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Grand Forks-East Grand Forks Regional ITS Architecture Update

Version 2.0

Final Report

December 2008

Grand Forks-East Grand Forks Regional ITS Architecture Update

Final Report

December 2008

The information contained in this report was obtained through extensive input from various stakeholders in the Grand Forks-East Grand Forks 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
CAT	Cities Area Transit
CCTV	Closed Circuit Television
Dist	District
DMS	Dynamic Message Sign
DOT	Department of Transportation
EAS	Emergency Alert System
EGF	East Grand Forks
EOC	Emergency Operations Center
EV	Emergency Vehicle
FD	Fire Department
FHWA	Federal Highway Administration
GF	Grand Forks
ISP	Information Service Provider
ITS	Intelligent Transportation Systems
MCO	Maintenance and Construction Operations
Mn/DOT	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

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 Grand Forks-East Grand Forks Regional Intelligent Transportation Systems (ITS) Architecture was prepared under the leadership of the Grand Forks-East Grand Forks Metropolitan Planning Organization (GF-EGF MPO). The goal of the GF-EGF regional architecture (RA) is to guide the implementation of ITS systems in the GF-EGF region and coordinate funding, deployment, information sharing, and operations of ITS systems in the region. The main ITS goal areas for the GF-EGF 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. A partnership agreement was established between ATAC and the Grand Forks-East Grand Forks MPO 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 GF-EGF region continues to experience increased economic and cultural activity, serving as a business and cultural center for the rural surrounding areas. 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 GF-EGF RA were primarily based on the metropolitan boundaries for the GF-EGF MPO. Major jurisdictions include:

1. City of Grand Forks, North Dakota
2. City of East Grand Forks, Minnesota
3. Grand Forks County, North Dakota
4. Polk 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 (Mn/DOT), and the Federal Highway Administration (FHWA) participated 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 three MPOs
    a. Two representatives from each MPO

    b. FHWA Division Office, Bismarck, North Dakota
    c. NDDOT
2. Technical Steering Committee: provide technical information on existing and planned systems 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, 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 GF-EGF 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 17 Market Packages were identified for the GF-EGF 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. Six potential agreements were identified for the GF-EGF region, including surface street control, incident management, emergency routing, network surveillance, and traffic enforcement.

The GF-EGF ITS projects for short-term deployment build upon existing arterial traffic management, advanced transit management, and transit fleet management systems. For

the medium-term, coordinated incident response are planned for deployment. Finally, fleet management technologies for maintenance vehicles are planned for the long-term deployment time frame.

As part of the RA development, the GF-EGF MPO has been designated with the role of maintaining and updating the GF-EGF Regional ITS Architecture on an as needed basis. The GF-EGF MPO will coordinate changes to the RA as more ITS projects have been planned or major changes to the transportation system have taken place.

ARCHITECTURE UPDATE SUMMARY

The regional ITS architecture (RA) is a live document that requires regular maintenance to reflect the most up-to-date ITS picture in the region and to continue to meet federal requirements. FHWA architecture conformity rule states that: "The agencies and other stakeholders participating in the development of the regional ITS architecture shall develop and implement procedures and responsibilities for maintaining it, as needs evolve in the region." The GF-EGF MPO has been designated with the role of maintaining and updating the GF-EGF RA as needed. As part of their partnership agreement, ATAC was contracted by the MPO to carry out the update.

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 GF-EGF RA specified an update cycle of about two years, the original RA development was completed in early 2005. The current, and first, update is set to be completed in December 2008.

This section of the report describes changes in the GF-EGF region as they pertain to ITS function areas. At the end of each functional area is a list of market packages (MP) impacted by these changes, please refer to the market packages in Appendix A to see updated MP diagrams with changes in subsystems and information flows. Appropriate changes have been made to corresponding sections in the report body to reflect the updates as well. The architecture consists of two components that are updated in the maintenance process: the architecture Turbo database and the architecture report document. Both files, and the report appendices, are available for download from the GF-EGF RA website:
http://www.atacenter.org/regional/grandforks/

Agency Updates by ITS Service Area

This section summarizes data collected by through stakeholder interviews in the maintenance process.

Public Transportation Management (Transit)

Updates

- Cities Area Transit (CAT) had an estimated 9% increase in ridership since the original RA was developed.

- CAT is upgrading to a new fare box system, installation expected to begin in early 2009.
- Along with the new fare boxes there will be an update to the management system. Currently multiple systems are being considered, some features of the new system would include:
    - Automated vehicle location (AVL) data on a map.
    - Automated display and annunciation of stops for the hearing and vision impaired.
    - Advanced communication and dispatch system that would require the bus be stopped before a dispatcher message can be read.
    - Automated transit signal priority (TSP) operations. Currently, TSP is initiated by the transit vehicle driver.
- Both the new fare boxes and management system will allow for better data collection and enhanced management of the transit system.
- CAT uses a computerized fleet management system that handles bus rotations and scheduling maintenance activities.
- Vehicles in the CAT fleet are now equipped with an enhanced video monitoring system that records inside and outside of the vehicle. The system is capable of recording driving events such as braking, and activating turn signals which can be reviewed in the case of an accident, this camera system is a valuable safety tool.

Architecture changes

- APTS04 Transit Fare Collection and Management
- APTS06 Transit Fleet Management
- APTS09 Transit Signal Priority
- APTS10 Transit Passenger Counting

Traffic Management

Updates

- Wireless connectivity has been added to a number of traffic signals in Grand Forks to replace legacy phone modem and twisted pair connections.
- The city of Grand Forks is capable of performing turning movement data collection at actuated intersections using video detection, currently one intersection is set up for data collection and automated download of the data. Other intersections are set up for data collection but require manual download of the data. More intersections can be set up if the need arises. The data collected is valuable for updating signal timing plans to improve traffic flow. The data can also be used to supplement the MPO's data collection activities for planning purposes.
- An MPO project has been recently completed to put in place updated coordinated signal plans on the 32nd Avenue S corridor.

Architecture changes

- ATMS03 Surface Street Control

Maintenance and Construction Management

Updates

- NDDOT is incrementally updating their fleet of snowplows with AVL capabilities.
- Mn/DOT has AVL on half their trucks.
- The city of Grand Forks is adding AVL capabilities to public works and other service vehicles.

Architecture changes

- MC01 Maintenance and Construction Vehicle and Equipment Tracking
- MC06 Winter Maintenance Activities

Emergency Management

Updates

- Emergency management agencies in the region have upgraded their communications to the Tait radio system that is digital, analog, and mixed mode capable.
- Emergency vehicles in the region are now equipped with GPS and AVL capabilities, allowing dispatchers to track vehicle movement on a live map.
- The Grand Forks Police Department (GFPD) has obtained three portable dynamic message signs (DMS) that are currently being used for events and incident management. The police department also makes the signs available to other agencies in the region when requested.

Architecture changes

- ATMS06 Traffic Information Dissemination
- ATMS08 Traffic Incident Management System

Project Deployment Timeframe Update

The original RA report completed in 2005 identified ITS projects based upon their projected deployment timeframe. Projects targeted for short-term deployment build upon existing arterial traffic management, automated treatment systems for bridges, and transit management systems. For the medium-term, integrated traveler information and coordinated incident response are planned for deployment. Finally, fleet management technologies for transit and maintenance vehicles and integrated traveler information are planned for the long-term deployment time frame.

As part of the RA update, the deployment timeframes and the status of identified projects were revisited, the following was observed:

- Short-term projects:
    - Arterial traffic management: efforts are ongoing as expected.

