Bismarck-Mandan MPO

Bismarck-Mandan Regional ITS Architecture

Version 3.0

Final Report

January 2014

Prepared for:
Bismarck-Mandan Metropolitan Planning Organization

Approved:
January 21st 2014 by the MPO's TAC and Policy Board

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NDSU | UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
ADVANCED TRAFFIC ANALYSIS CENTER

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The information contained in this report was obtained through extensive input from various stakeholders in the state of North Dakota. 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

ATAC	Advanced Traffic Analysis Center
AVL	Automated Vehicle Location
Bis	Bismarck
Bis-Man	Bismarck-Mandan
Bismarck FD	Bismarck Fire Department
Bismarck PD	Bismarck Police Department
Bismarck PW	Bismarck Public Works
CAT	Capitol Area Transit
CCTV	Closed Circuit Television
Dist	District
DMS	Dynamic Message Sign
DOT	Department of Transportation
EAS	Emergency Alert System
EOC	Emergency Operations Center
EV	Emergency Vehicle
FHWA	Federal Highway Administration
ISP	Information Service Provider
ITS	Intelligent Transportation Systems
Mandan FD	Mandan Fire Department
Mandan PD	Mandan Police Department
Mandan PW	Mandan Public Works
MCO	Maintenance and Construction Operations
MPO	Metropolitan Planning Organization
NDDOT	North Dakota Department of Transportation
NDHP	North Dakota Highway Patrol
OEM	Office of Emergency Management
RA	Regional Architecture
TOC	Traffic Operations Center

Standards

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

Service Packages

AD	Advanced Data Management
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 Bismarck-Mandan Regional Intelligent Transportation Systems (ITS) Architecture was prepared in March 2005 under the leadership of the Bismarck-Mandan Metropolitan Planning Organization (Bis-Man MPO). The architecture has been updated twice since the original development in 2008 and 2013. The goal of the Bismarck-Mandan regional architecture (RA) is to guide the implementation of ITS in the Bismarck-Mandan region and coordinate funding, deployment, information sharing, and operations of ITS systems in the region. The main ITS goal areas for the Bismarck-Mandan 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 Bismarck-Mandan area has experienced growth in population and increased economic activity. Bismarck is the capitol of North Dakota, and hence serves as a government, business, and cultural center. Therefore, an efficient transportation system is crucial for supporting mobility needs of individuals and businesses in the region.

The geographical boundaries identified for purposes of developing the Bismarck-Mandan RA consist of areas included in the Bis-Man MPO metropolitan boundaries. Major jurisdictions with significant roles in the RA include:

1. City of Bismarck
2. City of Mandan
3. Burleigh County
4. Morton County

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

The RA development closely followed federal guidelines and was guided by various regional stakeholders who were categorized into three groups:

1. Project Advisory Group: guide overall project
    a. Representative from the 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 and maintenance staff
g. FHWA representative
h. Law enforcement
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. Area medical and event centers

After the Bis-Man RA stakeholders were identified, a system inventory was conducted to identify 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, emergency management, advanced data management, and transit management. The inventory identified systems and their functions by agency and jurisdiction.

Under each of the service areas above, several Service Packages were identified and customized based on input from the stakeholders. They 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.

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. Five potential agreements were identified for the Bis-Man region and include: Transit Security, Network Surveillance, Traffic Information Dissemination, Traffic Incident Management, and Archived Data Management.

One of the greatest challenges to successful ITS deployment in the Bis-Man area is funding for ITS infrastructure, especially communications. Therefore, coordination and integration of key system components were cited as critical factors for success. Given the number and diversity of agencies involved, it is important to capitalize on and expand existing partnerships to include new ITS systems. These partnerships can result in cost-effective strategies that meet the demands of each agency and the traveling public in the Bis-Man region.

As part of the RA development, the Bis-Man MPO has been designated with the role of maintaining and updating the Bis-Man Regional ITS Architecture as needed. The Bis-Man MPO will coordinate changes to the RA as more ITS projects have been planned or major changes to the transportation system have taken place. An update cycle of every 2-3 years has also been identified. The first major update of the Bis-Man RA was completed in 2008 (version 2.0). The second major update was conducted in 2013 (version 3.0), in addition to the updated report and Turbo database file, a Turbo architecture website was created providing easy access to all the information and diagrams in the Turbo database via webpage.

The regional architecture is a living document requiring 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." Through partnership between the Bismarck-Mandan MPO, ATAC performed the architecture 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 2013 version of the Bis-Man RA brought it into compliance with the latest National ITS Architecture (version 7.0). Some of the changes in the National architecture include change of terminology from "Market Package" to "Service Package"; several information flows have been modified to reflect the current state of practice; ITS standards have been updated to the latest versions; and service packages and flows have been changed with some added and others discontinued.

