development of ITS Standards is an ongoing process. Therefore, the set of applicable ITS standards should be updated as new standards are approved. The table below shows applicable standards for the F-M RA based on Turbo Architecture output.

Standard Name	Document ID
Traffic Management Data Dictionary and Message Sets for External TMC Communication	ITE TMDD 2.1
NTCIP Center-to-Center Standards Group	NTCIP 1102 NTCIP 1104 NTCIP 2104 NTCIP 2202 NTCIP 2303 NTCIP 2304 NTCIP 2306
NTCIP Center-to-Field Standards Group	NTCIP 1102 NTCIP 1103 NTCIP 2101 NTCIP 2102 NTCIP 2103 NTCIP 2104 NTCIP 2201 NTCIP 2202 NTCIP 2301 NTCIP 2302 NTCIP 2303
Global Object Definitions	NTCIP 1201
Object Definitions for Actuated Traffic Signal Controller Units	NTCIP 1202
Object Definitions for Dynamic Message Signs	NTCIP 1203
Object Definitions for Environmental Sensor Stations & Roadside Weather Information System	NTCIP 1204
Data Dictionary for Closed Circuit Television (CCTV)	NTCIP 1205
Data Collection and Monitoring Devices	NTCIP 1206
Ramp Meter Controller Objects	NTCIP 1207
Object Definitions for Video Switches	NTCIP 1208
Transportation System Sensor Objects	NTCIP 1209
Objects for Signal Systems Master	NTCIP 1210
Objects Definitions for Signal Control and Prioritization (SCP)	NTCIP 1211
Standard for Transit Communications Interface Profiles	APTA TCIP-S-001 3.0.0
Dedicated Short Range Communication at 915 MHz Standards Group	ASTM E2158-01 ASTM PS 105-99

Standard Specification for Archiving ITS Generated Traffic Monitoring Data	ASTM WK7604
Incident Management Standards Group	IEEE 1512 -2006 IEEE 1512.1-2006 IEEE 1512.2-2004 IEEE 1512.3-2006 IEEE P1512.4
Standard for Functional Level Traffic Management Data Dictionary (TMDD)	ITE TM 1.03
Message Sets for External TMC Communication (MS/ETMCC)	ITE TM 2.01
Advanced Traveler Information Systems (ATIS) General Use Standards Group	SAE J2266 SAE J2354 SAE J2540 SAE J2540/1 SAE J2540/2 SAE J2540/3
Dedicated Short Range Communication at 5.9 GHz Standards Group	ASTM E2213-03 IEEE 1609.1-2006 IEEE 1609.2-2006 IEEE 1609.4-2006 IEEE P1609.3 IEEE P802.11p

11.0 PROJECTS SEQUENCE

This section briefly outlines possible time frame for deployment for selected ITS projects in the F-M area. Market Packages are arranged into implemented, short, medium, and long-term deployment categories. It should be noted that not all of the planned services for the F-M area have been fully developed into ITS projects yet.

Market Packages	Time Frame
Network Surveillance	Short
Surface Street Control	Short
Freeway Control	Long
Traffic Information Dissemination	Medium
Regional Traffic Control	Short-Medium
Traffic Incident Management System	Medium
Standard Railroad Grade Crossing	Medium
Speed Monitoring	Implemented
Roadway Automated Treatment	Implemented
Winter Maintenance	Short
Work Zone Management	Medium-Long
Transit Vehicle Tracking	Short
Transit Fixed-Route Operations	Implemented
Transit Passenger and Fare Management	Implemented
Transit Security	Implemented
Transit Signal Priority	Pilot Study
Emergency Call-Taking and Dispatch	Implemented
Emergency Routing	Implemented
Wide-Area Alert	Short
ITS Data Warehouse	Medium

11.1 Architecture Maintenance

As more ITS projects are deployed or the regional needs/services change in the Fargo-Moorhead area, the regional architecture must be updated to account for these changes. The Fargo-Moorhead Council of Governments has been designated with the role of maintaining the F-M regional ITS architecture. The FM-COG will accomplish this role through a partnership with the Advanced Traffic Analysis Center. It is envisioned that updates will be conducted every two years or upon the deployment of a major ITS project in the area.