    - Automated anti-icing treatment systems for bridges: no systems have been deployed mainly due to NDDOT suspending installations of new anti-icing systems, the suspension will remain until a benefit/cost study is completed. The study is expected to be completed in spring 2009.
    - Transit management systems: efforts are ongoing as expected; an integrated system can be in place in 2009.
- Medium-term projects:
    - Integrated traveler information: some new avenues for providing traveler information have been deployed, namely the GFPD portable DMS. However, an integrated system is still further ahead in the future.
    - Coordinated incident response: several key pieces of an incident response system have now been deployed, including upgrades to the communication system for emergency management agencies and the GFPD DMS. In addition to the new technologies, the MPO has recently pulled together a group of regional stakeholders that would be involved in incident response.
- Long-term projects:
    - Transit fleet management technologies: efforts are ongoing sooner than expected.
    - Maintenance fleet management technologies: efforts are ongoing sooner than expected.

Based on the deployment status and discussions with stakeholders in the region, the revised timeframe is:

- Short-term projects:
    - Arterial traffic management.
    - Advanced transit management.
    - Transit fleet management.
- Medium-term projects:
    - Coordinated incident response.
- Long-term projects:
    - Integrated traveler information.
    - Maintenance fleet management technologies.

1.0 INTRODUCTION

This document summarizes the results of the regional Intelligent Transportation architecture development for the Grand Forks-East Grand Forks 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 Grand Forks-East Grand Forks Regional Intelligent Transportation Systems (ITS) Architecture was prepared under the leadership of the Grand Forks-East Grand Forks Metropolitan Transportation Organization (GF-EGF MPO). The goal of the GF-EGF regional architecture (RA) is to guide the implementation of ITS systems in the GF-EGF area and coordinate funding, deployment, information sharing, and operations of ITS systems in the region. The main ITS goal areas for the GF-EGF area 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 is also facilitating the first RA update to be completed in December 2008.

1.1 Report Organization

The GF-EGF RA Report is organized into several main sections to facilitate the report use. In addition, an electronic file has been prepared using Turbo Architecture 3.0 in order to access the architecture and make changes or future updates.

Below is a description for each of the remaining sections of this report:

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	Detailed Market Packages
Appendix-B	Functional Requirements

2.0 REGION AND SCOPE

This section describes the geographical characteristics of the GF-EGF 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 GF-EGF RA primarily consisted of the GF-EGF MPO's metropolitan boundaries. Major jurisdictions within the region include the following (Figure 1):

1. City of Grand Forks, North Dakota
2. City of East Grand Forks, Minnesota
3. Grand Forks County, North Dakota
4. Polk County, Minnesota

In addition, the North Dakota Department of Transportation (NDDOT) is responsible for operating and maintaining the state highway system within North Dakota, including sections of Interstate highway I-29 and U.S. 2. The NDDOT also has an agreement with Grand Forks for operating traffic signals located on the state system. Similarly, the Minnesota Department of Transportation (Mn/DOT) is responsible for traffic signal operations in East Grand Forks.

2.2 Scope of the RA

The scope of the GF-EGF 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
    d. Highway-Rail Intersection
2. Public Transportation Management
    a. Fleet management (real-time information)
    b. Automated Passenger and Fare Management
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. Fleet Management

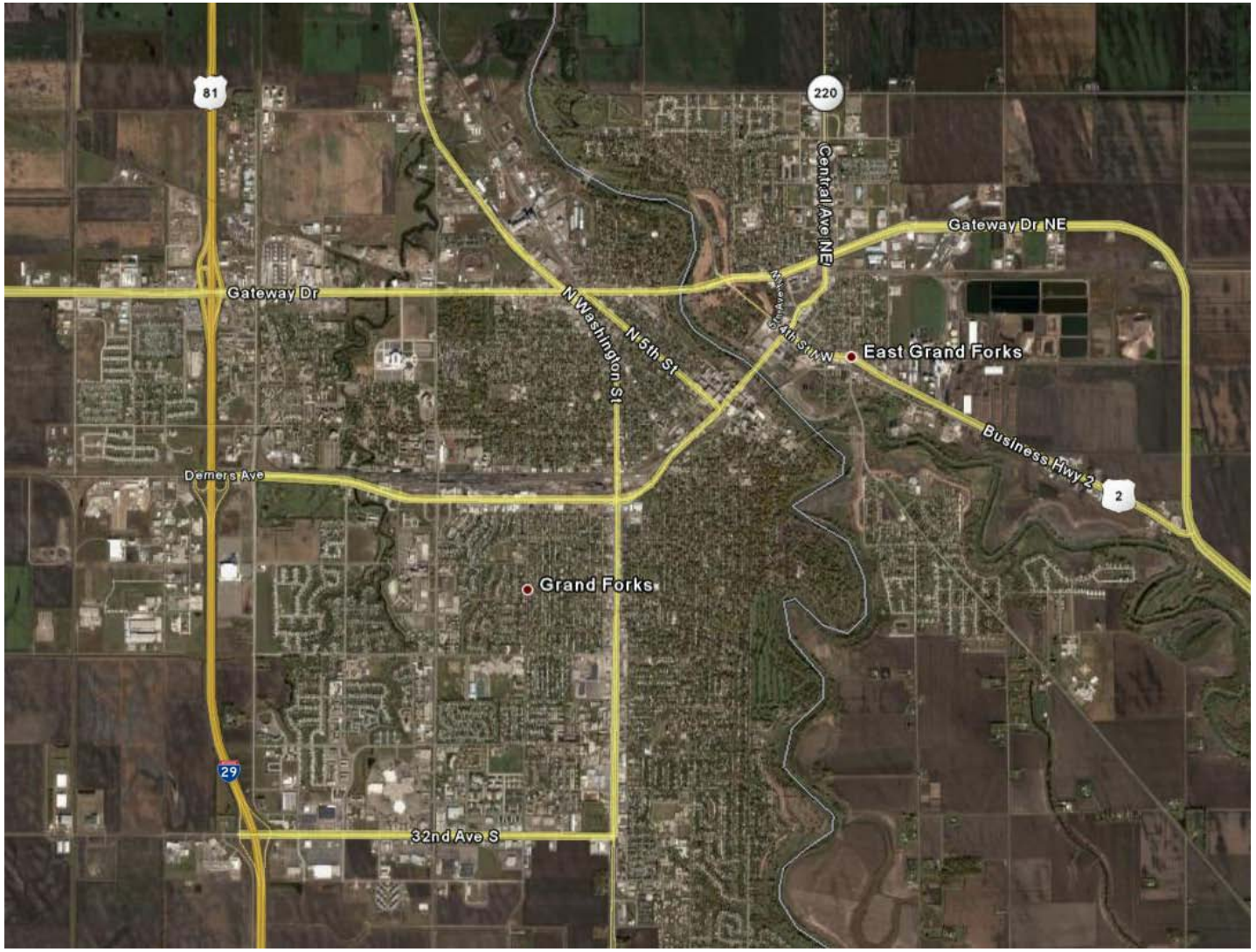


Figure 1. Map of the Grand Forks-East Grand Forks Area (Google Earth)

3.0 STAKEHOLDERS

Stakeholders who supported the regional ITS architecture developed in the GF-EGF area included transportation, public works, law enforcement, emergency management, transit, and other related agencies. For the GF-EGF these agencies spanned the two cities of Grand Forks and East Grand Forks, as well as the North Dakota and Minnesota transportation departments. Stakeholders who participated in the RA development and their corresponding representatives are shown in Table 3.1. Stakeholders (and associated ITS elements) with primary ITS ownership/operations are listed in Table 3.2.

