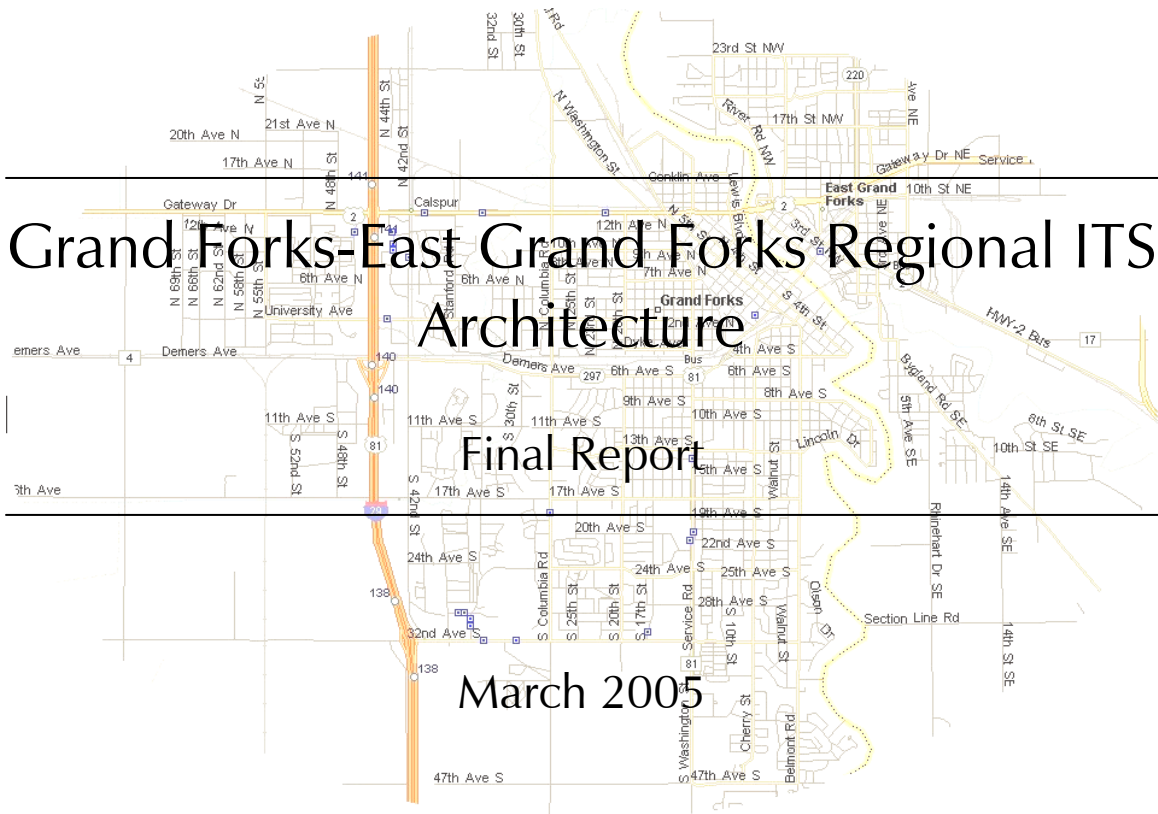




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Grand Forks-East Grand Forks Regional ITS Architecture

Final Report

March 2005

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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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 Bismarck-Mandan MPO, Fargo-Moorhead Council of Governments, and the Grand Forks-East Grand Forks MPO for supporting the RA development in each region.

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

A system inventory was updated to account for existing and planned ITS systems. The majority of these systems may be classified into the following service areas: traffic and travel management, 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 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 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 as needed. The GF/EGF will coordinate changes to the RA as more ITS projects have been planned or major changes to the transportation system have taken place.

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.

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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. Figure 1 shows a map of the region. Major jurisdictions within the region 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, the North Dakota Department of Transportation (NDDOT) is responsible for operating and maintaining the state system, 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 at the state system. Similarly, the Minnesota Department of Transportation (MnDOT) 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