APPENDIX A FARGO-MOORHEAD MARKET PACKAGES AND INFORMATION FLOWS

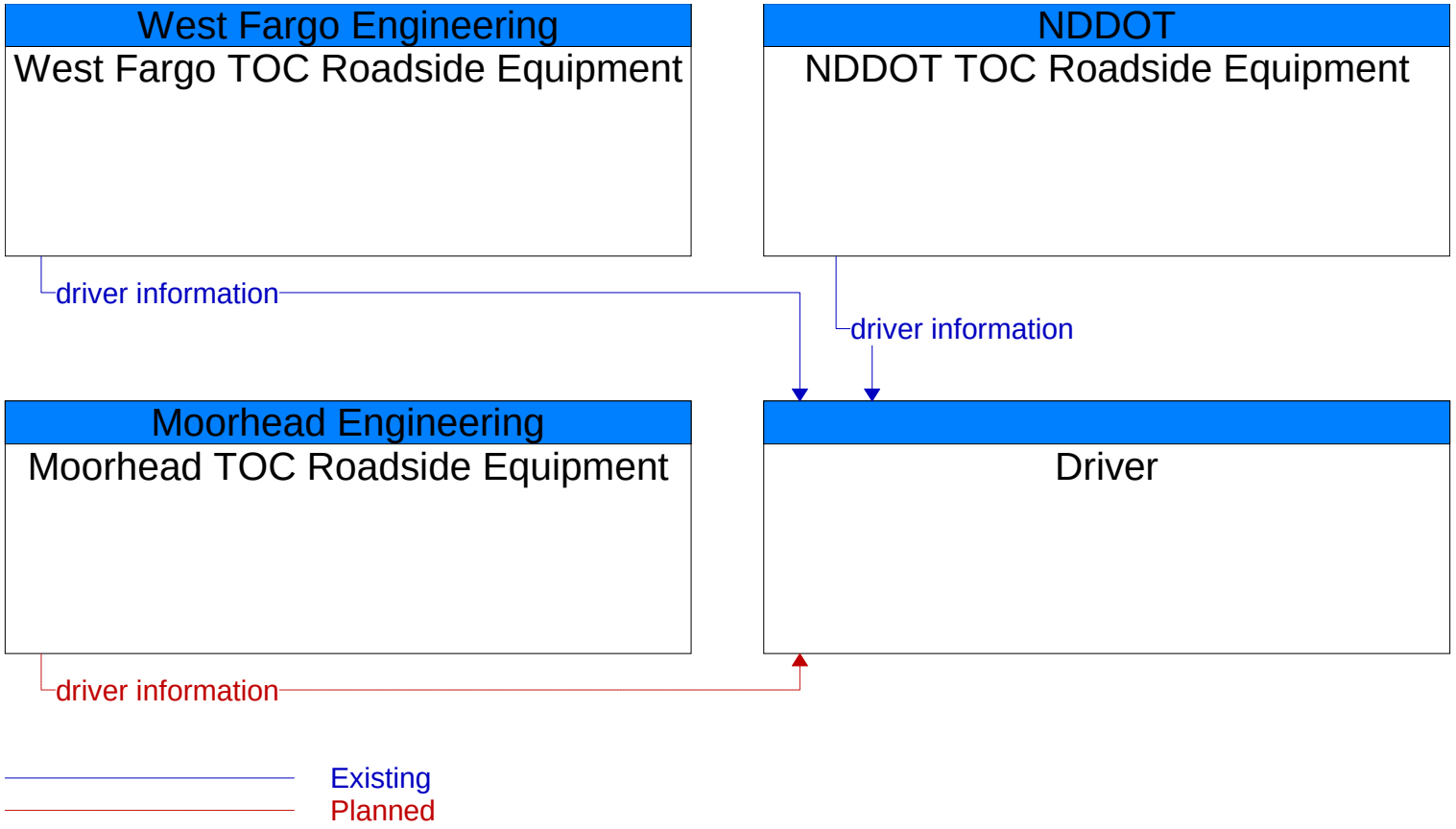
The Market Package Diagrams are available electronically at:

http://www.atacenter.org/regional/fargomhd/

Viewing electronically will allow for zooming and panning which is needed for the diagrams readability.

An example market package for ATMS 19: Speed Monitoring, is provided below.

ATMS 19 Speed Monitoring



APPENDIX B FARGO-MOORHEAD FUNCTIONAL REQUIREMENTS

Functional Requirements
Fargo-Moorhead Regional ITS Architecture (Region)