Table 3.1 Grand Forks – East Grand Forks Stakeholders

Name		Organization	Phone
Mark	Aubol	GP Public Works – Streets	(701) 746-2570
Dale	Bergman	Cities Area Transit	(701) 746-2600
Gregory	Boppre	City of EGF – City Engineer	(218)773-1185
Steve	Busek	FHWA – ND Division	(701) 250-4343 x112
Jim	Campbell	Grand Forks Co. Emergency Management	(701) 780-8213
Nancy	Ellis	GF-EGF MPO – EGF Planner	(218)772-0124
Kevin	Dean	Grand Forks Public Information Center	(701) 746-4636
Kent	Ehrenstrom	Mn/DOT	(218) 755-4521
Todd	Feland	GF Public Works	(701) 746-2570
Brad	Gengler	City of GF – City Planner	(701) 746-2655
Randy	Gust	EGF Fire Dept	(218) 773-2403
Bruce	Hansen	City of Grand Forks	(701) 746-2690
Earl	Haugen	GF-EGF MPO	(701) 746-2657
Mike	Hedlund	EGF Police Department/EGF Dispatch	(218) 773-1104
Mark	Johnson	FHWA-ND Division	(701) 250-4343
Adam	Jonasson	City of GF – Information Services	(701) 746-2682
Michael	Kamnikar	Mn/DOT	(218) 755-4521
Richard	Melby	MN State Patrol	(218) 681-0942
Allan	Morken	PSAP	(701) 787-8039
Peter	O'Neill	Grand Forks Fire Dept	(701) 476-2566
Richard	Onstad	Grand Forks County	(701) 780-8248
Gary	Orluck	ND Highway Patrol Grand Forks District	(701) 795-3832
Richard	Parton	NDDOT GF District – Maintenance Coordinator	(701)787-6507
Richard	Sanders	Polk County	(218) 470-8253
Keith	Schroeder	GF Police Department	(701) 746-2742
John	Wachter	EGF Public Works	(218) 773-2442
Allen	Wagner	Polk County Emergency Management	(218) 281-6713
Jane	Williams	City of GF – Traffic Engineer	(701) 746-7459

Table 3.2 Grand Forks - East Grand Forks ITS Stakeholders		
Stakeholder	**Description**	**Associated Elements**
NDDOT GF District	NDDOT Grand Forks district	NDDOT District Vehicles
NDDOT GF District	NDDOT Grand Forks district	NDDOT District Field Devices
NDDOT GF District	NDDOT Grand Forks district	NDDOT District Office
EGF PW	East Grand Forks Public Works	EGF PW Operations Center
EGF PW	East Grand Forks Public Works	EGF PW Field Devices
GF PD	Grand Forks Police Department	GF PD Vehicles
EGF PD	East Grand Forks Police Department	EGF PD Vehicles
EGF PD	East Grand Forks Police Department	EGF Dispatch Center
CAT	Cities Area Transit (CAT)	CAT Operations Center
CAT	Cities Area Transit (CAT)	Transit Vehicles
CAT	Cities Area Transit (CAT)	Traveler Card
CAT	Cities Area Transit (CAT)	CAT System Operator
CAT	Cities Area Transit (CAT)	CAT Drivers
Mn/DOT Dist 2	Minnesota DOT District 2 Bemidji	Mn/DOT D2 Vehicles
Mn/DOT Dist 2	Minnesota DOT Distrc-t 2 Bemidji	Mn/DOT D2 Field Devices
Mn/DOT Dist 2	Minnesota DOT Distrct 2 Bemidji	Mn/DOT D2 TOC
NDHP	North Dakota Highway Patrol	NDHP Vehicles
MSP	Minnesota State Patrol Crookston	MSP Vehicles
MSP	Minnesota State Patrol Crookston	MSP Dispatch Center Crookston
GF PW	Grand Forks Public Works	GF PW Operations Center
GF PW	Grand Forks Public Works	GF PW Vehicles
GF PW	Grand Forks Public Works	GF PW Field Devices
GF Engineering	GF Engineering agencies	GF TOC Field Devices
GF Engineering	GF Engineering agencies	GF TOC
Grand Forks	City of Grand Forks	PIC
Grand Forks	City of Grand Forks	PSAP
GF FD	Grand Forks Fire Department	GF FD Vehicles
EGF FD	East Grand Forks Fire Department	EGF FD Vehicles
Altru Ambulance	GF-EGF area ambulance service	Altru Ambulance Vehicles
ND Department of Emergency Services	North Dakota Department of Emergency Services	State Radio
GF Event Venus	Alerus Center, Ralph Engelstad Arena, other venues	Event Promoters

4.0 SYSTEM INVENTORY

This section summarizes the results of the system inventory process for the GF-EGF 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 GF-EGF region:

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

These entities are explained in greater details in the following subsections. Section 4.5 shows a summary of ITS inventory in the GF-EGF for each stakeholder.

4.1 GF-EGF 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, 6 were found to apply to the GF-EGF RA. A representation of the GF-EGF 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 GF-EGF area are concentrated into the main corridors in the area. They primarily include arterial traffic control and managing event traffic for the Alerus Center. The specific traffic management systems within the GF-EGF area classified by agency are discussed in the next section.