Changes specific to the Bis-Man region include:

- The status of several service packages has been updated from "planned" to "existing" based on deployment. Service packages were also added in the following areas:
    - Advanced Data Management: ITS Data Warehouse.
    - Advanced Traffic Management: Speed Warning.
    - Advanced Public Transportation: Transit Fleet Management and Transit Passenger Counting.
    - Maintenance and Construction Management: Vehicle Maintenance.
- The functional requirements for all service areas have been updated.
- The ITS inventory have been updated:

    - For usability combined all the region's emergency vehicle inventory item instead of including all agencies since they have similar ITS functionality and capabilities.
    - Clarified and changed the names of several items.
- The interfaces for all service packages have been updated.
- An agreement for ITS data archival has been added.
- Service package diagrams have all been updated.
- The Turbo database has been updated to the latest version 7.0 along with all relevant 2013 Bis-Man updates.
- An architecture website has been created providing easy access to the information in the Turbo database.

1.0 INTRODUCTION

This document summarizes the results of the regional Intelligent Transportation architecture development for the Bismarck-Mandan Area. Intelligent Transportation Systems (ITS) refer to integrated applications of sensing, communications, computer processing, and electronics to enhance the transportation system. 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 Bismarck-Mandan Regional Intelligent Transportation Systems (ITS) Architecture was prepared under the leadership of the Bismarck-Mandan Metropolitan Transportation Organization (Bis-Man MPO). The goal of the Bis-Man regional architecture (RA) is to guide the implementation of ITS systems in the Bis-Man area and coordinate funding, deployment, information sharing, and operations of ITS systems in the region. The main ITS goal areas for the Bis-Man 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. 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.

1.1 Report Organization

The Bis-Man RA Report is organized into several main sections to facilitate the report use. In addition, an electronic file has been prepared using Turbo Architecture 7.0 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 Service Packages
6 Operational Concept	Roles and responsibilities of participating agencies
7 Potential Agreements	Regional agreements to facilitate integration
8 Functional Requirements	High-level description of what the systems will do
9 ITS Standards	Brief discussion of applicable ITS standards
10 Sequence of Projects	Time-frame for ITS projects
Appendix-A	Detailed Service Packages and Information Flows
Appendix-B	Functional Requirements

2.0 REGION AND SCOPE

This section describes the geographical characteristics of the Bis-Man 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 boundaries identified for purposes of developing the Bismarck-Mandan RA consist of areas included in the Bis-Man MPO metropolitan boundaries. Major jurisdictions with significant roles in the RA include:

1. City of Bismarck
2. City of Mandan
3. Burleigh County
4. Morton County

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

2.2 Scope of the RA

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

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

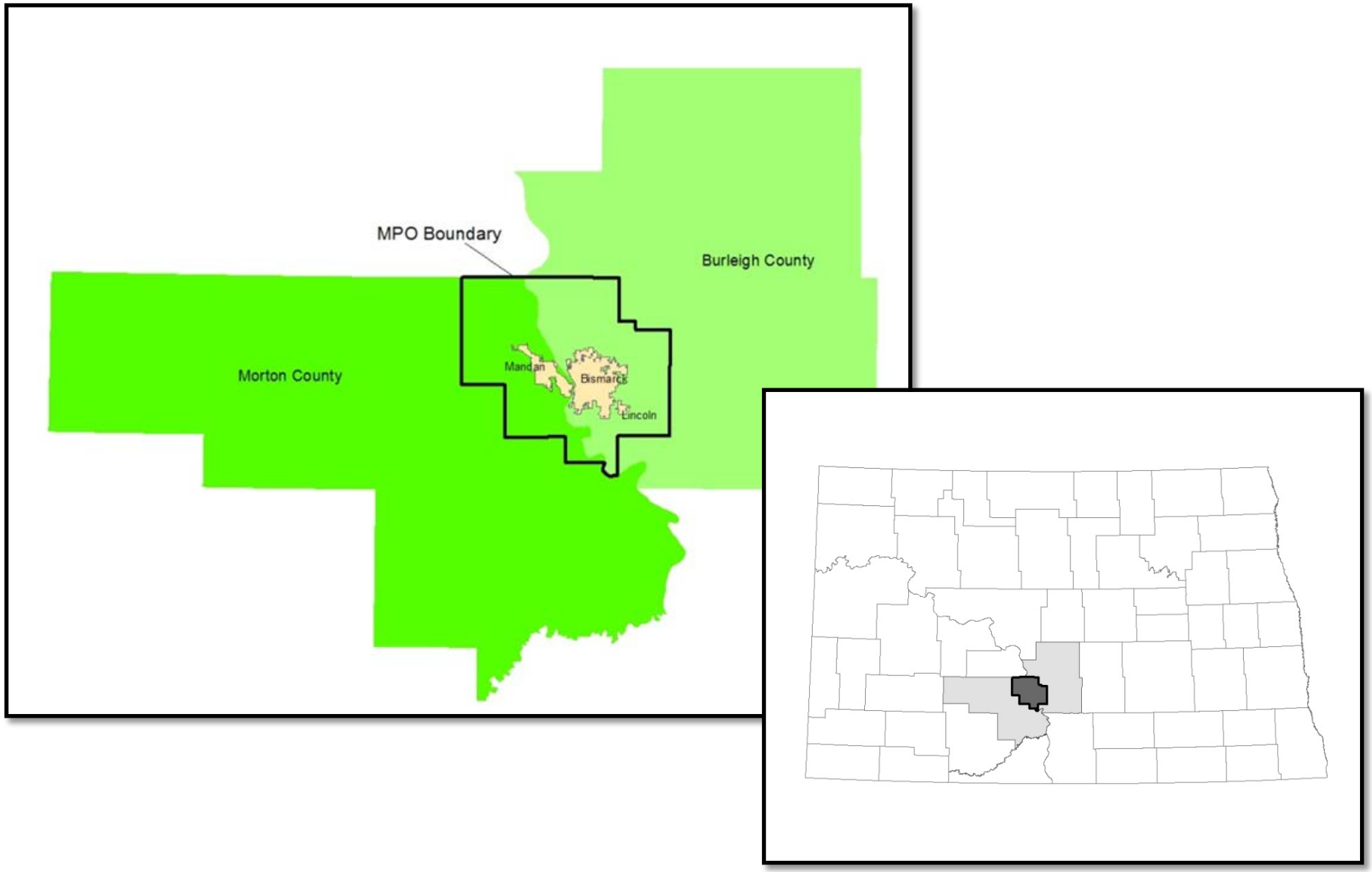


Figure 1. Map of the Bismarck-Mandan Region

3.0 STAKEHOLDERS

Stakeholders participating in the development of the Bis-Man RA included transportation, public works, law enforcement, emergency management, transit, and other related agencies. A regional ITS Core Group consisting of agencies who own/operate ITS elements or will do so in the future has the primary role of guiding the RA development.

Table 3.1 Bismarck-Mandan ITS Stakeholders

Stakeholder	Description	ITS Elements
Bismarck PD	Bismarck Police Department	Bismarck PD Vehicles
Mandan PD	Mandan Police Department	Mandan PD Dispatch Center
		Mandan PD Vehicles
NDHP Bismarck	North Dakota Highway Patrol – Bismarck District	NDHP Vehicles
NDDOT Bis Dist	NDDOT Bismarck District	NDDOT District Vehicles
		NDDOT District Office
		NDDOT District Field Devices
Mandan PW	Mandan Public Works	Mandan PW Vehicles
		Mandan PW Operations Center
Bismarck PW	Bismarck Public Works	Bismarck PW Vehicles
		Bismarck PW Operations Center
		Bismarck PW Field Devices
Bismarck FD	Bismarck Fire Department	Bismarck FD Vehicles
Mandan FD	Mandan Fire Department	Mandan FD Vehicles
Mandan Engineering	Mandan Engineering Department	Mandan Engineering Field Devices
		Mandan Traffic Engineering
Bismarck Engineering	Bismarck Engineering Department	Bismarck TOC Field Devices
		Bismarck Engineers
		Bismarck TOC
Bis-Man Transit	Bismarck-Mandan Transit	Bis-Man Transit Operator
		Bis-Man Transit Drivers
		Transit Fare Card
		Bis-Man Transit Vehicles
		Bis-Man Transit Center
Bismarck/Burleigh Emergency Management	Emergency Management for Bismarck and Burleigh County	Bismarck/Burleigh Combined Communications Center
Morton County OEM	Morton County Office of Emergency Management	Morton County Communications

Stakeholder	Description	ITS Elements
Burleigh County Sheriff	Burleigh County Sheriff Department	Burleigh County Sheriff Vehicles
Morton County Sheriff	Morton County Sheriff department	Morton County Sheriff Vehicles
Metro Area Ambulance	Bismarck-Mandan regional ambulance service	Metro Area Ambulance Vehicles
ND DES	North Dakota Division of Emergency Services	State Radio

4.0 SYSTEM INVENTORY

This section summarizes the results of the system inventory process for the Bis-Man RA. The information in this section was developed through extensive input from stakeholders in the region. Survey instruments, interviews, and small group meetings were used to obtain and verify the inventory information.