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **ATAC data warehouse**		
Entity: **Archived Data Management Subsystem**		
Functional Area: **ITS Data Repository** Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.		
Requirement:	1 The center shall collect data to be archived from one or more data sources.	Planned
Requirement:	2 The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail).	Planned
Requirement:	7 The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.	Planned
Requirement:	9 The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive.	Planned
Functional Area: **Traffic and Roadside Data Archival** Collects and archives traffic and environmental information directly from the roadside for use in off-line planning, research, and analysis.		
Requirement:	1 The center shall manage the collection of archive data directly from collection equipment located at the roadside.	Planned
Requirement:	2 The center shall collect traffic sensor information from roadside devices.	Planned
Requirement:	6 The center shall record the status about the imported traffic and roadside data.	Planned
Element: **Fargo FD Vehicles**		
Entity: **Emergency Vehicle Subsystem**		
Functional Area: **On-board EV En Route Support** On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.		
Requirement:	5 The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.	Existing
Element: **Fargo PW Operations Center**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Automated Treatment System Control**		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Fargo PW Operations Center**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Automated Treatment System Control** Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.		
Requirement:	1 The center shall remotely control automated roadway treatment systems. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	2 The center shall remotely control the environmental sensors that upon detecting changes in environmental or atmospheric conditions, automatically activate roadway treatment systems.	Planned
Requirement:	3 The center shall collect automated roadway treatment system and associated environmental sensor operational status.	Planned
Requirement:	4 The center shall collect automated roadway treatment system and associated environmental sensor fault data and request repair.	Planned
Requirement:	5 The center shall accept requests for automated roadway treatment system activation from center personnel.	Planned
Functional Area: **MCM Incident Management** Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.		
Requirement:	4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.	Existing
Requirement:	5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.	Existing
Requirement:	6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.	Existing
Requirement:	7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.	Existing
Requirement:	8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.	Existing
Functional Area: **MCM Winter Maintenance Management**		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Fargo PW Operations Center**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Winter Maintenance Management** Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.		
Requirement:	1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.	Existing
Requirement:	6 The center shall collect real-time information on the state of the regional transportation system from other centers including current traffic and road conditions, weather conditions, special event and incident information and use the collected information to support winter maintenance operations.	Existing
Requirement:	8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.	Existing
Requirement:	9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.	Existing
Functional Area: **MCM Roadway Maintenance and Construction** Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.		
Requirement:	2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.	Existing
Requirement:	4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.	Existing
Requirement:	9 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).	Existing
Functional Area: **MCM Work Zone Management** Remotely monitors and supports work zone activities, controlling traffic through dynamic message signs (DMS), highway advisory radio, gates and barriers, and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Fargo PW Operations Center**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Work Zone Management** Remotely monitors and supports work zone activities, controlling traffic through dynamic message signs (DMS), highway advisory radio, gates and barriers, and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).		
Requirement:	3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.	Existing
Element: **Fargo PW Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Equipment Coordination** Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.		
Requirement:	1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.	Planned
Requirement:	3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.	Planned
Requirement:	4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.	Planned
Functional Area: **Roadway Automated Treatment** Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.		
Requirement:	1 The field element shall activate automated roadway treatment systems based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	2 The field element shall activate automated roadway treatment systems under center control. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	3 The field element shall return automated roadway treatment system and associated environmental sensor operational status to the maintenance center.	Planned

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Fargo PW Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Automated Treatment** Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.		
Requirement:	4 The field element shall return automated roadway treatment system and associated environmental sensor fault data to the maintenance center for repair.	Planned
Element: **Fargo TOC**		
Entity: **Traffic Management**		
Functional Area: **Collect Traffic Surveillance** Management of traffic sensors and surveillance (CCTV) equipment, collection of current traffic conditions, and distribution of the collected information to other centers and operators.		
Requirement:	1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.	Planned
Functional Area: **TMC Signal Control** Remotely controls traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.		
Requirement:	1 The center shall remotely control traffic signal controllers.	Existing
Requirement:	3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.	Existing
Requirement:	4 The center shall collect traffic signal controller fault data from the field.	Existing
Requirement:	5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.	Planned
Functional Area: **TMC Traffic Information Dissemination** Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.		
Requirement:	1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.	Planned
Requirement:	6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.	Planned
Functional Area: **TMC Regional Traffic Management** Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Fargo TOC**		
Entity: **Traffic Management**		
Functional Area: **TMC Regional Traffic Management** Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.		
Requirement:	1 The center shall exchange traffic information with other traffic management centers including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.	Planned
Requirement:	2 The center shall exchange traffic control information with other traffic management centers to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).	Planned
Functional Area: **TMC Incident Dispatch Coordination/Communication** Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.		
Requirement:	1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.	Planned
Requirement:	2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.	Planned
Requirement:	3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.	Planned
Requirement:	4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.	Planned
Requirement:	5 The center shall share resources with allied agency centers to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.	Planned

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Fargo TOC**		
Entity: **Traffic Management**		
Functional Area: **TMC Incident Dispatch Coordination/Communication** Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.		
Requirement:	6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, border crossings, and rail operations centers.	Planned
Requirement:	7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.	Planned
Requirement:	9 The center shall coordinate information and controls with other traffic management centers.	Planned
Functional Area: **TMC Traffic Network Performance Evaluation** Systems to predict travel demand patterns to support traffic flow optimization, demand management, and incident management. Collects data from surveillance equipment as well as input from other management centers including emissions, event promoters, and other TMCs.		
Requirement:	1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center to support overall network performance evaluations.	Planned
Requirement:	3 The center shall collect and store plans from event promoters for major future events possibly impacting traffic to support overall network performance evaluations.	Planned
Requirement:	6 The center shall exchange traffic information with other traffic management centers, including incidents, congestion data, traffic data, signal timing plans, and real-time signal control information to support overall network performance evaluations.	Planned
Functional Area: **Traffic Data Collection** Collection and storage of traffic management data. For use by operations personnel or data archives in the region.		
Requirement:	1 The center shall collect traffic management data such as operational data, event logs, etc.	Planned
Requirement:	3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.	Planned
Element: **Fargo TOC Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Signal Priority** Field elements that provide the capability to receive vehicle signal priority requests and control traffic signals accordingly.		
Requirement:	1 The field element shall respond to requests for indicator (e.g., signal) preemption requests from emergency vehicles at intersections, pedestrian crossings, and multimodal crossings.	Existing

