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Fargo-Moorhead Regional ITS Architecture Update

Version 3.0

Final Report

December 2014

NDSU

UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
ADVANCED TRAFFIC ANALYSIS CENTER

Fargo-Moorhead Regional ITS Architecture Version 3.0

Draft Report

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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.

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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

Service Packages

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

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EXECUTIVE SUMMARY

The Fargo-Moorhead Regional Intelligent Transportation Systems (ITS) Architecture was developed under the leadership of the Fargo-Moorhead Council of Governments (Metro COG). The goal of the F-M regional architecture (RA) is to be a framework and a roadmap that guides the implementation of ITS in the F-M region. The RA coordinates funding, deployment, information sharing, and operations of ITS in the region. The main ITS goal areas for the F-M region include enhanced traveler safety; effective traffic, freeway, and transit management; coordinated incident response; and enhanced data management and traveler information. A 10-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 and Metro COG for supporting the RA development and maintenance.

This version of the RA is the third iteration in a maintenance process that aims to keep the architecture up-to-date in accordance with FHWA guidelines and to continue to reflect the most current ITS picture in the region. This update was completed in concert with Metro COG's effort to update the F-M ITS Deployment Strategy and supports the strategy and other previously completed planning efforts. This version of the RA is based on the current version (7.0) of the National ITS Architecture.

The development and update of the RA was guided by a stakeholder group that owns and operates ITS in the F-M region and included:

- MPO planning staff
- City engineering and maintenance staff
- Transit staff
- State DOT district engineering and maintenance staff
- Law enforcement and emergency responders
- County engineering/planning staff
- Agency information technology technical staff
- Other agencies responsible for system operations and maintenance

The F-M RA supports the region's vision for the establishment of a traffic operations center (TOC) that will enhance arterial and freeway traffic operations. The RA includes options for a short-term goal of a hybrid TOC where interconnect among the traffic operators and with other relevant agencies is established; signal operations are coordinated; and data, including surveillance video, are shared among agencies in the area. In addition to the hybrid TOC scenario, the RA supports the regional longer-term goal for establishing a centralized TOC where all traffic operations functions in the area would be colocated.

In addition to traffic operations related ITS services, the RA includes services in the following areas: ***transit management*** with a focus on fixed route and demand response transit operations; ***maintenance and construction management*** with a focus on winter maintenance; ***emergency management*** with a focus on incident management strategies; and ***data management*** with a focus on coordinating the collection and archival of transportation data.

The architecture provides the basis for ITS deployment, and the information for the federally required systems engineering (SE) analysis for ITS projects. Specifically, the architecture contributes to completing the concept exploration; concept of operations; system requirements; and system validation and verification steps of the SE process.

The RA is technology independent and focused on services, information sharing, and interoperability. This allows the RA to remain valid over the entire planning horizon as technologies might change.

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 (Metro 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 two RA updates since in 2007 and 2014.

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 service 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	ITS Standards	Brief discussion of applicable ITS standards
10	Sequence of Projects	Time-frame for ITS projects
	Appendix A	Service Packages and Information Flow Diagrams
	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 Metro COG's metropolitan boundaries, which are also included in the Metro 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 ramp termini. 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. Fixed route and demand response transit services
 - b. Fleet management
 - c. Transit traveler 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
- d. Fleet management