Grand Forks, North Dakota, United States

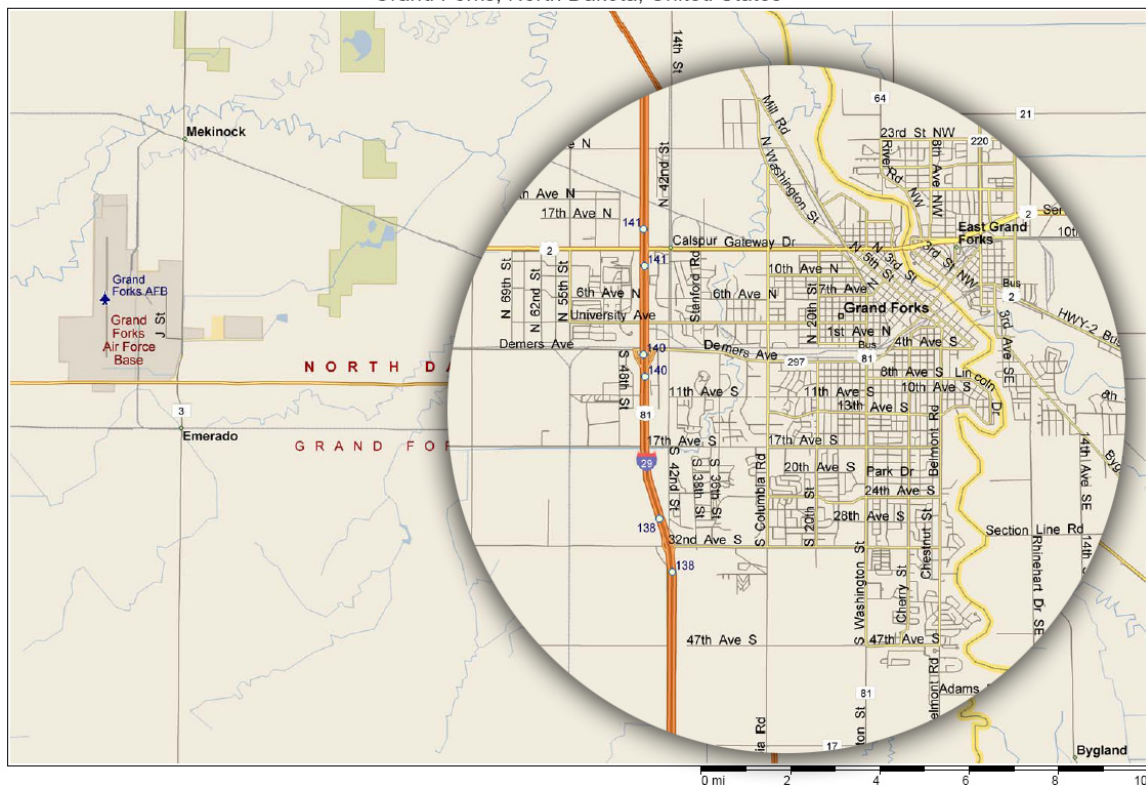


Figure 1 Map of the Grand Forks/East Grand Forks Area

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
Paul	Benning	NDDOT-Local Government	(701) 328-2217
Kathy	Briscoe	MnDOT	(651) 296-1614
Ryan	Brooks	GF-EGF MPO	(218) 773-0124
Jim	Campbell	Grand Forks Co. Emergency Management	(701) 780-8213
Kevin	Dean	Grand Forks Public Information Center	(701) 746-4636
Kent	Ehrenstrom	MnDOT	(218) 755-4521
Todd	Feland	GF Public Works	(701) 746-2570
Roger	Foster	Cities Area Transit	(701) 746-2590
Bruce	Hansen	City of Grand Forks	(701) 746-2690
Earl	Haugen	GF-EGF MPO	(701) 746-2657
Mark	Johnson	FHWA-ND Division	(701) 250-4343
Dan	Jonasson	City of Grand Forks Engineering	(701) 746-2642
Michael	Kamnikar	MnDOT	(218) 755-4521
Mike	Lealos	EGF Police Department/EGF Dispatch	(218) 773-1104
Kitt	McNamee	City of Grand Forks	(701) 746-2682
Richard	Melby	MN State Patrol	(218) 681-0942
Allan	Morken	PSAP	(701) 787-8039
Les	Noehre	NDDOT Grand Forks District	(701) 787-6500
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
Dennis	Potter	City of Grand Forks	(701) 746-2655
Frank	Ringstad	EGF Fire Dept	(218) 773-2403
Darcy	Rosendahl	NDDOT-Planning	(701) 328-2217
Richard	Sanders	Polk County	(218) 281-3952
Keith	Schroeder	GF Police Department	(701) 746-2742
John	Thompson	EGF Public Works	(218) 773-2442
Allen	Wagner	Polk County Emergency Management	(218) 281-6713
Gregory	Waidley	FHWA Minnesota Division	(651) 291-6121
Dean	Wieland	City of East Grand Forks	(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
MnDOT Dist 2	Minnesota DOT District 2 Bemidji	MnDOT D2 Vehicles
MnDOT Dist 2	Minnesota DOT Distrct 2 Bemidji	MnDOT D2 Field Devices
MnDOT Dist 2	Minnesota DOT Distrct 2 Bemidji	MnDOT 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	
EGF FD	East 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 Division of Emergency Management	North Dakota Division of Emergency Management	State Radio
GF Event Venus	Alerus Center, Ralph Engelstad Arena, other venus	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.