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Fargo TOC Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Signal Priority** Field elements that provide the capability to receive vehicle signal priority requests and control traffic signals accordingly.		
Requirement:	2 The field element shall respond to requests for indicator (e.g., signal) priority requests from transit vehicles at intersections, pedestrian crossings, and multimodal crossings.	Planned
Functional Area: **Roadway Traffic Information Dissemination** Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).		
Requirement:	1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).	Planned
Requirement:	4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.	Planned
Functional Area: **Roadway Equipment Coordination** Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.		
Requirement:	1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.	Planned
Requirement:	3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.	Planned
Requirement:	4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.	Planned
Functional Area: **Roadway Automated Treatment** Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.		
Requirement:	1 The field element shall activate automated roadway treatment systems based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Fargo TOC Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Automated Treatment** Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.		
Requirement:	2 The field element shall activate automated roadway treatment systems under center control. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	3 The field element shall return automated roadway treatment system and associated environmental sensor operational status to the maintenance center.	Planned
Requirement:	4 The field element shall return automated roadway treatment system and associated environmental sensor fault data to the maintenance center for repair.	Planned
Functional Area: **Roadway Data Collection** Field elements to collect traffic, road, and environmental conditions information for use in transportation planning, research, and other off-line applications. Includes the sensors, supporting roadside infrastructure, and communications equipment.		
Requirement:	1 The field element shall collect traffic, road, and environmental conditions information.	Existing
Requirement:	2 The field element shall include the sensors and supporting roadside devices that sense, collect, and send traffic, road, and environmental conditions information to a center for archival.	Planned
Requirement:	3 The field element shall collect sensor status and sensor faults from roadside equipment and send it along with the recorded data to a center for archival.	Planned
Element: **FM Ambulance Vehicles**		
Entity: **Emergency Vehicle Subsystem**		
Functional Area: **On-board EV En Route Support** On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.		
Requirement:	1 The emergency vehicle, including roadway service patrols, shall compute the location of the emergency vehicle based on inputs from a vehicle location determination function.	Existing
Requirement:	2 The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.	Existing
Requirement:	3 The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.	Existing
Requirement:	4 The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.	Existing
Requirement:	5 The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.	Existing

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **FM Emergency Management**		
Entity: **Emergency Management**		
Functional Area: **Incident Command** Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.		
Functional Area: **Emergency Response Management** Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.		
Functional Area: **Emergency Evacuation Support** Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.		
Element: **GTC**		
Entity: **Transit Management**		
Functional Area: **Transit Center Vehicle Tracking** Monitoring transit vehicle locations via interactions with on-board systems. Furnish users with real-time transit schedule information and maintain interface with digital map providers.		
Requirement:	1 The center shall monitor the locations of all transit vehicles within its network.	Planned
Requirement:	2 The center shall determine adherence of transit vehicles to their assigned schedule.	Planned
Requirement:	4 The center shall provide transit operational data to traveler information service providers.	Planned
Functional Area: **Transit Center Fixed-Route Operations** Management of fixed route transit operations. Planning, scheduling, and dispatch associated with fixed and flexible route transit services. Updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.		
Requirement:	3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.	Planned
Requirement:	5 The center shall collect transit operational data for use in the generation of routes and schedules.	Planned
Functional Area: **Transit Center Security** Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.		
Requirement:	1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.	Planned

Architecture			Status
Fargo-Moorhead Regional ITS Architecture (Region)			(Region)
Element: **GTC**			
Entity: **Transit Management**			
Functional Area: **Transit Center Security** Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.			
Requirement:	2	The center shall receive reports of emergencies on-board transit vehicles entered directly be the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.	Planned
Requirement:	5	The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.	Planned
Requirement:	7	The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.	Planned
Functional Area: **Transit Evacuation Support** Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.			
Requirement:	1	The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.	Existing
Functional Area: **Transit Data Collection** Collection and storage of transit management data. For use by operations personnel or data archives in the region.			
Requirement:	1	The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.	Existing
Element: **MAT Vehicles**			
Entity: **Transit Vehicle Subsystem**			
Functional Area: **On-board Transit Trip Monitoring** Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.			
Requirement:	1	The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.	Planned
Functional Area: **On-board Transit Fare Management** On-board systems provide fare collection using a travelers non-monetary fare medium. Collected fare data are made available to the center.			
Requirement:	1	The transit vehicle shall read data from the traveler card / payment instrument presented by boarding passengers.	Existing
Requirement:	10	The transit vehicle shall provide fare statistics data to the center.	Existing
Functional Area: **On-board Transit Security**			