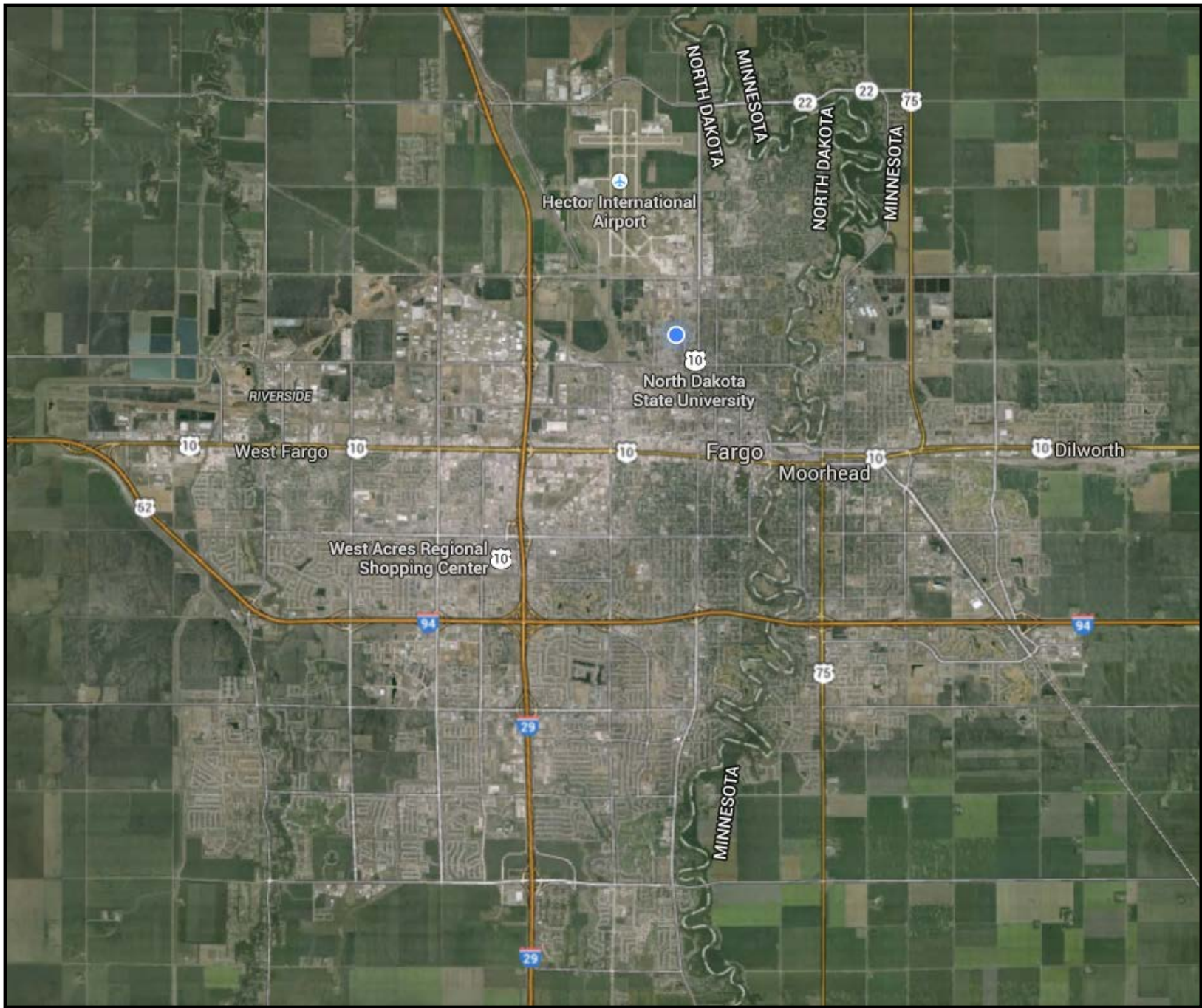


Figure 1 Map of the Fargo-Moorhead Region (Google)

3.0 STAKEHOLDERS

The development of the F-M RA was guided by several stakeholder groups. An ITS Architecture Core Group had the primary 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 3.2 lists stakeholders mapped to the F-M RA and identifies corresponding ITS elements.

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
BNSF Fargo	Burlington Northern Santa Fe – Fargo Office	BNSF
County Sheriffs	Cass County and Clay County Sheriff Departments	County Sheriff Vehicles
Fargo Engineering	City of Fargo Engineering Department	Fargo TOC Fargo Engineers Fargo Cameras Fargo Traffic Sensors Fargo Traffic Signals
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, Valley Fair, etc.	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 Cameras MnDOT D4 DMS MnDOT D4 Traffic Sensors MnDOT D4 Traffic Signals 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 Cameras NDDOT TOC DMS NDDOT TOC Traffic Sensors NDDOT TOC Traffic Signals NDDOT TOC NDDOT TOC Personnel NDDOT TOC Maintenance Vehicles
NDHP	North Dakota Highway Patrol - Fargo	NDHP Vehicles
<u>RRRDC Regional Partners</u> 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. Below are specific traffic management systems within the F-M area classified by agency.