Since the Bismarck-Mandan Metropolitan ITS Plan was completed fairly recently, the majority of the ITS user services identified in the plan were directly applicable for the RA development. However, the inventory had to account for existing ITS systems and those that were deployed after the plan was updated in 2008.

Based on the National ITS Architecture, four types of Physical Architecture entities were identified for the Bis-Man region, which include:

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

These entities are explained in greater details in the following subsections. An Inventory Report generated from Turbo Architecture summarizes ITS elements for each stakeholder is included in section 4.5.

4.1 Bis-Man Centers

Centers in the Physical Architecture represent 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. Each of these centers communicates with other centers to enable coordination between modes and across jurisdictions. Out of the 10 possible centers, five were found to apply to the Bis-Man area. Figure 2 shows these centers as well as other components of the Physical Architecture.

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 Bis-Man area are limited. Most of the traffic signals in the area are operated by the City of Bismarck, which maintains several coordinated corridors. Video detection is used at several signalized intersections in Bismarck, however, it is strictly intended to support traffic signal operations and not for incident management or traffic monitoring.

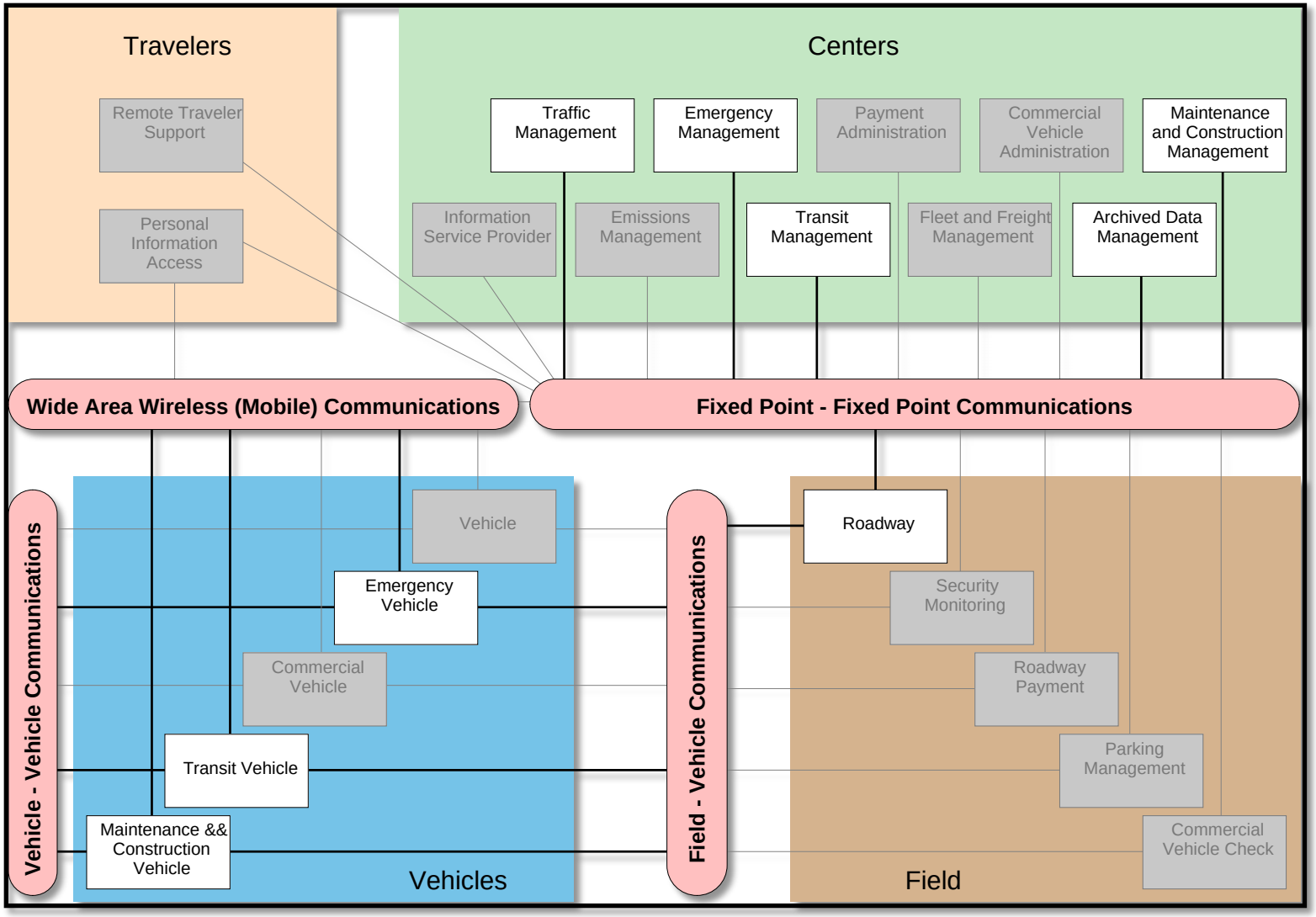


Figure 0.1 Bismarck-Mandan Physical Architecture

4.1.2 Emergency Management Center

Emergency management is handled by several local, county, and state agencies. The Cities of Bismarck and Burleigh County operate a Combined Communications Center which provides 911 and dispatch service to law enforcement, fire, and ambulance services. The City of Mandan and Morton County each maintain a dispatch center which also handles 911 calls. The NDHP dispatch is handled through State Radio.