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **MAT Vehicles**		
Entity: **Transit Vehicle Subsystem**		
Functional Area: **On-board Transit Security** On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.		
Requirement:	1 The transit vehicle shall perform video and audio surveillance inside of transit vehicles and output raw video or audio data for either local monitoring (for processing or direct output to the transit vehicle operator), remote monitoring or for local storage (e.g., in an event recorder).	Existing
Functional Area: **On-board Transit Signal Priority** On-board systems request signal priority through short range communication directly with traffic control equipment at the roadside (intersections, ramps, interchanges, etc.).		
Requirement:	2 The transit vehicle shall send priority requests to traffic signal controllers at intersections, pedestrian crossings, and multimodal crossings on the roads (surface streets) and freeway (ramp controls) network that enable a transit vehicle schedule deviation to be corrected.	Planned
Functional Area: **On-board Transit Information Services** On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.		
Requirement:	3 The transit vehicle shall broadcast advisories about the imminent arrival of the transit vehicle at the next stop via an on-board automated annunciation system.	Planned
Element: **MnDOT D4 TOC**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Automated Treatment System Control** Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.		
Requirement:	1 The center shall remotely control automated roadway treatment systems. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	2 The center shall remotely control the environmental sensors that upon detecting changes in environmental or atmospheric conditions, automatically activate roadway treatment systems.	Planned
Requirement:	3 The center shall collect automated roadway treatment system and associated environmental sensor operational status.	Planned
Requirement:	4 The center shall collect automated roadway treatment system and associated environmental sensor fault data and request repair.	Planned
Requirement:	5 The center shall accept requests for automated roadway treatment system activation from center personnel.	Planned
Functional Area: **MCM Incident Management**		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **MnDOT D4 TOC**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Incident Management** Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.		
Requirement:	4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.	Existing
Requirement:	5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.	Existing
Requirement:	6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.	Existing
Requirement:	7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.	Existing
Requirement:	8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.	Existing
Functional Area: **MCM Winter Maintenance Management** Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.		
Requirement:	1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.	Existing
Requirement:	6 The center shall collect real-time information on the state of the regional transportation system from other centers including current traffic and road conditions, weather conditions, special event and incident information and use the collected information to support winter maintenance operations.	Existing
Requirement:	8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.	Existing

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **MnDOT D4 TOC**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Winter Maintenance Management** Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.		
Requirement:	9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.	Existing
Functional Area: **MCM Roadway Maintenance and Construction** Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.		
Requirement:	2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.	Existing
Requirement:	4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.	Existing
Requirement:	9 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).	Existing
Functional Area: **MCM Work Zone Management** Remotely monitors and supports work zone activities, controlling traffic through dynamic message signs (DMS), highway advisory radio, gates and barriers, and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).		
Requirement:	3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.	Existing
Entity: **Traffic Management**		
Functional Area: **TMC Signal Control** Remotely controls traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.		
Requirement:	1 The center shall remotely control traffic signal controllers.	Existing
Requirement:	3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.	Existing
Requirement:	4 The center shall collect traffic signal controller fault data from the field.	Existing

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **MnDOT D4 TOC**		
Entity: **Traffic Management**		
Functional Area: **TMC Signal Control** Remotely controls traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.		
Requirement:	5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.	Planned
Functional Area: **TMC Traffic Information Dissemination** Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.		
Requirement:	1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.	Existing
Requirement:	3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).	Existing
Requirement:	4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.	Existing
Requirement:	6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.	Planned
Functional Area: **TMC Regional Traffic Management** Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.		
Requirement:	1 The center shall exchange traffic information with other traffic management centers including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.	Planned
Requirement:	2 The center shall exchange traffic control information with other traffic management centers to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).	Planned
Functional Area: **TMC Incident Dispatch Coordination/Communication** Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.		
Requirement:	3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.	Planned
Requirement:	9 The center shall coordinate information and controls with other traffic management centers.	Planned