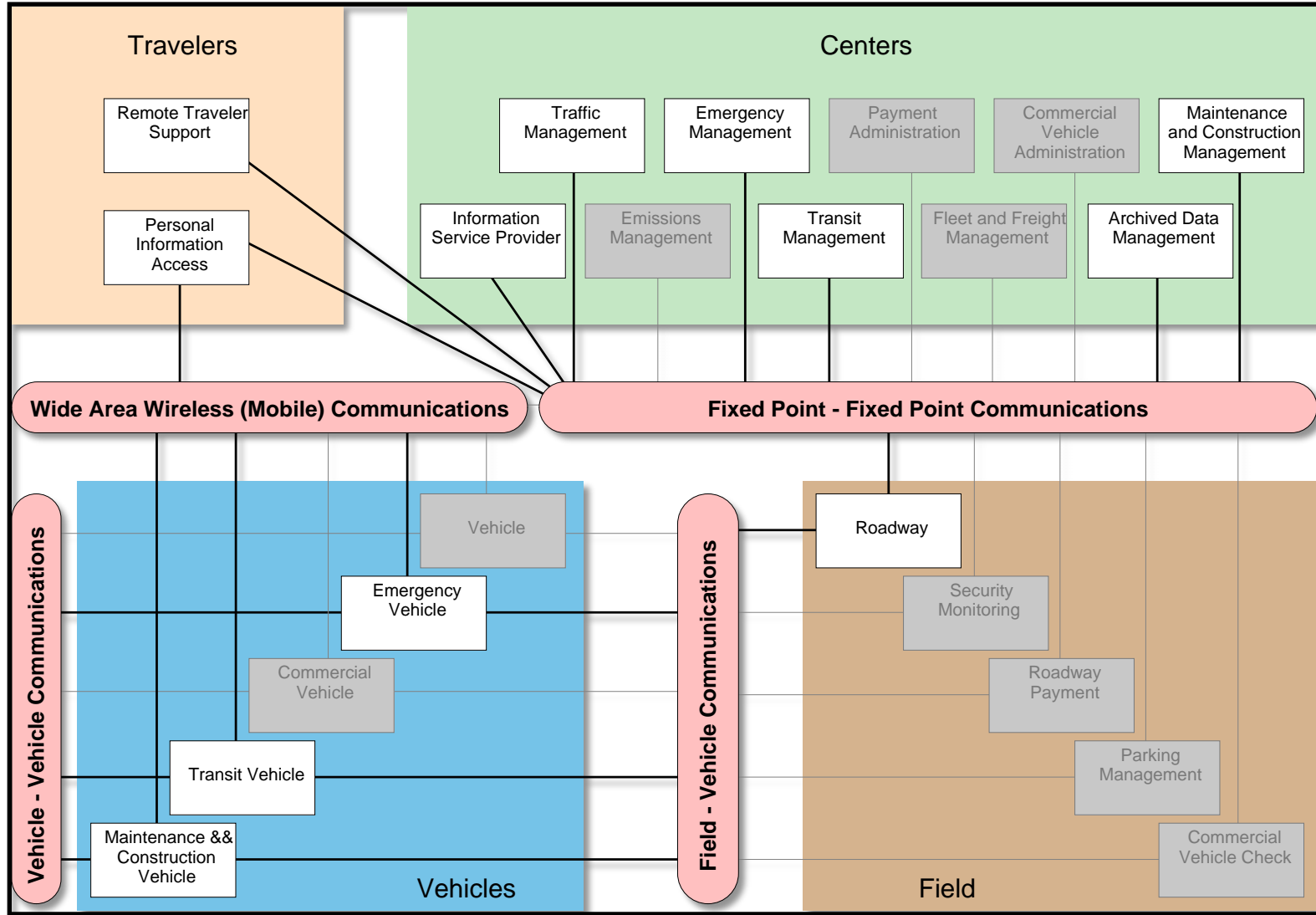


Figure 2 Fargo-Moorhead Physical Architecture

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.