In addition, each jurisdiction within the Bis-Man area maintains an Emergency Operations Center (EOC). The EOC brings together law enforcement, fire, emergency management, and public works agencies to coordinate emergencies. These EOCs currently rely on traditional phone line communications for sharing information, i.e., they have little or no ITS.

4.1.3 Maintenance and Construction Management Center

Currently there are three entities which handle Maintenance and Construction Management (MCO) in the Bis-Man area, including: Bismarck Public Works, Mandan Public Works, and NDDOT. County road departments handle rural road maintenance but, as the counties have limited ITS capabilities, there are no official interfaces between the rural and metropolitan systems in the ITS RA.

The NDDOT and the City of Bismarck are planning for an automated anti-icing system to be installed as part of the new Memorial Bridge project in Bismarck.

4.1.4 Information Service Provider

Functions associated with an Information Service Provider (ISP) are currently provided through multiple agencies in the Bis-Man area. Generally, law enforcement agencies are the main point of contact for issuing travel advisories and contacting the media. There currently is no traffic information provided for the metropolitan area. However, the NDDOT maintains a statewide traveler information system which uses 511 and a web page where travelers can obtain a variety of road conditions, weather, and construction information.

4.1.5 Transit Management Center

Bis-Man Transit provides public transportation services for the cities of Bismarck and Mandan as well as surrounding areas. In 2004 a new fixed-route transit service was added in Bismarck, called Capitol Area Transit (CAT).

Buses acquired for CAT are equipped with onboard security surveillance equipment. Additionally, CAT is in the process of installing an electronic fare management system which will allow enhanced fare data functions.

4.1.6 Archived Data Management Center

There currently is no entity which handles ITS data collection in the Bis-Man area. This may in part be due to the small number of ITS devices collecting traffic and other data in the area.

4.2 Bis-Man Field Devices

Field devices in the Physical Architecture refer to hardware installed to support ITS systems. The majority of field devices in the Bis-Man area may be classified under the Roadway Subsystem. Below is a listing of these devices by agency.

1. Sensors
    a. Weather
        i. RWIS and Surface sensors located on I-94 (NDDOT)
    b. Traffic
        i. Video traffic detectors (Bismarck)
        ii. Loop detectors (Bismarck and Mandan)
2. Control devices
    a. Traffic signal controllers (Bismarck and Mandan)
3. Warning/advisory devices
    a. Permanent DMS (NDDOT)

4.3 Bis-Man Area Vehicles

There are three types of vehicles included in the Bis-Man 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 Bismarck and Mandan
    a. Fire (existing)
    b. Law enforcement (existing)
    c. Ambulance (existing)
2. Transit Vehicle
    a. CAT buses with electronic fare box (existing)
3. MCO vehicles for NDDOT and Bismarck
    a. Snowplows equipped with AVL (existing)

4.4 Bis-Man Communication Infrastructure

Existing communication infrastructure in the Bis-Man area is limited. Below is a brief summary of available communications:

1. Fiber
    a. Arterial network (Bismarck)
2. Phone drops (dial-up)
    a. Traffic signals (Bismarck)
3. Wireless/cellular
    a. NDDOT DMS