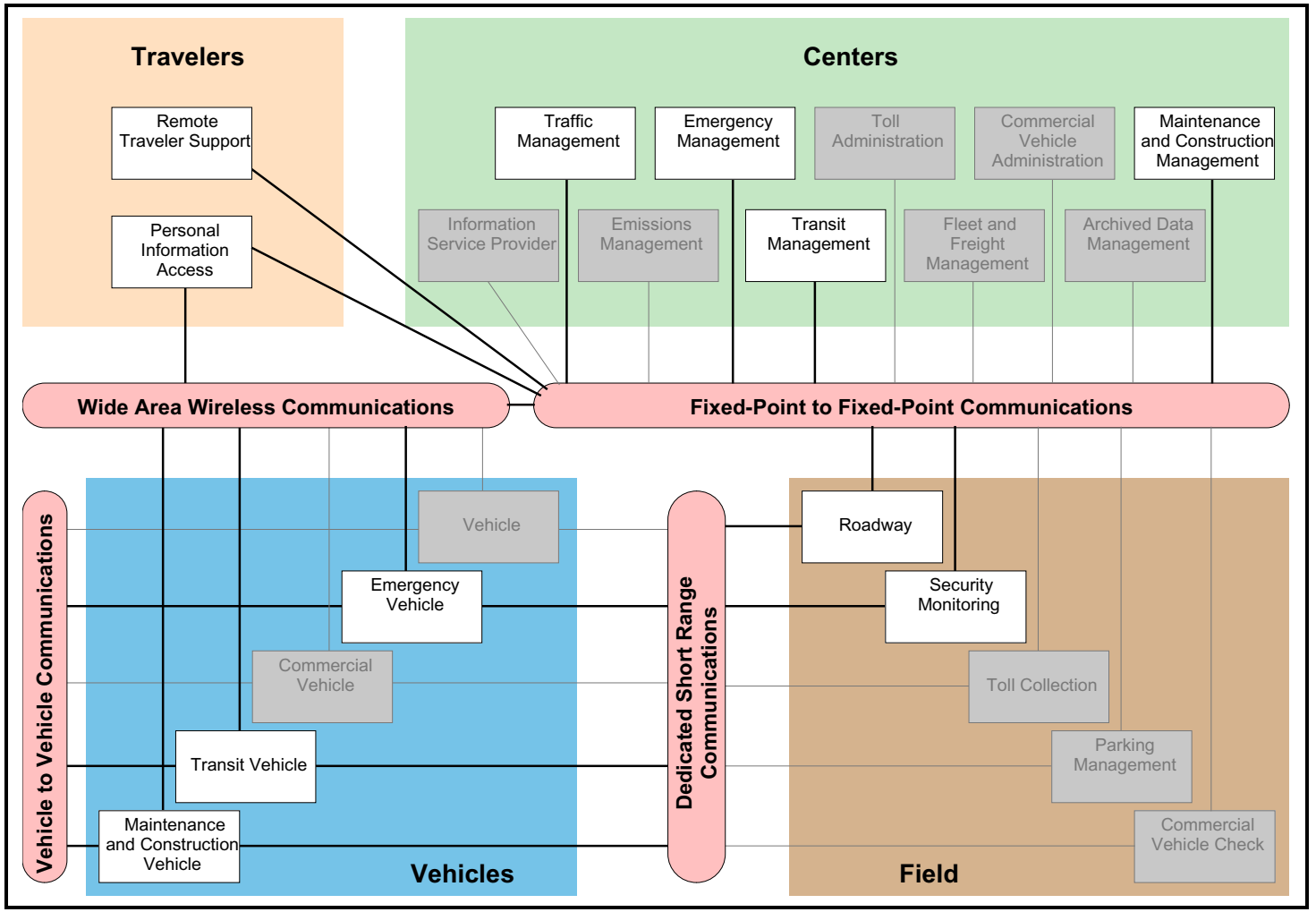


Figure 2. Grand Forks-East Grand Forks Physical Architecture

City of Grand Forks Traffic Signal System

The City of Grand Forks maintains a modern traffic signal control system with several coordinated corridors. All signals, except for the downtown area, have communication capabilities using fiber, twisted pair, and wireless communications for several closed-loop systems. The city also has several intersections supported by video detection, which enables traffic monitoring and detailed traffic data collection. In addition, the City of Grand Forks operates electronic lane control signs to increase capacity at signalized intersections in the Alerus Center vicinity. These signs primarily control lane usage for turning traffic during event traffic control plans.

4.1.2 Emergency Management Center

Emergency management and 9-1-1 dispatch functions for the City of Grand Forks and Grand Forks County are performed through the Public Safety Answering Point (PSAP). They provide radio communications for Grand Forks Fire and Police, Grand Forks Sheriff's Office, UND Police, Altru Ambulance, and all rural fire departments. The PSAP dispatch center also provides emergency medical pre-arrival instruction to callers. Dispatch and 9-1-1 services in East Grand Forks are provided by the police department while Polk County Sheriff's office provides those services for Polk County. Grand Forks emergency management agencies have recently upgraded their communications system to a Tait radio that is digital, analog, and mixed mode capable.

4.1.3 Maintenance and Construction Management Center

Currently, there are four entities which handle Maintenance and Construction Management (MCO) in the GF-EGF area, including: Grand Forks Public Works, East Grand Forks Public Works, NDDOT, and Mn/DOT. These agencies are incrementally adding fleet management capabilities, using Automated Vehicle Location (AVL) technologies. Among the ITS technologies that fit under winter maintenance activities are automated roadway treatment systems (i.e., bridge anti-icing systems). However, the timing of deploying these systems is tentative given funding uncertainties.

4.1.4 Information Service Provider

Functions associated with an Information Service Provider (ISP) are currently handled through multiple agencies in the GF-EGF region. Grand Forks has a Public Information Center (PIC) which serves as a resource for citizens, city departments, city council, and the mayor. The PIC administers the City's website and interfaces daily with media outlets to provide public information. The NDDOT handles traveler information at the statewide level using 511 and a traveler information web page. The NDDOT Grand Forks District Office controls a number of portable DMS which are used to warn drivers of incidents and weather related road conditions. The GF Police Department also uses their portable DMS to provide travelers with incident and detour information.

4.1.5 Transit Management Center

The Cities Area Transit (CAT) provides public transportation services for the GF-EGF metropolitan area. CAT operates eight fixed routes in Grand Forks and two in East Grand Forks. CAT is in the process of acquiring a new automated fare box system which provides enhanced management capabilities, including revenue analysis, passenger data analysis, and in the future GPS bus location. CAT will also be adding a new transit management system that will enable AVL functionality, automated audible and visual stop announcements, and add the capability of performing automated transit signal priority.

4.1.6 Archived Data Management Center

Only Grand Forks Engineering and CAT currently have the ability to collect data from ITS sensors. However, as more ITS devices are deployed, it is expected that data archival functions will be coordinated region-wide.

4.2 GF-EGF Field Devices

This type of physical entities refers to field devices used to support ITS systems. The majority of field devices in the GF-EGF 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-29 in Grand Forks
2. Warning/advisory devices
    b. Two portable DMS along I-29

4.2.2 City of Grand Forks Field Devices

1. Sensors
    a. Traffic
        i. Video traffic detectors
        ii. Loop detectors
2. Control devices
    b. Traffic signal controllers
    c. Electronic lane use signs

4.2.3 City of East Grand Forks/Mn/DOT Field Devices

1. Sensors
    a. Traffic
        i. Loop detectors
2. Control devices
    b. Traffic signal controllers

4.2.3 City of Grand Forks Police Department Field Devices

1. Warning/advisory devices
   a. Three portable DMS

4.3 GF-EGF Vehicles

There are three types of vehicles included in the GF-EGF 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 GF-EGF area
   a. Fire (signal preemption)
   b. Law enforcement (AVL)
   c. Ambulance (signal preemption)
2. Transit Vehicle
   a. CAT buses with electronic fare box, AVL capabilities, and traffic signal priority (TSP)
3. MCO vehicles for NDDOT and Grand Forks
   a. Snowplows equipped with AVL (planned)

4.4 GF-EGF Communication Infrastructure

Below is a brief description of existing and planned communication infrastructure in the GF-EGF 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 GF-EGF RA is implemented.

1. Fiber
   a. Arterial network (Grand Forks)
2. Phone drops (dial-up)
   a. Grand Forks traffic signals
   b. East Grand Forks traffic signals
3. Wireless/cellular
   a. NDDOT portable DMS
   b. Grand Forks traffic signals
   c. GFPD portable DMS

4.5 Summary of GF-EGF Inventory

Entity	ITS Element	Description	Status	Stakeholder
Emergency Management	PSAP	Public Safety Answering Point	Existing	Grand Forks
Emergency Vehicle Subsystem	GF FD Vehicles	Grand Forks Fire Department Vehicles	Existing	EGF FD
Maintenance and Construction Management	GF PW Operations Center	Grand Forks Public Works operations	Existing	GF PW
Maintenance and Construction Vehicle	GF PW Vehicles	Grand Forks Public Works vehicles	Existing	GF PW
Roadway Subsystem	GF PW Field Devices	Grand Forks Public Works devices	Planned	GF PW
Traffic Management	GF TOC	Grand Forks area Traffic Operations Center	Planned	GF Engineering
Roadway Subsystem	GF TOC Field Devices	Grand Forks area traffic sensors and control devices	Existing	GF Engineering
Transit Vehicle Subsystem	Transit Vehicles	CAT buses	Existing	CAT
Traveler Card	Traveler Card	CAT fare card	Existing	CAT
Traffic	Traffic	Terminator	Existing	
Information Service Provider	PIC	Public Information Center	Existing	Grand Forks
Driver	Driver	Terminator	Existing	
Transit Vehicle Operator	CAT Drivers	CAT bus drivers	Existing	CAT
Transit System Operators	CAT System Operator	CAT dispatch and operations personnel	Existing	CAT
Media	Media	Terminator	Existing	
Transit Management	CAT Operations Center	Cities Area Transit dispatch center	Existing	CAT
Emergency Vehicle Subsystem	GF PD Vehicles	Grand Forks Police Department Vehicles	Existing	GF PD
	EGF PD Vehicles	East Grand Forks Police Department Vehicles	Existing	EGF PD
	EGF FD Vehicles	East Grand Forks Fire Department Vehicles	Existing	EGF FD
Maintenance and Construction Vehicle	EGF PW Vehicles	East Grand Forks public works vehicles	Existing	
	NDDOT District Vehicles	NDDDOT maintenance and construction vehicles	Existing	NDDOT GF District
	EGF PW Operations Center	East Grand Forks public works operations	Existing	EGF PW
Roadway Subsystem	EGF PW Field Devices	East Grand Forks public works devices	Planned	EGF PW
Emergency Vehicle	NDHP Vehicles	NDHP vehicles	Existing	NDHP