Fargo TOC

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 cable. The city uses the Tactics central control software to facilitate effective traffic signal control management, facilitate traffic data collection, and support traffic flow analysis.

MnDOT TOC

MnDOT District 4 has performed a major update on their signal and communications system in Moorhead. An agreement is being worked out with the city of Moorhead to combine traffic operations.

Moorhead TOC

The city of Moorhead is in the process of converting all their signals to utilize the Voyage rail preemption controllers. The signals are expected to be controlled with Peek's Spinnaker central control software.

MnTOC

This planned TOC will combine signal operations in Moorhead for city and MnDOT owned signals, the city of Moorhead will take on the task of operating MnDOT signals. This arrangement is supported by the regional TOC concept of operations effort.

West Fargo TOC

The city of West Fargo operates an interconnected signal system of Econolite controllers utilized the Centracs central control software.

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, Moorhead, and West Fargo as well as Cass and Clay Counties. It also coordinates emergency management with the North Dakota Highway Patrol (NDHP), the Minnesota State Patrol (MSP), 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 response to emergencies. These EOCs currently rely on traditional phone line communications for sharing information. Metro COG had conducted emergency planning and within the process, ITS has been identified as a valuable asset. Appropriate emergency management service 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, GPS bus location, and transit traveler information.

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.

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. PTZ video cameras
4. Control devices
 - a. Traffic signal controllers
5. Warning/advisory devices
 - a. Permanent DMS
6. Roadway treatment devices
 - a. Red River Bridge automated anti-icing system

4.2.2 City of Fargo

1. Sensors
 - a. Loop detectors
2. Control devices
 - a. Traffic signal controllers
3. Surveillance/monitoring
 - a. PTZ video cameras

4.2.3 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 TH10
4. Roadway treatment devices
 - a. Red River Bridge automated anti-icing system

4.2.4 City of Moorhead

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

4.2.5 City of West Fargo Field Devices

1. Sensors
 - a. Video traffic detectors
2. Control devices
 - a. Traffic signal controllers
3. Surveillance/monitoring
 - a. PTZ video cameras

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
 - b. Law enforcement
 - c. Ambulance
2. Transit Vehicle
 - a. MAT buses with electronic fare box, AVL, and transit security
3. MCO vehicles for NDDOT and Fargo
 - a. Snowplows equipped with AVL and monitoring sensors

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 while this infrastructure has started as agency-specific, integration and interconnect efforts have taken place at several locations with more expected in the future as other services in the F-M RA are implemented.

1. Fiber
 - a. I-29 and I-94 (NDDOT)
 - b. Arterial network (Fargo)
 - c. Arterial network (West Fargo)
 - d. Arterial network (Moorhead)
 - e. MnDOT state highway system
2. 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 Services
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	Existing	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
	Moorhead TOC	Existing	Moorhead Traffic Operations Center	Moorhead Engineering
	West Fargo TOC	Existing	West Fargo Traffic Operations Center	West Fargo Engineering
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
	Moorhead Engineers	Existing	Moorhead Traffic Engineers	Moorhead Engineering
	West Fargo Engineers	Existing	West Fargo Traffic Engineers	West Fargo Engineering
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 and update.

5.1 Needs

The ITS needs from the 2007 architecture were revisited and updated accordingly. The stakeholders were extensively involved in updating the status of ITS projects identified in the architecture as well as identifying new projects and applications given their experience over the past few years since the last update.

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 service 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 Service 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 Service Packages

The following service 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 service package in the F-M area is also indicated (i.e., existing or planned. service packages with an Existing followed by an asterisk (*), indicates there are portions of the service package already deployed in the F-M area but additional portions are planned for deployment). Customized F-M Service Packages and associated Information Flows are shown in more detail in Appendix A. Please note that service packages in the Advanced Traffic Management and some in the Emergency Management areas now have three instances: one is to represent the existing conditions, and the other two are for how the service would be performed under the centralized and hybrid TPC scenarios.