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, six 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. Below are specific traffic management systems within the GF/EGF area classified by agency.

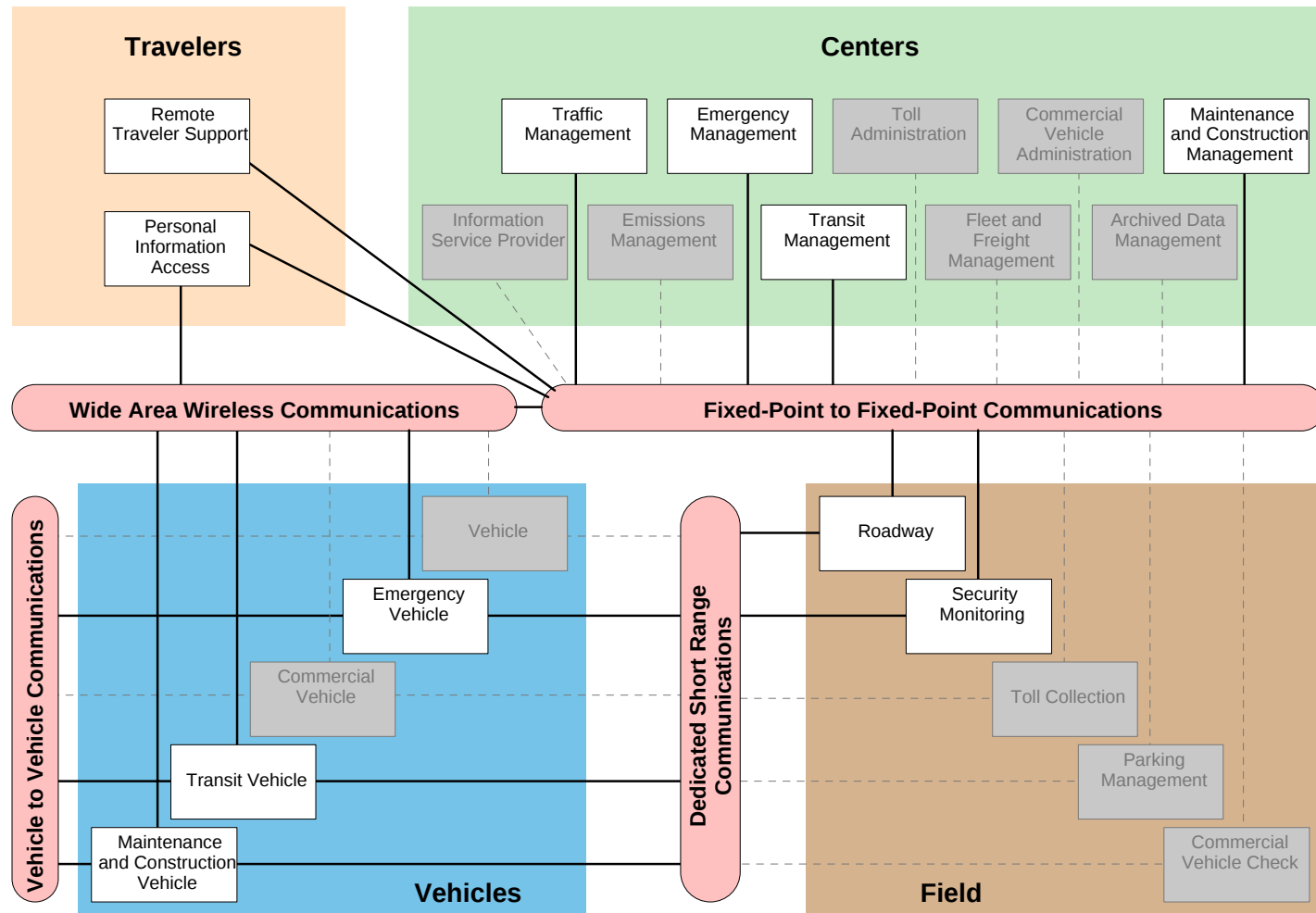


Figure 2 Grand Forks/East Grand Forks Physical Architecture

City of Grand Forks Traffic Signal System

The City of Grand Forks maintains a modern traffic signal control system with several coordinated corridors. Most of these signals have communication capabilities using dial-up modems as well as fiber and twisted pair for 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 in order to increase capacities 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 provide those services for Polk County.