Subsystem				
Emergency Management	State Radio	ND State Radio	Existing	ND Department of Emergency Services
Alerting and Advisory Systems	State Radio	ND State Radio	Existing	ND Department of Emergency Services
Other Roadway	Other Roadway	DMS operating in conjunction with other sensors and systems (i.e., anti-icing systems)	Planned	
Emergency Vehicle Subsystem	Altru Ambulance Vehicles	Altru ambulance vehicles	Existing	Altru Ambulance
Traffic Management	Mn/DOT D2 TOC	Mn/DOT District 2 Traffic Operations Center	Existing	Mn/DOT Dist 2
Maintenance and Construction Management	Mn/DOT D2 TOC	Mn/DOT District 2 Traffic Operations Center	Existing	Mn/DOT Dist 2
Maintenance and Construction Vehicle	Mn/DOT D2 Vehicles	Mn/DOT District 2 maintenance and construction vehicles	Existing	Mn/DOT Dist 2
Roadway Subsystem	Mn/DOT D2 Field Devices	Mn/DOT District 2 sensors and control devices	Planned	MnDOT Dist 2
Emergency Management	EGF Dispatch Center	East Grand Forks and Polk County dispatch	Existing	EGF PD
Maintenance and Construction Management	NDDOT District Office	NDDOT District maintenance and construction	Existing	NDDOT GF District
Roadway Subsystem	NDDOT District Field Devices	NDDOT District field devices	Planned	NDDOT GF District
Emergency Vehicle Subsystem	MSP Vehicles	Minnesota State Patrol Crookston vehicles	Existing	MSP
Emergency Management	MSP Dispatch Center Crookston	Minnesota State Patrol dispatch	Existing	MSP
Event Promoters	Event Promoters	Alerus Center, Ralph Engelstad Arena, other venues	Existing	GF Event Venus

5.0 NEEDS AND SERVICES

This section describes the ITS user services selected for the GF-EGF 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 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 as part of the RA maintenance process, some services were added to comply with the national ITS architecture version 6.0, others were revised or removed.

5.1 Needs

The process of identifying the GF-EGF regional needs consisted of 1) using output from the Grand Forks-East Grand Forks ITS Strategy Plan, 2) updating ITS project deployment since the plan was developed in 2001, 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 identifying new projects and applications given their experience over the past few years since the plan was developed.

Transportation needs in the GF-EGF 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. Special events traffic management
    c. Work-zone and road construction management
    d. Winter weather impact management
    e. School traffic circulation and safety
2. Enhance traveler information and customer service
3. Enhance transit operations to improve service and increase transit use
4. Coordinate emergency and security management

5.2 Services

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 GF-EGF area, while Subsection 5.2.2 outlines the GF-EGF area's Market Packages.

5.2.1 GF-EGF 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.

1.2. En-route Driver Information: Provide information, such as alternative routes to destination, to vehicle drivers while en-route, i.e., using DMS.
1.6. Traffic Control: Provide functions to efficiently manage the movement of traffic on streets and highways.

1.7. Incident Management: Identify incidents, 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.

5. Emergency Management

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

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 GF-EGF Market Packages

The following Market Packages were identified for the GF-EGF area in support of needs and services. The descriptions are based on the National ITS Architecture. The status of each Market Package in the GF-EGF area is also indicated (i.e., existing or planned). An Existing * status indicates the Market Package is not fully deployed. Customized GF-EGF Market Packages and their Information Flows are shown in more detail in **Appendix A**.

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.

Surface Street Control (Existing *)

This market package provides central control and monitoring equipment, communication links, and 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 to fully traffic-responsive systems. 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.

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.

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.

Traffic Incident Management System (Existing *)

This market package manages both unexpected incidents and planned events so 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.

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 upon 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.

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.

Roadway Automated Treatment (Planned)

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.

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.

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.

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.

Transit Fare Collection Management (Existing)

This market 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 vehicle allow electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem. Two other market packages, ATMS10: Electronic Toll Collection and ATMS16: Parking Facility Management also provide electronic payment services. These three market packages in combination provide an integrated electronic payment system for transportation services.

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.

Transit Fleet Management (Existing)

This market package supports automatic transit maintenance scheduling and monitoring. On-board condition sensors monitor system status and transmit critical status information to the Transit Management Subsystem. Hardware and software in the Transit Management Subsystem processes this data and schedules preventative and corrective maintenance. The market package also supports the day to day management of the transit fleet inventory, including the assignment of specific transit vehicles to blocks.

Transit Signal Priority (Existing)

This market package determines the need for transit priority on routes and at certain intersections and requests transit vehicle priority at these locations. The signal priority may result from limited local coordination between the transit vehicle and the individual intersection for signal priority or may result from

coordination between transit management and traffic management centers. 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 overall performance of the traffic network.

Transit Passenger Counting

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.

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 support dispatch and provision of information to responding personnel.

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.

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 web sites.

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 GF-EGF RA. The operational concept outlines these roles and responsibilities for specific scenarios, e.g., traffic incidents, major winter storms, 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 GF-EGF 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 GF-EGF 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, GF, EGF
Surface Street Control	GF Engineering, Mn/DOT
Traffic Information Dissemination	NDDOT, GFPD
Traffic Incident Management System	NDDOT, Mn/DOT, GF Engineering, GFPD
Regional Traffic Control	GF Engineering, EGF Engineering, Mn/DOT
Standard Railroad Grade Crossing	GF Engineering, EGF Engineering, Mn/DOT
Maint. & Const. Vehicle Tracking	GP Public Works, NDDOT
Roadway Automated Treatment	NDDOT
Winter Maintenance	GF Public Works, EGF Public Works, Mn/DOT, NDDOT
Transit Vehicle Tracking	CAT
Transit Fixed-Route Operations	CAT
Transit Fare Collection Management	CAT
Transit Security	CAT, GFPD
Transit Signal Priority	CAT, GF Engineering
Emergency Call-Taking and Dispatch	GF Police, EGF Police, GF County Sheriff, EGF County Sheriff, NDHP, MSP
Emergency Routing	GF Engineering, EGF Engineering, Mn/DOT
Wide-Area Alert	GF PD, EGF PD, NDHP, MSP

6.2 Operational Roles and Responsibilities

Responsibility Area	Stakeholder	Role
Emergency Management	EGF PD	1. Coordinate with other emergency management 2. Provide 9-1-1 and dispatch services for East Grand Forks and Polk county
	Grand Forks	1. Coordinate with other emergency management 2. Provide 9-1-1 and dispatch services in Grand Forks and GF County
	MSP	1. Coordinate with other emergency management 2. Provide dispatch for MSP
	ND Department of Emergency Services	1. Issue Amber Alerts 2. Provide dispatch for NDHP
Incident Management	Altru Ambulance	Provide ambulance service
	EGF FD	1. Respond to incidents in EGF 2. Respond to incidents in EGF
	EGF PW	Provide resources
	GF FD	1. Respond to incidents in GF 2. Display incident and traffic information to travelers via portable DMS
	GF PW	Provide resources
	Grand Forks	1. Provide dispatch and communications 2. Provide incident information
	MnDOT Dist 2	Provide resources
	MSP	Respond to incidents on Minnesota state system
	ND Department of Emergency Services	Provide dispatch and communications to NDHP
	NDDOT GF District	Provide resources
	NDHP	1. Respond to incidents on ND state system
Maintenance and Construction	EGF PW	1. EGF city system road maintenance 2. Winter maintenance (snow plow operations, sanding, anti icing) in EGF
	GF PW	1. GF city system road maintenance 2. Winter maintenance (snow plow operations, sanding, anti icing) in GF

	MnDOT Dist 2	1. MN state system road maintenance 2. Winter maintenance (snow plow operations, sanding, anti icing) on MN state system
	NDDOT GF District	1. ND state system road maintenance 2. Winter maintenance (snow plow operations, sanding, anti icing) in ND state system
Surface Street Management	GF Engineering	1. Design, operate, and maintain signal control in GF 2. Operate TOC
	MnDOT Dist 2	Design, operate, and maintain signal control in EGF
Transit Services	CAT	Provide transit fixed route operations for the GF-EGF area