ATMS01: Network Surveillance (Existing)

This service 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 service 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: Traffic Signal Control (Existing)

This service package provides the central control and monitoring equipment, communication links, and the signal control equipment that support traffic control at signalized intersections. A range of traffic signal control systems are represented by this service package ranging from fixed-schedule control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. This service package is generally an intra-jurisdictional package.

ATMS04: Traffic Metering (Planning)

This service package provides central monitoring and control, communications, and field equipment that support metering of traffic. It supports the complete range of metering strategies including ramp, interchange, and mainline metering. This package incorporates the instrumentation included in the Network Surveillance service package (traffic sensors are used to measure traffic flow and queues) to support traffic monitoring so responsive and adaptive metering strategies can be implemented.

ATMS06: Traffic Information Dissemination (Existing *)

This service 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, travel restrictions, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), 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 and restrictions due to maintenance and construction activities to be disseminated. The sharing of transportation operations data described in this service package also supports other services like ATMS09- Traffic Decision Support and Demand Management.

ATMS07: Regional Traffic Control (Existing *)

This service package provides for the sharing of traffic information and control among traffic management centers to support regional traffic management strategies. Regional traffic management strategies that are supported include inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor. This service package advances the ATMS03-Traffic Signal Control and ATMS04-Traffic Metering service packages by adding the communications links and integrated control strategies that enable integrated, interjurisdictional traffic management. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Traffic Signal Control and Traffic Metering service packages and adds hardware, software, and fixed-point to fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of control between traffic management centers.

ATMS08: Traffic Incident Management System (Existing)

This service package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The service package 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 rail operations and event promoters. Information from these diverse sources is collected and correlated by this service package to detect and verify incidents and implement an appropriate response. This service 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 using the Traffic Information Dissemination service package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information service packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.

ATMS13: Standard Railroad Grade Crossing (Existing)

This service package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the roadway subsystem and the driver in the architecture definition.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced 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. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the traffic management subsystem.

ATMS19: Speed Warning (Existing)

This service package monitors vehicle speeds and supports warning drivers when their speed is excessive. Also the service includes notifications to an enforcement agency to enforce the speed limit of the roadway. Speed monitoring can be made via spot speed or average speed measurements. Roadside equipment can display the speed of passing vehicles and/or suggest a safe driving speed. Environmental conditions and vehicle characteristics may be monitored and factored into the safe speed advisories that are provided to the motorist. For example, warnings can be generated recognizing the limitations of a given vehicle for the geometry of the roadway such as rollover risk for tall vehicles.

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

This service 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 service package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments include fog dispersion, anti-icing chemicals, etc. The service package includes the environmental sensors that detect adverse conditions, and the automated treatment system itself.

MC06: Winter Maintenance (Existing)

This service 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 service package manages work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work activities are underway. Traffic conditions are monitored using CCTV cameras and controlled using dynamic message signs (DMS), Highway Advisory Radio (HAR), gates and barriers. Work zone information is coordinated with other groups (e.g., ISP, traffic management, other maintenance and construction centers). Work zone speeds and delays are provided to the motorist prior to the work zones. This service package provides control of field equipment in all maintenance and construction areas, including fixed, portable, and truck-mounted devices supporting both stationary and mobile work zones.

APTS01: Transit Vehicle Tracking (Existing)

This service 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. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A two-way wireless communication link with the Transit Management Subsystem is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. 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 service package performs automated dispatch and system monitoring for fixed-route and flexible-route transit services. This service performs scheduling activities including the creation of schedules, blocks and runs, as well as operator assignment. This service determines the transit vehicle trip performance against

the schedule using AVL data and provides information displays at the Transit Management Subsystem.