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **MnDOT D4 TOC**		
Entity: **Traffic Management**		
Element: **MnDOT D4 TOC Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Signal Priority** Field elements that provide the capability to receive vehicle signal priority requests and control traffic signals accordingly.		
Requirement:	1 The field element shall respond to requests for indicator (e.g., signal) preemption requests from emergency vehicles at intersections, pedestrian crossings, and multimodal crossings.	Existing
Requirement:	2 The field element shall respond to requests for indicator (e.g., signal) priority requests from transit vehicles at intersections, pedestrian crossings, and multimodal crossings.	Planned
Functional Area: **Roadway Traffic Information Dissemination** Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).		
Requirement:	1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).	Planned
Requirement:	4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.	Planned
Functional Area: **Standard Rail Crossing** Field elements at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Includes traditional HRI warning systems augmented with other standard traffic management devices.		
Requirement:	1 The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI).	Planned
Requirement:	2 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center.	Planned
Requirement:	6 The field element shall control the dynamic message signs (DMS) in the vicinity of a highway-rail intersection (HRI) to advise drivers, cyclists, and pedestrians of approaching trains.	Planned
Requirement:	7 The field element shall close the highway-rail intersection (HRI) when a train is approaching using gates, lights/signs, barriers, and traffic control signals.	Existing
Requirement:	8 The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection.	Existing
Functional Area: **Roadway Equipment Coordination** Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **MnDOT D4 TOC Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Equipment Coordination** Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.		
Requirement:	1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.	Planned
Requirement:	3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.	Planned
Requirement:	4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.	Planned
Functional Area: **Roadway Automated Treatment** Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.		
Requirement:	1 The field element shall activate automated roadway treatment systems based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	2 The field element shall activate automated roadway treatment systems under center control. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	3 The field element shall return automated roadway treatment system and associated environmental sensor operational status to the maintenance center.	Planned
Requirement:	4 The field element shall return automated roadway treatment system and associated environmental sensor fault data to the maintenance center for repair.	Planned
Element: **Moorhead FD Vehicles**		
Entity: **Emergency Vehicle Subsystem**		
Functional Area: **On-board EV En Route Support** On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Moorhead PW Operations Center**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Automated Treatment System Control** Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.		
Requirement:	1 The center shall remotely control automated roadway treatment systems. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	2 The center shall remotely control the environmental sensors that upon detecting changes in environmental or atmospheric conditions, automatically activate roadway treatment systems.	Planned
Requirement:	3 The center shall collect automated roadway treatment system and associated environmental sensor operational status.	Planned
Requirement:	4 The center shall collect automated roadway treatment system and associated environmental sensor fault data and request repair.	Planned
Requirement:	5 The center shall accept requests for automated roadway treatment system activation from center personnel.	Planned
Functional Area: **MCM Incident Management** Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.		
Requirement:	4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.	Existing
Requirement:	5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.	Existing
Requirement:	6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.	Existing
Requirement:	7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.	Existing
Requirement:	8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.	Existing
Functional Area: **MCM Winter Maintenance Management**		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Moorhead PW Operations Center**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Winter Maintenance Management** Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.		
Requirement:	1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.	Existing
Requirement:	6 The center shall collect real-time information on the state of the regional transportation system from other centers including current traffic and road conditions, weather conditions, special event and incident information and use the collected information to support winter maintenance operations.	Existing
Requirement:	8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.	Existing
Requirement:	9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.	Existing
Functional Area: **MCM Roadway Maintenance and Construction** Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.		
Requirement:	2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.	Existing
Requirement:	4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.	Existing
Requirement:	9 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).	Existing
Functional Area: **MCM Work Zone Management** Remotely monitors and supports work zone activities, controlling traffic through dynamic message signs (DMS), highway advisory radio, gates and barriers, and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Moorhead PW Operations Center**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Work Zone Management** Remotely monitors and supports work zone activities, controlling traffic through dynamic message signs (DMS), highway advisory radio, gates and barriers, and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).		
Requirement:	3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.	Existing
Element: **Moorhead PW Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Equipment Coordination** Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.		
Requirement:	1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.	Planned
Requirement:	3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.	Planned
Requirement:	4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.	Planned
Functional Area: **Roadway Automated Treatment** Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.		
Requirement:	1 The field element shall activate automated roadway treatment systems based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	2 The field element shall activate automated roadway treatment systems under center control. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	3 The field element shall return automated roadway treatment system and associated environmental sensor operational status to the maintenance center.	Planned

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **Moorhead PW Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Automated Treatment** Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.		
Requirement:	4 The field element shall return automated roadway treatment system and associated environmental sensor fault data to the maintenance center for repair.	Planned
Element: **NDDOT TOC**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Automated Treatment System Control** Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.		
Requirement:	1 The center shall remotely control automated roadway treatment systems. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	2 The center shall remotely control the environmental sensors that upon detecting changes in environmental or atmospheric conditions, automatically activate roadway treatment systems.	Planned
Requirement:	3 The center shall collect automated roadway treatment system and associated environmental sensor operational status.	Planned
Requirement:	4 The center shall collect automated roadway treatment system and associated environmental sensor fault data and request repair.	Planned
Requirement:	5 The center shall accept requests for automated roadway treatment system activation from center personnel.	Planned
Functional Area: **MCM Incident Management** Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.		
Requirement:	4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.	Existing
Requirement:	5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.	Existing
Requirement:	6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.	Existing