7.0 AGREEMENTS

This section briefly outlines potential agreements needed to support the GF-EGF RA. The process of identifying needed agreements 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 to finalize 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 GF-EGF 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 regarding what the agreement addresses
3. Stakeholders
    a. List of stakeholders (agencies) which would be included in the agreement
4. Issues
    a. List of specific issues to be included in the agreement

(This space was intentionally left blank)

Market Packages	Purpose	Stakeholders	Issues
ATMS01-Network Surveillance	Share data	GF Engineering EGF Engineering NDDOT-Grand Forks Dist.	Access to sensors Access to databases Access to networks
ATMS03-Surface Street Control	Corridor coordination	GF Engineering EGF Engineering NDDOT-Grand Forks Dist. MnDOT District 2A	Plans compatibility Hardware/software Liability
ATMS07-Regional Traffic Control	Sharing data (flow, video) Corridor operations	GF Engineering EGF Engineering MnDOT-District 2	Communications links Hardware compatibility Operating standards
ATMS08-Traffic Incident Mgt	Incident/special event traffic response	GF PD EGF PD NDHP MSP GF Engineering EGF Engineering NDDOT GF District MnDOT District 2	Communication links Response protocols
EM02-Emergency Routing	Metro-wide pre-emption	GF Engineering EGF Engineering MnDOT District 2	Hardware compatibility

8.0 FUNCTIONAL REQUIREMENTS

This section discusses detailed functional requirements for the user services and market packages identified for the GF-EGF 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.

Grand Forks-East Grand Forks Regional ITS Architecture (Region)
Element: **CAT Operations Center**
Entity: **Transit Management**
Functional Area: **Transit Vehicle Tracking**
Monitoring transit vehicle locations via interactions with on-board systems. Furnish usurers 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

Functional Area: **Transit Fixed Route Operations**
Management of fixed route transit operations. Planning, scheduling, and dispatch associated with fixed route transit services. Updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

Requirement: 5 The center shall collect transit operational data for use in the generation of routes and schedules. Existing

Requirement: 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc. Planned

9.0 INTERFACE REQUIREMENTS

This section outlines the possible interconnects in the GF-EGF RA. Potential interfaces were identified initially using Market Packages to reflect existing and planned information flows. The following summary table uses output from Turbo Architecture that shows potential information flows for each Market Package in the GF-EGF RA. For each functional area, the table shows information flows between entities and the status of the flow.

Network Surveillance		
GF TOC	GF TOC Field Devices	Existing
GF TOC Field Devices	Other Roadway	Existing
GF TOC Field Devices	Traffic	Existing
NDDOT District Field Devices	Other Roadway	Planned
NDDOT District Field Devices	Traffic	Planned
Surface Street Control		
Driver	GF TOC Field Devices	Existing
Driver	Mn/DOT D2 Field Devices	Planned
GF TOC	GF TOC Field Devices	Existing
GF TOC Field Devices	Other Roadway	Existing
GF TOC Field Devices	Traffic	Existing
Mn/DOT D2 Field Devices	Mn/DOT D2 TOC	Existing
Mn/DOT D2 Field Devices	Other Roadway	Planned
Mn/DOT D2 Field Devices	Traffic	Existing
Traffic Information Dissemination		
CAT Operations Center	GF TOC	Planned
Driver	GF TOC Field Devices	Existing
Driver	Mn/DOT D2 Field Devices	Planned
Driver	NDDOT District Field Devices	Planned
EGF Dispatch Center	GF TOC	Planned
EGF PW Operations Center	Mn/DOT D2 TOC	Existing
GF PW Operations Center	GF TOC	Planned
GF TOC	GF TOC Field Devices	Existing
GF TOC	Media	Planned
GF TOC	Mn/DOT D2 TOC	Planned
GF TOC	PIC	Planned
GF TOC	PSAP	Planned
Mn/DOT D2 Field Devices	Mn/DOT D2 TOC	Existing
GFPD	GFPD DMS	Existing

Regional Traffic Control		
GF TOC	GF TOC Field Devices	Existing
GF TOC	Mn/DOT D2 TOC	Planned
Mn/DOT D2 Field Devices	Mn/DOT D2 TOC	Existing
Traffic Incident Management		
Altru Ambulance Vehicles	PSAP	Existing
CAT Operations Center	EGF Dispatch Center	Existing
CAT Operations Center	PSAP	Existing
EGF Dispatch Center	EGF FD Vehicles	Existing
EGF Dispatch Center	EGF PD Vehicles	Existing
EGF Dispatch Center	EGF PW Operations Center	Existing
EGF Dispatch Center	Event Promoters	Planned
EGF Dispatch Center	GF TOC	Planned
EGF Dispatch Center	MSP Dispatch Center Crookston	Existing
EGF Dispatch Center	PSAP	Existing
EGF PD Vehicles	PSAP	Planned
EGF PW Operations Center	GF PW Operations Center	Existing
EGF PW Operations Center	Mn/DOT D2 TOC	Existing
Event Promoters	GF TOC	Planned
Event Promoters	PSAP	Planned
GF FD Vehicles	PSAP	Existing
GF PD Vehicles	PSAP	Existing
GF PW Operations Center	GF TOC	Planned
GF PW Operations Center	NDDOT District Office	Existing
GF PW Operations Center	PSAP	Existing
GF TOC	GF TOC Field Devices	Existing
GF TOC	Media	Planned
GF TOC	Mn/DOT D2 TOC	Planned
GF TOC	PIC	Planned
GF TOC Field Devices	Traffic	Existing
Media	PSAP	Planned
MSP Dispatch Center Crookston	MSP Vehicles	Existing
NDDOT District Field Devices	Traffic	Planned
NDDOT District Office	State Radio	Existing
NDHP Vehicles	State Radio	Existing
PIC	PSAP	Existing
PSAP	State Radio	Existing
GFPD	GFPD DMS	Existing
Highway Rail Intersections		
Driver	GF TOC Field Devices	Existing
GF TOC Field Devices	Traffic	Existing

Maintenance and Construction Vehicle Tracking		
GF PW Operations Center	GF PW Vehicles	Existing
Mn/DOT D2 TOC	Mn/DOT Vehicles	Existing
NDDOT District Office	NDDOT District Vehicles	Existing
Automated Treatment		
Driver	EGF PW Field Devices	Planned
Driver	GF PW Field Devices	Planned
Driver	Mn/DOT D2 Field Devices	Planned
Driver	NDDOT District Field Devices	Planned
EGF PW Field Devices	EGF PW Operations Center	Planned
EGF PW Field Devices	Other Roadway	Planned
GF PW Field Devices	GF PW Operations Center	Planned
GF PW Field Devices	Other Roadway	Planned
Mn/DOT D2 Field Devices	Mn/DOT D2 TOC	Planned
Mn/DOT D2 Field Devices	Other Roadway	Planned
NDDOT District Field Devices	NDDOT District Office	Planned
NDDOT District Field Devices	Other Roadway	Planned
Winter Maintenance		
CAT Operations Center	EGF PW Operations Center	Existing
CAT Operations Center	GF PW Operations Center	Existing
CAT Operations Center	NDDOT District Office	Existing
EGF Dispatch Center	EGF PW Operations Center	Existing
EGF PW Operations Center	EGF PW Vehicles	Existing
EGF PW Operations Center	GF PW Operations Center	Existing
EGF PW Operations Center	Mn/DOT D2 TOC	Existing
GF PW Operations Center	GF PW Vehicles	Existing
GF PW Operations Center	GF TOC	Planned
GF PW Operations Center	Media	Existing
GF PW Operations Center	NDDOT District Office	Existing
GF PW Operations Center	PIC	Existing
GF PW Operations Center	PSAP	Existing
GF TOC	Mn/DOT D2 TOC	Planned
Mn/DOT D2 TOC	Mn/DOT D2 Vehicles	Existing
NDDOT District Office	NDDOT District Vehicles	Existing
NDDOT District Office	State Radio	Existing
Transit Vehicle Tracking		
CAT Operations Center	Transit Vehicles	Existing