APTS03: Demand Response Transit Operations (Existing)

This service package performs automated dispatch and system monitoring for demand responsive transit services. This service performs scheduling activities as well as operator assignment. In addition, this service package performs similar functions to support dynamic features of flexible-route transit services. This package monitors the current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. The Transit Management Subsystem provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. This service includes the capability for a traveler request for personalized transit services to be made through the Information Service Provider (ISP) Subsystem. The ISP may either be operated by a transit management center or be independently owned and operated by a separate service provider. In the first scenario, the traveler makes a direct request to a specific paratransit service. In the second scenario, a third party service provider determines that the paratransit service is a viable means of satisfying a traveler request and makes a reservation for the traveler.

APTS04: Transit Fare Collection Management (Existing)

This service package manages transit fare collection on-board transit vehicles and at transit stops using electronic means. It allows transit users to use a traveler card or other electronic payment device. Readers located either in the infrastructure or on-board the transit vehicles enable 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 service 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 service 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 service 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 service 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 service 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 service 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 (Existing)

This service 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 service 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 service 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 service package tracks and coordinates the transportation resources - the transportation professionals, equipment, and materials - that constitute a portion of the disaster response.

The service 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 service 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 service 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 (Existing)

This service package supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. The service 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 service 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 (Existing)

This service 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 service 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 service 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 service 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 service 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 service 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 service 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 Service Packages for the F-M area was the vehicle used for facilitating the operational concept development. Using Service 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 Service Package. Once the small group discussions were completed, the results (i.e., customized Service Packages) were presented to all the stakeholders participating in the RA development.

After the Service Packages were approved by the stakeholders, relevant changes were entered into Turbo Architecture. Turbo was used to generate the operational concept for each Service 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 Service Package. Subsection 6.2 summarizes operational roles and responsibilities, organized by stakeholders.

6.1 Implementation Roles

Service Packages	Stakeholders with Implementation Roles
Network Surveillance	NDDOT, Fargo, Moorhead, MnDOT, West Fargo
Traffic Signal Control	Fargo Engineering, Moorhead Engineering, MnDOT, NDDOT, West Fargo Engineering
Traffic Metering	NDDOT
Traffic Information Dissemination	NDDOT, MnDOT
Regional Traffic Control	Fargo Engineering, Moorhead Engineering, MnDOT, NDDOT, West Fargo Engineering
Traffic Incident Management System	NDDOT, MnDOT
Standard Railroad Grade Crossing	Fargo Engineering, Moorhead Engineering, MnDOT
Speed Warning	NDDOT, Fargo Engineering, West Fargo Engineering
Maintenance Vehicle Tracking	NDDOT, MnDOT, Fargo PW, Moorhead PW, West Fargo PW
Roadway Automated Treatment	NDDOT, MnDOT
Winter Maintenance	Fargo PW, Moorhead PW, MnDOT, NDDOT, West Fargo PW
Work Zone Management	Fargo PW, NDDOT, MnDOT, Moorhead PW, West Fargo PW
Transit Vehicle Tracking	MAT
Transit Fixed-Route Operations	MAT
Demand Response Transit Operations	
Transit Fare Collection Management	MAT
Transit Security	MAT
Transit Fleet Management	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, West Fargo Engineering
Disaster Response and Recovery	FM Emergency Management, RRRDC, ND Division of Emergency Services
Evacuation and Reentry Management	FM Emergency Management, RRRDC, ND Division of Emergency Services

Disaster Traveler Information	NDDOT, MnDOT
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 for archiving
	NDDOT	Collect and provide data for archiving
	MnDOT	Collect and provide data for archiving
	Moorhead	Collect and provide data for archiving
	West Fargo	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 for clearing incidents