4.5 Summary of Bis-Man ITS Inventory

Entity	ITS Element	Description	Status	Stakeholder
Alerting and Advisory Systems	State Radio	North Dakota State Radio	Existing	ND Division of Emergency Management
Driver	Driver		Existing	
Emergency Management	Bismarck/Burleigh Combined Communications Center	911 and dispatch center for Bismarck and Burleigh County	Existing	Bismarck/Burleigh Emergency Management
Emergency Management	Mandan PD Dispatch Center	Mandan Police Department dispatch	Existing	Mandan PD
Emergency Management	Morton County Communications	Morton County communications department	Existing	Morton County OEM
Emergency Management	State Radio	North Dakota State Radio	Existing	ND Division of Emergency Management
Emergency Telecommunications System	Bismarck/Burleigh Combined Communications Center	911 and dispatch center for Bismarck and Burleigh County	Existing	Bismarck/Burleigh Emergency Management
Emergency Vehicle Subsystem	Bismarck PD Vehicles	Bismarck Police Department vehicles	Existing	Bismarck PD
Emergency Vehicle Subsystem	Bismarck FD Vehicles	Bismarck Fire Department vehicles	Existing	Bismarck FD
Emergency Vehicle Subsystem	Mandan PD Vehicles	Mandan Police Department vehicles	Existing	Mandan PD
Emergency Vehicle Subsystem	Mandan FD Vehicles	Mandan Fire Department vehicles	Existing	Mandan FD
Emergency Vehicle Subsystem	Burleigh County Sheriff Vehicles	Burleigh County Sheriff department vehicles	Existing	Burleigh County Sheriff
Emergency Vehicle Subsystem	Morton County Sheriff Vehicles	Morton County Sheriff department vehicles	Existing	Morton County Sheriff
Emergency Vehicle Subsystem	Metro Area Ambulance Vehicles	Metro Area ambulance service vehicles	Existing	Metro Area Ambulance
Maintenance and Construction Management	Bismarck PW Operations Center	Bismarck Public Works operations	Existing	Bismarck PW
Maintenance and Construction Management	Mandan PW Operations Center	Mandan Public Works operations	Existing	Mandan PW
Maintenance and Construction Management	NDDOT District Office	NDDOT District maintenance and construction	Existing	NDDOT Bis Dist

Maintenance and Construction Vehicle	Mandan PW Vehicles	Mandan public works vehicles	Existing	Mandan PW
Maintenance and Construction Vehicle	Bismarck PW Vehicles	Bismarck public works vehicles	Existing	Bismarck PW
Maintenance and Construction Vehicle	NDDOT District Vehicles	NDDOT District maintenance and construction vehicles	Existing	NDDOT Bis Dist
Media	Media	Terminator	Existing	
Other Roadway	Other Roadway	Terminator	Existing	
Pedestrians	Pedestrians	Terminator	Existing	
Roadway Subsystem	Bismarck TOC Field Devices	Bismarck TOC traffic monitoring and control devices	Existing	Bismarck Engineering
Roadway Subsystem	Bismarck PW Field Devices	Bismarck Public Works field devices	Planned	Bismarck PW
Roadway Subsystem	NDDOT District Field Devices	NDDOT District field devices	Planned	NDDOT Bis Dist
Roadway Subsystem	Mandan Engineering Field Devices	Mandan traffic field devices	Existing	Mandan Engineering
Traffic	Traffic		Existing	
Traffic Management	Bismarck TOC	Bismarck Traffic Operations Center	Planned	Bismarck Engineering
Traffic Management	Mandan Traffic Engineering	Mandan traffic engineering	Existing	Mandan Engineering
Traffic Operations Personnel	Bismarck Engineers	Bismarck traffic engineering personnel	Existing	Bismarck Engineering
Transit Management	Bis-Man Transit Center	Bismarck Mandan Transit Center	Existing	Bis-Man Transit
Transit System Operators	Bis-Man Transit Operator		Existing	Bis-Man Transit
Transit Traveler	Bis-Man Transit Center	Bismarck Mandan Transit Center	Existing	Bis-Man Transit
Transit Vehicle Operator	Bis-Man Transit Drivers		Existing	Bis-Man Transit
Transit Vehicle Subsystem	Bis-Man Transit Vehicles	Bis-Man Transit buses	Existing	Bis-Man Transit
Traveler Card	Traveler Card	Bis-Man Transit fare cars	Existing	Bis-Man Transit
Emergency Vehicle Subsystem	NDHP Vehicles	NDHP vehicles	Existing	NDHP

5.0 NEEDS AND SERVICES

This section describes the ITS user services selected for the Bis-Man area. These services were identified from previous ITS planning efforts and from stakeholders input during the RA development. It should be noted that due to the recent completion of the Bismarck-Mandan Metropolitan ITS Plan, the set of ITS User Services were readily available for use in the RA development.

5.1 Needs

The Bis-Man area enjoys a well-developed transportation system which operates at a high level of service. The Metropolitan ITS Plan identified possible areas of improvement that involve ITS applications. The broad areas for improvement include: improved peak-hour traffic and special events traffic management; coordinated incident response; and enhanced transit operations. Communication infrastructure was also identified as an overarching issue which not only directly affects ITS deployment, but also the ability of agencies in the Bis-Man area to coordinate their services.

5.2 Services

Bis-Man RA stakeholders assisted in customizing potential ITS User Services and corresponding Service Packages to reflect regional needs. Subsection 5.2.1 provides a summary of the ITS User Services identified for the Bis-Man area while Subsection 5.2.2 outlines the area's Service Packages.