Transit Fixed-Route Operations		
CAT Drivers	CAT Operations Center	Existing
CAT Drivers	Transit Vehicles	Existing
CAT Operations Center	CAT System Operator	Existing
CAT Operations Center	EGF PW Operations Center	Existing
CAT Operations Center	GF PW Operations Center	Existing
CAT Operations Center	NDDOT District Office	Existing
CAT Operations Center	Transit Vehicles	Existing
Transit Fare Collection Management		
CAT Operations Center	CAT System Operator	Existing
CAT Operations Center	Transit Vehicles	Existing
Transit Vehicles	Traveler Card	Existing
Transit Security		
CAT Drivers	Transit Vehicles	Existing
CAT Operations Center	CAT System Operator	Existing
CAT Operations Center	EGF Dispatch Center	Existing
CAT Operations Center	PSAP	Existing
CAT Operations Center	Transit Vehicles	Existing
EGF Dispatch Center	MSP Dispatch Center Crookston	Existing
EGF Dispatch Center	PSAP	Existing
PSAP	Transit Vehicles	Existing
Transit Vehicle Priority		
GF TOC Field Devices	Transit Vehicles	Existing
Mn/DOT D2 Field Devices	Transit Vehicles	Existing
Transit Fleet Management		
CAT Operations Center	CAT System Operator	Existing
CAT Operations Center	CAT Vehicles	Existing
Transit Passenger Counting		
CAT Operations Center	CAT System Operator	Existing
CAT Operations Center	CAT Vehicles	Existing
Emergency Call-Taking and Dispatch		
Altru Ambulance Vehicles	PSAP	Existing
CAT Operations Center	EGF Dispatch Center	Existing
CAT Operations Center	PSAP	Existing
EGF Dispatch Center	EGF FD Vehicles	Existing
EGF Dispatch Center	EGF PD Vehicles	Existing
EGF Dispatch Center	GF TOC	Planned
EGF Dispatch Center	MSP Dispatch Center Crookston	Existing
EGF Dispatch Center	PSAP	Existing
EGF PD Vehicles	PSAP	Planned
GF FD Vehicles	PSAP	Existing

GF PD Vehicles	PSAP	Existing
GF TOC	PSAP	Planned
MSP Dsptch. Cent. Crookston	MSP Vehicles	Existing
NDHP Vehicles	State Radio	Existing
PSAP	State Radio	Existing
Emergency Routing		
Altru Ambulance Vehicles	GF TOC Field Devices	Existing
Altru Ambulance Vehicles	Mn/DOT D2 Field Devices	Planned
EGF FD Vehicles	GF TOC Field Devices	Planned
EGF FD Vehicles	Mn/DOT D2 Field Devices	Existing
GF FD Vehicles	GF TOC Field Devices	Existing
GF FD Vehicles	Mn/DOT D2 Field Devices	Planned
Wide-Area Alert		
Driver	GF TOC Field Devices	Existing
Driver	NDDOT District Field Devices	Planned
EGF Dispatch Center	GF TOC	Planned
EGF Dispatch Center	MSP Dispatch Center Crookston	Existing
EGF Dispatch Center	PSAP	Existing
GF TOC	GF TOC Field Devices	Existing
GF TOC	PSAP	Planned
NDDOT District Office	State Radio	Existing
PIC	PSAP	Existing
PSAP	State Radio	Existing

10.0 ITS STANDARDS

This section identifies applicable ITS Standards identified for the GF-EGF 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 GF-EGF 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 Collection and Monitoring Devices	NTCIP 1206
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
Incident Management Standards Group	IEEE 1512 -2006 IEEE 1512.1-2006 IEEE 1512.2-2004 IEEE 1512.3-2006 IEEE P1512.4
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 GF-EGF area. Market Packages are arranged into short, medium, and long-term deployment categories. It should be noted that not all of the planned services for the GF-EGF area have been fully developed into ITS projects yet. Please note that Market Packages are organized in the same order they appear in the National ITS Architecture.

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

11.1 Regional ITS Architecture Maintenance

The Grand Forks-East Grand Forks MPO is responsible for maintaining and updating the GF-EGF Regional ITS Architecture. It is envisioned that the updates will be conducted every two years if needed or upon the deployment of a major ITS project in the area. The updates will account for any changes to existing systems, as well as changes to regional needs and priorities.

APPENDIX-A

GRAND FORKS-EAST GRAND FORKS MARKET PACKAGES AND INFORMATION FLOWS

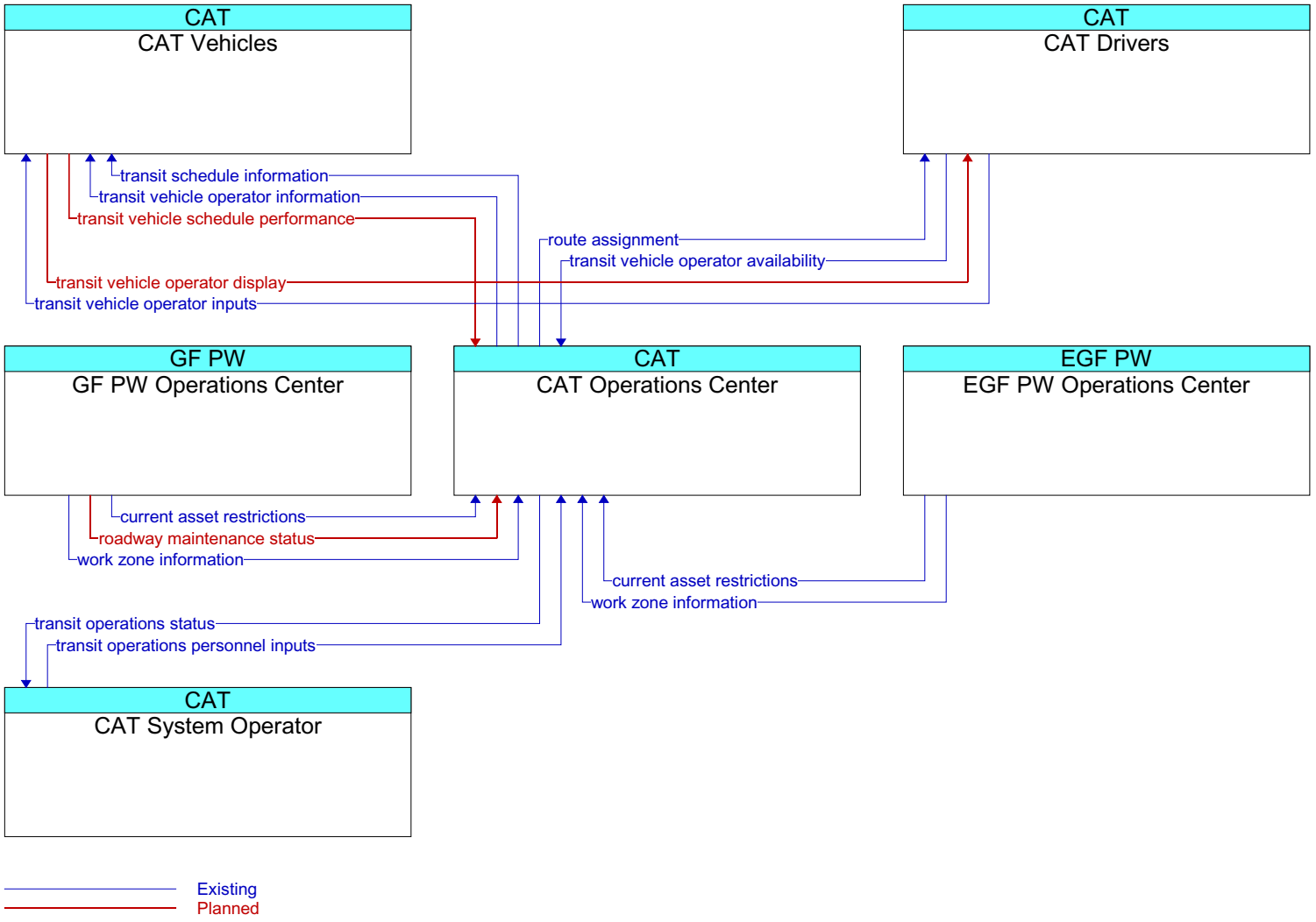
The Market Package Diagrams are available electronically at:

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

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

An example market package for APTS02: Transit Fixed Route Operations is provided below.