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 MnDOT. Among the ITS technologies targeted for early deployment are roadway treatment systems (i.e., bridge anti-icing systems). These agencies are also considering adding fleet management capabilities, using Automated Vehicle Location technologies. However, the timing of deploying these systems is highly 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 two portable DMS which are used to warn drivers of incidents and weather related road conditions.

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 recently acquired an automated fare box system which provides enhanced management capabilities, including revenue analysis, passenger data analysis, and in the future GPS bus location.

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/MnDOT Field Devices

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

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 (pre-emption)
 - b. Law enforcement (planned AVL)
 - c. Ambulance (pre-emption)
2. Transit Vehicle
 - a. CAT buses with electronic fare box 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

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 Subsystem	NDHP Vehicles	NDHP vehicles	Existing	NDHP

Emergency Management	State Radio	ND State Radio	Existing	ND Division of Emergency Management
Alerting and Advisory Systems	State Radio	ND State Radio	Existing	ND Division of Emergency Management
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	MnDOT D2 TOC	MnDOT District 2 Traffic Operations Center	Existing	MnDOT Dist 2
Maintenance and Construction Management	MnDOT D2 TOC	MnDOT District 2 Traffic Operations Center	Existing	MnDOT Dist 2
Maintenance and Construction Vehicle	MnDOT D2 Vehicles	MnDOT District 2 maintenance and construction vehicles	Existing	MnDOT Dist 2
Roadway Subsystem	MnDOT D2 Field Devices	MnDOT 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 Venue

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.

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 (Planned)

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 (Planned)

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.

Speed Monitoring (Planned)

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

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 Passenger and Fare Management (Existing)

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

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.

Multi-modal Coordination (Existing)

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

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, EGF Engineering, MnDOT
Traffic Information Dissemination	NDDOT
Traffic Incident Management System	NDDOT, MnDOT
Regional Traffic Control	GF Engineering, EGF Engineering, MnDOT
Standard Railroad Grade Crossing	GF Engineering, EGF Engineering, MnDOT
Speed Monitoring	GF Engineering, NDDOT, EGF Engineering, MnDOT
Roadway Automated Treatment	GF Public Works, NDDOT
Winter Maintenance	GF Public Works, EGF, MnDOT, NDDOT
Transit Vehicle Tracking	CAT
Transit Fixed-Route Operations	CAT
Transit Passenger and Fare Management	CAT
Transit Security	CAT
Multi-modal Coordination	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, MnDOT
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 Division of Emergency Management	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. Respond to incidents in GF
	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 Division of Emergency Management	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: GF Fire Department Vehicles

Entity: Emergency Vehicle Subsystem

Functional Area: On-board EV En Route Support

On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.

<i>Requirement:</i>	1	The emergency vehicle, including roadway service patrols, shall compute the location of the emergency vehicle based on inputs from a vehicle location determination function.	Planned
<i>Requirement:</i>	2	The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.	Planned
<i>Requirement:</i>	3	The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.	Planned
<i>Requirement:</i>	5	The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.	Existing

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	MnDOT D2 Field Devices	Planned
GF TOC	GF TOC Field Devices	Existing
GF TOC Field Devices	Other Roadway	Existing
GF TOC Field Devices	Traffic	Existing
MnDOT D2 Field Devices	MnDOT D2 TOC	Existing
MnDOT D2 Field Devices	Other Roadway	Planned
MnDOT D2 Field Devices	Traffic	Existing
Traffic Information Dissemination		
CAT Operations Center	GF TOC	Planned
Driver	GF TOC Field Devices	Existing
Driver	MnDOT D2 Field Devices	Planned
Driver	NDDOT District Field Devices	Planned
EGF Dispatch Center	GF TOC	Planned
EGF PW Operations Center	MnDOT D2 TOC	Existing
GF PW Operations Center	GF TOC	Planned
GF TOC	GF TOC Field Devices	Existing
GF TOC	Media	Planned
GF TOC	MnDOT D2 TOC	Planned
GF TOC	PIC	Planned
GF TOC	PSAP	Planned
MnDOT D2 Field Devices	MnDOT D2 TOC	Existing

Regional Traffic Control		
GF TOC	GF TOC Field Devices	Existing
GF TOC	MnDOT D2 TOC	Planned
MnDOT D2 Field Devices	MnDOT 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	MnDOT 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	MnDOT 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
Highway Rail Intersections		
Driver	GF TOC Field Devices	Existing
GF TOC Field Devices	Traffic	Existing