	MSP DL	<ol style="list-style-type: none"> 1. Coordinate with other law enforcement and emergency management agencies 2. Respond to incidents on MN state system
	NDDOT	<ol style="list-style-type: none"> 1. Broadcast traveler information 2. Provide resources 3. Provide surveillance images to NDHP
	NDHP	<ol style="list-style-type: none"> 1. Coordinate with other law enforcement and emergency management agencies 2. Respond to incidents on ND state system
	RRRDC Regional Partners	<ol style="list-style-type: none"> 1. Coordinate response 2. Provide dispatch and communications
	FM Emergency Management	Coordinate disaster response and evacuation
	West Fargo PW	Provide resources for clearing incidents
Maintenance and Construction	Fargo PW	<ol style="list-style-type: none"> 1. City system road maintenance 2. Provide maintenance information 3. Winter maintenance (snow plow operations, sanding, anti icing) on Fargo city system
	MnDOT D4	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Moorhead city system road maintenance 2. Provide maintenance information 3. Winter maintenance (snow plow operations, sanding, anti icing) on Moorhead city system
	NDDOT	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Design, operate, and maintain signal control in Fargo city system 2. Coordinate with NDDOT and Moorhead
	MnDOT D4	<ol style="list-style-type: none"> 1. Design, operate, and maintain signal control on MN state system in Moorhead 2. Coordinate with Moorhead
	Moorhead Engineering	<ol style="list-style-type: none"> 1. Design, operate, and maintain signal control in Moorhead city system 2. Coordinate activities with MnDOT
	NDDOT	<ol style="list-style-type: none"> 1. Signal control on ND state system 2. Coordinate with Fargo and West Fargo
	West Fargo Engineering	<ol style="list-style-type: none"> 1. Design, operate, and maintain signal control in West Fargo city system 2. Coordinate with NDDOT and Fargo
Transit Services	MAT	Operate fixed route and demand response transit 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 Service 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. ITS service area
 - a. The service area 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

ITS Service Area	Purpose	Stakeholders	Issues
Archived Data Management	Data use/storage	ATAC NDDOT MnDOT Fargo Engineering Moorhead Engineering West Fargo Engineering MAT	Security, resource sharing
Advanced Traffic Management – 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
Advanced Traffic Management – Inter-jurisdictional Signal Systems Interconnect	Connect signal systems between area agencies	NDDOT Fargo West Fargo	Security Data sharing Access to networks
Advanced Traffic Management – Establish MnTOC for hybrid TOC	Minnesota joint signal operations	MnDOT Moorhead	Access to networks and devices
Advanced Traffic Management – Centralized TOC	Regional centralized signal operations	NDDOT MnDOT Fargo Moorhead West Fargo	Access to networks and devices Resource sharing

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 service 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.

<i>Requirement:</i>	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
<i>Requirement:</i>	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
<i>Requirement:</i>	3	The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.	Existing
<i>Requirement:</i>	4	The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.	Existing
<i>Requirement:</i>	5	The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.	Existing
<i>Requirement:</i>	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.	Existing

9.0 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

10.0 PROJECTS SEQUENCE

This section briefly outlines possible time frame for deployment for selected ITS projects in the F-M area. Service 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.

In the following table, Service Packages are arranged into short (0-3 years), medium (3-6 years), and long-term (6-15 years) deployment categories. Please note that Service Packages are organized in the same order they appear in the National ITS Architecture.

Service Packages	Time Frame
Network Surveillance	Short
Traffic Signals Control	Implemented
Traffic Metering	Long
Traffic Information Dissemination	Medium
Regional Traffic Control	Short-Medium
Traffic Incident Management System	Medium
Standard Railroad Grade Crossing	Implemented
Speed Warning	Implemented
Roadway Automated Treatment	Implemented
Winter Maintenance	Implemented
Work Zone Management	Medium
Transit Vehicle Tracking	Implemented
Transit Fixed-Route Operations	Implemented
Demand Response Transit Operations	Implemented
Transit Passenger and Fare Management	Implemented
Transit Security	Implemented
Transit Signal Priority	Limited implementation
Transit Passenger Counting	Short
Emergency Call-Taking and Dispatch	Implemented
Emergency Routing	Implemented
Wide-Area Alert	Implemented
ITS Data Warehouse	Short-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. Metro 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 SERVICE PACKAGES AND INFORMATION FLOWS

The Service 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

APPENDIX B FARGO-MOORHEAD FUNCTIONAL REQUIREMENTS