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **NDDOT TOC**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Incident Management** Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.		
Requirement:	7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.	Existing
Requirement:	8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.	Existing
Functional Area: **MCM Winter Maintenance Management** Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.		
Requirement:	1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.	Existing
Requirement:	6 The center shall collect real-time information on the state of the regional transportation system from other centers including current traffic and road conditions, weather conditions, special event and incident information and use the collected information to support winter maintenance operations.	Existing
Requirement:	8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.	Existing
Requirement:	9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.	Existing
Functional Area: **MCM Roadway Maintenance and Construction** Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.		
Requirement:	2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.	Existing

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **NDDOT TOC**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Roadway Maintenance and Construction** Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.		
Requirement:	4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.	Existing
Requirement:	9 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).	Existing
Functional Area: **MCM Work Zone Management** Remotely monitors and supports work zone activities, controlling traffic through dynamic message signs (DMS), highway advisory radio, gates and barriers, and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).		
Requirement:	3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.	Existing
Requirement:	4 The center shall control traffic in work zones by providing remote control of dynamic message signs, highway advisory radio systems, gates, and barriers located in or near the work zone.	Existing
Entity: **Traffic Management**		
Functional Area: **Collect Traffic Surveillance** Management of traffic sensors and surveillance (CCTV) equipment, collection of current traffic conditions, and distribution of the collected information to other centers and operators.		
Requirement:	1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.	Existing
Requirement:	2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.	Existing
Requirement:	4 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.	Planned
Functional Area: **TMC Signal Control** Remotely controls traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.		
Requirement:	1 The center shall remotely control traffic signal controllers.	Existing

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **NDDOT TOC**		
Entity: **Traffic Management**		
Functional Area: **TMC Signal Control** Remotely controls traffic signal controllers to implement traffic management strategies at signalized intersections based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.		
Requirement:	3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.	Existing
Requirement:	4 The center shall collect traffic signal controller fault data from the field.	Existing
Requirement:	5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.	Planned
Functional Area: **TMC Traffic Information Dissemination** Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.		
Requirement:	1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.	Existing
Requirement:	2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.	Existing
Requirement:	3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).	Existing
Requirement:	4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.	Existing
Requirement:	5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.	Planned
Requirement:	6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.	Planned
Functional Area: **TMC Regional Traffic Management** Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.		
Requirement:	1 The center shall exchange traffic information with other traffic management centers including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.	Planned

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **NDDOT TOC**		
Entity: **Traffic Management**		
Functional Area: **TMC Regional Traffic Management** Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.		
Requirement:	2 The center shall exchange traffic control information with other traffic management centers to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).	Planned
Functional Area: **TMC Incident Dispatch Coordination/Communication** Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.		
Requirement:	1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.	Planned
Requirement:	2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.	Planned
Requirement:	3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.	Planned
Requirement:	4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.	Planned
Requirement:	5 The center shall share resources with allied agency centers to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.	Planned
Requirement:	6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, border crossings, and rail operations centers.	Planned
Requirement:	7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.	Planned

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **NDDOT TOC**		
Entity: **Traffic Management**		
Functional Area: **TMC Incident Dispatch Coordination/Communication** Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.		
Requirement:	9 The center shall coordinate information and controls with other traffic management centers.	Planned
Functional Area: **TMC Traffic Network Performance Evaluation** Systems to predict travel demand patterns to support traffic flow optimization, demand management, and incident management. Collects data from surveillance equipment as well as input from other management centers including emissions, event promoters, and other TMCs.		
Requirement:	1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center to support overall network performance evaluations.	Planned
Requirement:	3 The center shall collect and store plans from event promoters for major future events possibly impacting traffic to support overall network performance evaluations.	Planned
Requirement:	6 The center shall exchange traffic information with other traffic management centers, including incidents, congestion data, traffic data, signal timing plans, and real-time signal control information to support overall network performance evaluations.	Planned
Functional Area: **Traffic Data Collection** Collection and storage of traffic management data. For use by operations personnel or data archives in the region.		
Requirement:	1 The center shall collect traffic management data such as operational data, event logs, etc.	Planned
Requirement:	3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.	Planned
Element: **NDDOT TOC Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Basic Surveillance** Field elements that monitor traffic conditions using loop detectors and CCTV cameras.		
Requirement:	1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.	Existing
Requirement:	2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.	Existing
Requirement:	4 The field element shall return sensor and CCTV system operational status to the controlling center.	Existing
Requirement:	5 The field element shall return sensor and CCTV system fault data to the controlling center for repair.	Existing