Speed Monitoring		
Driver	NDDOT District Field Devices	Planned
NDDOT District Field Devices	Traffic	Planned
Automated Treatment		
Driver	EGF PW Field Devices	Planned
Driver	GF PW Field Devices	Planned
Driver	MnDOT 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
MnDOT D2 Field Devices	MnDOT D2 TOC	Existing
MnDOT 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	MnDOT 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	MnDOT D2 TOC	Planned
MnDOT D2 TOC	MnDOT 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	GF TOC	Planned
CAT Operations Center	NDDOT District Office	Existing
CAT Operations Center	Transit Vehicles	Existing
Transit Fare 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
Multimodal Coordination		
GF TOC Field Devices	Transit Vehicles	Existing
MnDOT D2 Field Devices	Transit 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 Dispatch Center 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	MnDOT D2 Field Devices	Planned
EGF FD Vehicles	GF TOC Field Devices	Planned
EGF FD Vehicles	MnDOT D2 Field Devices	Existing
GF FD Vehicles	GF TOC Field Devices	Existing
GF FD Vehicles	MnDOT 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
NTCIP Center-to-Center Standards Group	NTCIP 1102 NTCIP 1104 NTCIP 1105 NTCIP 1106 NTCIP 2104 NTCIP 2202 NTCIP 2303 NTCIP 2304 NTCIP 2305 NTCIP 2501 NTCIP 2502
NTCIP Center-to-Field Standards Group	NTCIP 1101 NTCIP 1102 NTCIP 1103 NTCIP 2101 NTCIP 2102 NTCIP 2103 NTCIP 2104 NTCIP 2201 NTCIP 2202 NTCIP 2301 NTCIP 2302 NTCIP 2303
Global Object Definitions	NTCIP 1201
Object Definitions for Actuated Traffic Signal Controller Units	NTCIP 1202
Object Definitions for Dynamic Message Signs	NTCIP 1203
Object Definitions for Environmental Sensor Stations & Roadside Weather Information System	NTCIP 1204
Data Dictionary for Closed Circuit Television (CCTV)	NTCIP 1205
Data Collection and Monitoring Devices	NTCIP 1206
Object Definitions for Video Switches	NTCIP 1208
Transportation System Sensor Objects	NTCIP 1209
Objects for Signal Systems Master	NTCIP 1210
Objects for Signal Control Priority	NTCIP 1211
TCIP - Incident Management (IM) Business Area Standard	NTCIP 1402
TCIP - Passenger Information (PI) Business Area Standard	NTCIP 1403

TCIP - Scheduling/Run-cutting (SCH) Business Area Standard	NTCIP 1404
TCIP - Onboard (OB) Business Area Standard	NTCIP 1406
TCIP - Control Center (CC) Business Area Standard	NTCIP 1407
TCIP - Fare Collection (FC) Business Area Standard	NTCIP 1408
Dedicated Short Range Communication at 915 MHz Standards Group	ASTM E2158-01 ASTM PS 105-99
Incident Management Standards Group	IEEE 1512.1-2003 IEEE 1512.3-2002 IEEE 1512-2000 IEEE P1512.2
Standard for Functional Level Traffic Management Data Dictionary (TMDD)	ITE TM 1.03
Message Sets for External TMC Communication (MS/ETMCC)	ITE TM 2.01
Advanced Traveler Information Systems (ATIS) General Use Standards Group	SAE J2266 SAE J2354 SAE J2529 SAE J2540 SAE J2540-1 SAE J2540-2 SAE J2540-3 SAE J2630
Dedicated Short Range Communication at 5.9 GHz Standards Group	IEEE 1609.1 IEEE 1609.2 IEEE 1609.3 IEEE 1609.4 IEEE 802.11 IEEE 802.2 ISO 21210

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	Short
Traffic Information Dissemination	Medium
Regional Traffic Control	Short-Medium
Traffic Incident Management System	Medium-Long
Standard Railroad Grade Crossing	Medium-Long
Speed Monitoring	Medium-Long
Roadway Automated Treatment	Short
Winter Maintenance	Short
Transit Vehicle Tracking	Medium
Transit Fixed-Route Operations	Short-Medium
Transit Passenger and Fare Management	Short
Transit Security	Short
Multi-modal Coordination	Medium-Long
Emergency Call-Taking and Dispatch	Short-Medium
Emergency Routing	Short-Medium
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.