5.2.1 Bis-Man ITS User Services

1. Travel and Traffic Management

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

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

1.3. Route Guidance: Provide travelers with directions to selected destinations.

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

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

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.

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 Bis-Man Service Packages

The following Service Packages were identified for the Bis-Man region in order to support ITS services. The descriptions are based on information from the National ITS Architecture. The status of each Service Package is also indicated (i.e., existing, planned, or Existing *). The Existing * indicates that portions of the Service Package are deployed in the area but additional portions are planned for deployment. Customized Bis-Man Service Packages and associated information flows are shown in more detail in **Appendix A**.

AD2: ITS Data Warehouse (Planned)

This service package includes all the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this service package in addition to the basic query and reporting user access features offered by the ITS Data Mart.

ATMS01: Network Surveillance (Existing *)

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

ATMS03: Traffic Signal Control (Existing *)

This Service Package provides the central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management. Traffic signal control systems represented by this Service Package range from fixed-schedule control systems 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 Service Package is consistent with typical urban traffic signal control systems.

ATMS06: Traffic Information Dissemination (Existing)

This Service Package provides driver information using roadway equipment such as dynamic message signs. 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.

ATMS08: Traffic Incident Management System (Planned)

This Service Package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. It includes incident detection capabilities through roadside surveillance devices and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as event promoters. This Service Package supports traffic operations personnel in developing an appropriate response in coordination with other agencies. The response may include traffic control strategy modifications or resource coordination between center subsystems. Incident response also includes presentation of information to affected travelers.

ATMS19: Speed Warning and Enforcement (Planned)

This Service Package monitors the speeds of vehicles traveling through a roadway system. If the speed is determine to be excessive, roadside equipment can suggest a safe driving speed. This service can also support notifications to an enforcement agency to enforce the speed limit on a roadway system.

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

This Service Package will track the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities. Activities monitored through this Service Package include ensuring the correct

roads are being plowed and that maintenance work is being performed at the correct locations.

MC02: Maintenance and Construction Vehicle Maintenance (Existing)

This service package performs vehicle maintenance scheduling and manages both routine and corrective maintenance activities on vehicles and other maintenance and construction equipment. It includes on-board sensors capable of automatically performing diagnostics for maintenance and construction vehicles, and the systems that collect this diagnostic information and use it to schedule and manage vehicle maintenance.

MC05: Roadway Automated Treatment (Planned)

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

MC06: Winter Maintenance (Existing)

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

APTS01: Transit Vehicle Tracking (Existing)

This Service Package monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real time schedule adherence and update the transit system's schedule in real-time. A two-way wireless communication link with the Transit Management Subsystem is used for relaying vehicle position and control measures. The Transit Management Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider.

APTS02: Transit Fixed-Route Operations (Existing)

This Service 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.

APTS03: Demand responsive Transit Operations (Existing)

This Service Package performs vehicle routing and scheduling as well as automatic operator assignment and monitoring for demand responsive transit services. This package monitors the current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. This service includes the capability for a traveler request for personalized transit services to be made through the Information Service Provider (ISP) Subsystem. The ISP may either be operated by a transit management center or be independently owned and operated by a separate service provider.

ATPS04: Transit Fare Collection Management (Existing)

This Service Package manages transit fare collection on-board transit vehicles and at transit stops using electronic means. It allows transit users to use a traveler card or other electronic payment device. Readers located either in the infrastructure or on-board the transit vehicle allow electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem.

APTS05: Transit Security (Existing)

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

APTS06: Transit Fleet Management (Existing)

This service 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 service package also supports the day to day management of the transit fleet inventory, including the assignment of specific transit vehicles to blocks.

APTS10: Transit Passenger Counting (Planned)

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

EM01: Emergency Call-Taking and Dispatch (Existing)

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

EM02: Emergency Routing (Existing *)

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

EM06: Wide-Area Alert (Existing)

This Service Package uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather events, civil emergencies, and other situations. The alert includes information and instructions for transportation system operators and the traveling public. 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, and others that operate ITS systems. The ITS systems, in turn, provide the alert information to 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 Bis-Man RA. The operational concept outlines the roles and responsibilities of relevant stakeholders for specific ITS service areas, i.e., emergency management, incident management, maintenance and construction management, surface street management, and transit service. Specific scenarios were used to facilitate documenting stakeholder roles, e.g., traffic incidents, major winter storm, floods, etc. In addition to providing a snapshot of how things are done for a certain scenario, the operational concept explores additional integration opportunities in the region with particular focus on stakeholder involvement.