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **NDDOT TOC Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Signal Priority** Field elements that provide the capability to receive vehicle signal priority requests and control traffic signals accordingly.		
Requirement:	1 The field element shall respond to requests for indicator (e.g., signal) preemption requests from emergency vehicles at intersections, pedestrian crossings, and multimodal crossings.	Existing
Requirement:	2 The field element shall respond to requests for indicator (e.g., signal) priority requests from transit vehicles at intersections, pedestrian crossings, and multimodal crossings.	Planned
Functional Area: **Roadway Traffic Information Dissemination** Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).		
Requirement:	1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).	Planned
Requirement:	4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.	Planned
Functional Area: **Roadway Equipment Coordination** Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.		
Requirement:	1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.	Planned
Requirement:	3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.	Planned
Requirement:	4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.	Planned
Functional Area: **Roadway Automated Treatment** Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.		

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **NDDOT TOC Roadside Equipment**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Automated Treatment** Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.		
Requirement:	1 The field element shall activate automated roadway treatment systems based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	2 The field element shall activate automated roadway treatment systems under center control. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.	Planned
Requirement:	3 The field element shall return automated roadway treatment system and associated environmental sensor operational status to the maintenance center.	Planned
Requirement:	4 The field element shall return automated roadway treatment system and associated environmental sensor fault data to the maintenance center for repair.	Planned
Functional Area: **Roadway Work Zone Traffic Control** Field elements in maintenance and construction areas including CCTV cameras, driver information systems (such as DMS), and gates/barriers that monitor and control traffic and provide information directly to drivers in affected areas.		
Requirement:	1 The field element shall collect, process, and send work zone images to the center for further analysis and distribution, under center control.	Planned
Requirement:	2 Under traffic and maintenance center control, the field element shall include driver information systems (such as dynamic messages signs and highway advisory radios) that advise drivers of activity around the work zone through which they are currently passing.	Planned
Requirement:	5 The field element shall provide operational status for the surveillance (e.g. CCTV), driver information systems, and gates/barriers in work zones to the maintenance center.	Planned
Requirement:	6 The field element shall provide fault data for the surveillance (e.g. CCTV), driver information systems, and gates/barriers in work zones to the maintenance center for repair.	Planned
Functional Area: **Roadway Data Collection** Field elements to collect traffic, road, and environmental conditions information for use in transportation planning, research, and other off-line applications. Includes the sensors, supporting roadside infrastructure, and communications equipment.		
Requirement:	1 The field element shall collect traffic, road, and environmental conditions information.	Existing
Requirement:	2 The field element shall include the sensors and supporting roadside devices that sense, collect, and send traffic, road, and environmental conditions information to a center for archival.	Existing

Architecture			Status
Fargo-Moorhead Regional ITS Architecture (Region)			(Region)
Element: **NDDOT TOC Roadside Equipment**			
Entity: **Roadway Subsystem**			
Functional Area: **Roadway Data Collection** Field elements to collect traffic, road, and environmental conditions information for use in transportation planning, research, and other off-line applications. Includes the sensors, supporting roadside infrastructure, and communications equipment.			
Requirement:	3	The field element shall collect sensor status and sensor faults from roadside equipment and send it along with the recorded data to a center for archival.	Planned
Element: **RRRDC**			
Entity: **Emergency Management**			
Functional Area: **Emergency Call-Taking** Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.			
Requirement:	1	The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.	Existing
Requirement:	2	The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.	Existing
Requirement:	3	The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.	Existing
Requirement:	5	The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.	Existing
Requirement:	6	The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.	Existing
Requirement:	9	The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.	Existing
Requirement:	10	The center shall update the incident information log once the emergency system operator has verified the incident.	Existing
Requirement:	11	The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.	Existing
Functional Area: **Emergency Dispatch** Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units.			
Requirement:	1	The center shall dispatch emergency vehicles to respond to verified emergencies under center personnel control.	Existing

Architecture		Status
Fargo-Moorhead Regional ITS Architecture (Region)		(Region)
Element: **RRRDC**		
Entity: **Emergency Management**		
Functional Area: **Emergency Dispatch** Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units.		
Requirement:	2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.	Existing
Requirement:	3 The center shall relay location and incident details to the responding vehicles.	Existing
Requirement:	4 The center shall track the location and status of emergency vehicles responding to an emergency based on information from the emergency vehicle.	Planned
Requirement:	6 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.	Existing
Requirement:	7 The center shall receive traffic images to support dispatch of emergency vehicles.	Planned
Requirement:	9 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.	Existing
Functional Area: **Emergency Routing** Routing of emergency vehicles to facilitate the quickest/safest arrival. Routes may be determined based on real-time traffic information and road conditions or routes may be provided by Traffic Management on request.		
Requirement:	1 The center shall collect current traffic and road condition information for emergency vehicle route calculation.	Planned
Requirement:	4 The center shall receive asset restriction information to support the dispatching of appropriate emergency resources.	Existing