APTS02 Transit Fixed Route Operations



APPENDIX-B

FUNCTIONAL REQUIREMENTS

Functional Requirements
GF-EGF Regional Architecture RA (Region)

Architecture		Status
GF-EGF Regional Architecture RA (Region)		(Region)
Element: **Altru 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:	5 The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.	Existing
Element: **CAT Operations Center**		
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
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:	5 The center shall collect transit operational data for use in the generation of routes and schedules.	Existing
Requirement:	9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.	Planned
Functional Area: **Transit Center Fare Management** Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.		
Requirement:	4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.	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
Requirement:	4 The center shall be able to produce sample products of the data available.	Existing
Element: **CAT Vehicles**		
Entity: **Transit Vehicle Subsystem**		

Architecture		Status
GF-EGF Regional Architecture RA (Region)		(Region)
Element: **CAT 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:	10 The transit vehicle shall provide fare statistics data to the center.	Existing
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.	Existing
Element: **EGF Dispatch Center**		
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:	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

Architecture			Status
GF-EGF Regional Architecture RA (Region)			(Region)
Element: **EGF Dispatch Center**			
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:	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
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:	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:	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.	Existing
Requirement:	4	The center shall receive asset restriction information to support the dispatching of appropriate emergency resources.	Existing
Element: **EGF FD Vehicles**			
Entity: **Emergency Vehicle Subsystem**			
Functional Area: **On-board EV En Route Support**			

Architecture			Status
GF-EGF Regional Architecture RA (Region)			(Region)
Element: **EGF 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: **EGF PW Field Devices**			
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
Element: **EGF 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 Winter Maintenance Management**			

Architecture			Status
GF-EGF Regional Architecture RA (Region)			(Region)
Element: **EGF 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:	7	The center shall dispatch and route winter maintenance vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.	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
Element: **GF 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: **GF PW Field Devices**			
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

Architecture		Status
GF-EGF Regional Architecture RA (Region)		(Region)
Element: **GF PW Field Devices**		
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
Element: **GF 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 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:	7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.	Existing

Architecture		Status
GF-EGF Regional Architecture RA (Region)		(Region)
Element: **GF 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:	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
Element: **GF PW Vehicles**		
Entity: **Maintenance and Construction Vehicle**		
Functional Area: **MCV Vehicle Location Tracking** On-board systems to track vehicle location and reports the position and timestamp information to the dispatch center.		
Requirement:	1 The maintenance and construction vehicle shall compute the location of the vehicle based on inputs from a vehicle location determination function.	Existing
Requirement:	2 The maintenance and construction vehicle shall send the time stamped vehicle location to the controlling center.	Existing
Element: **GF 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.	Existing
Requirement:	2 The center shall monitor, analyze, and distribute traffic images from CCTV systems 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:	4 The center shall collect traffic signal controller fault data from the field.	Existing

Architecture		Status
GF-EGF Regional Architecture RA (Region)		(Region)
Element: **GF 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.	Existing
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
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
Element: **GF TOC Field Devices**		
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.	Planned
Requirement:	2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.	Planned
Requirement:	4 The field element shall return sensor and CCTV system operational status to the controlling center.	Planned
Requirement:	5 The field element shall return sensor and CCTV system fault data to the controlling center for repair.	Planned
Functional Area: **Roadway Signal Controls** Field elements including traffic signal controllers for use at signalized intersections; also supports pedestrian crossings.		

Architecture		Status
GF-EGF Regional Architecture RA (Region)		(Region)
Element: **GF TOC Field Devices**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Signal Controls** Field elements including traffic signal controllers for use at signalized intersections; also supports pedestrian crossings.		
Requirement:	1 The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control.	Existing
Requirement:	6 The field element shall return traffic signal controller operational status to the controlling center.	Existing
Requirement:	7 The field element shall return traffic signal controller fault data to the maintenance center for repair.	Existing
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.	Existing
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
Element: **Mn/DOT D2 Field Devices**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Signal Controls** Field elements including traffic signal controllers for use at signalized intersections; also supports pedestrian crossings.		
Requirement:	1 The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control.	Existing
Requirement:	6 The field element shall return traffic signal controller operational status to the controlling center.	Existing
Requirement:	7 The field element shall return traffic signal controller fault data to the maintenance center for repair.	Existing
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
GF-EGF Regional Architecture RA (Region)		(Region)
Element: **Mn/DOT D2 Field Devices**		
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.	Existing
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: **Mn/DOT D2 Office**		
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 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.		

Architecture			Status
GF-EGF Regional Architecture RA (Region)			(Region)
Element: **Mn/DOT D2 Office**			
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:	7	The center shall dispatch and route winter maintenance vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.	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
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:	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.	Existing
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
GF-EGF Regional Architecture RA (Region)		(Region)
Element: **Mn/DOT D2 Office**		
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
Element: **MSP Dispatch Center Crookston**		
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:	1 The center shall dispatch emergency vehicles to respond to verified emergencies under center personnel control.	Existing
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:	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:	4 The center shall receive asset restriction information to support the dispatching of appropriate emergency resources.	Existing
Element: **NDDOT District Field Devices**		
Entity: **Roadway Subsystem**		
Functional Area: **Roadway Traffic Information Dissemination** Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).		

Architecture		Status
GF-EGF Regional Architecture RA (Region)		(Region)
Element: **NDDOT District Field Devices**		
Entity: **Roadway Subsystem**		
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
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 Speed Monitoring** Vehicle speed sensors that detect excessive vehicle speeds, informing drivers, centers and/or enforcement agencies of speed violations.		
Requirement:	1 The field element shall include sensors to detect vehicle speeds, under traffic or maintenance center control.	Planned
Requirement:	3 If the speed detected by vehicle speed sensors is determined to be excessive, the field element shall provide a safe speed advisory to passing drivers via a driver information system (such as portable messages signs, etc.).	Planned
Element: **NDDOT District Office**		
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

Architecture			Status
GF-EGF Regional Architecture RA (Region)			(Region)
Element: **NDDOT District Office**			
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:	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 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:	7	The center shall dispatch and route winter maintenance vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.	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

Architecture			Status
GF-EGF Regional Architecture RA (Region)			(Region)
Element: **PIC**			
Entity: **Information Service Provider**			
Functional Area: **Basic Information Broadcast** Broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.			
Requirement:	1	The center shall disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.	Existing
Requirement:	2	The center shall disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities.	Existing
Element: **PSAP**			
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:	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
Requirement:	2	The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.	Existing

Architecture			Status
GF-EGF Regional Architecture RA (Region)			(Region)
Element: **PSAP**			
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:	3	The center shall relay location and incident details to the responding vehicles.	Existing
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:	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.	Existing
Requirement:	4	The center shall receive asset restriction information to support the dispatching of appropriate emergency resources.	Existing
Element: **State Radio**			
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:	1	The center shall dispatch emergency vehicles to respond to verified emergencies under center personnel control.	Existing
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:	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:	4	The center shall receive asset restriction information to support the dispatching of appropriate emergency resources.	Existing