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

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

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

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

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

6.1 Implementation Roles

Service Packages	Stakeholders with Implementation Roles
Network Surveillance	NDDOT, Bismarck
Surface Street Control	Bismarck Engineering, Mandan Engineering
Traffic Information Dissemination	NDDOT
Traffic Incident Management System	Bismarck, NDDOT
Maintenance and Construction Vehicle and Equipment Tracking	Bismarck PW, NDDOT
Roadway Automated Treatment	Bismarck PW, NDDOT
Winter Maintenance	Bismarck PW, Mandan PW, NDDOT
Transit Vehicle Tracking	Bis-Man Transit
Transit Fixed-Route Operations	Bis-Man Transit
Demand Response Transit Operations	Bis-Man Transit
Transit Fare Collection Management	Bis-Man Transit
Transit Security	Bis-Man Transit
Emergency Call-Taking and Dispatch	Combined Communications Center, Mandan PD, Morton County Emergency Management
Emergency Routing	Bismarck Engineering, Mandan Engineering
Wide-Area Alert	Bismarck PD, Mandan PD, NDHP

6.2 Operational Roles and Responsibilities

Responsibility Area	Stakeholder	Role
Emergency Management	Bismarck/Burleigh Emergency Management	1. Coordinate response 2. Provide 911 service for Bismarck and Burleigh 3. Provide dispatch service
	Mandan PD	1. Coordinate emergency response 2. Provide 911 service to Mandan 3. Provide dispatch for Mandan PD and FD
	Morton County OEM	1. Coordinate emergency response 2. Provide 911 service for Morton County 3. Provide dispatch for Morton County Sheriff and rural fire
	ND Division of Emergency Management	1. Issue Amber Alerts 2. Provide dispatch for NDHP
Incident Management	Bismarck Engineering	Coordinate with Law Enforcement and Maintenance and Construction agencies
	Bismarck FD	Respond to incidents
	Bismarck PD	Respond to incidents in Bismarck
	Bismarck PW	Provide resources
	Bismarck/Burleigh Emergency Management	Provides dispatch and communications
	Burleigh County Sheriff	Respond to incidents on Burleigh County system
	Mandan FD	Respond to incidents
	Mandan PD	Respond to incidents
	Mandan PW	Provide resources
	Metro Area Ambulance	Respond to incidents
	Morton County OEM	Coordinate response Provides dispatch and communications to Morton County
	Morton County Sheriff	Respond to incidents on Morton County system
	ND Division of Emergency Management	Provide dispatch and communications for NDHP
	NDDOT Bis Dist	Provide resources
	NDHP	Respond to incidents on the state system
Maintenance and Construction	Bismarck PW	1. Perform roadway construction and maintenance activities in Bismarck 2. Perform winter maintenance activities (snow plow operations, sanding, deicing) in Bismarck
	Mandan PW	1. Perform roadway construction and maintenance activities in Mandan 2. Perform winter maintenance activities (snow plow operations, sanding, deicing) in Mandan

	NDDOT Bis Dist	1. Perform roadway construction and maintenance activities on state system 2. Perform winter maintenance activities (snow plow operations, sanding, deicing) on state system
Surface Street Management	Bismarck Engineering	Design, operate, and maintain signal control in Bismarck
	Mandan Engineering	Design, operate, and maintain signal control in Mandan
Transit Services	Bis-Man Transit	1. Provide demand response transit services for the Bismarck Mandan area
		2. Provide transit fixed route services for the Bismarck Mandan area

7.0 AGREEMENTS

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

The table on the following page shows a summary of potential agreements in the Bis-Man area. The table provides the following information for each agreement:

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

Bismarck-Mandan Potential ITS Agreements			
Service Packages	**Purpose**	**Stakeholders**	**Issues**
APTS5-Transit Security	Response to incidents on buses	Bis-Man Transit Bismarck PD Mandan PD	Response protocols Communications
ATMS01-Network Surveillance	Share data	Bismarck Engineering Mandan Engineering NDDOT-Bismarck District	Access to sensors Access to databases Access to networks/servers
ATMS06-Traffic Info Dissemination	Coordinate traveler information	Bismarck Engineering Mandan Engineering NDDOT-Bismarck District	Communications links Notification protocols
ATMS08-Traffic Incident Management	Incident traffic response Sharing data (flow, video)	Bismarck Police Dept Mandan Police Dept Burleigh Co. Sheriff Morton Co. Sheriff ND Highway Patrol	Communications links Response protocols
AD2-ITS Data Warehouse	Archival of ITS data from various agencies for the purpose of measuring and improving performance	Bismarck Engineering Mandan Engineering NDDOT-Bismarck District Bis-Man Transit	Information sharing for data archival

8.0 FUNCTIONAL REQUIREMENTS

This section lists the functional requirements necessary to execute user services and service packages identified for the Bis-Man RA. 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: Systems or portions of systems in the regional architecture
2. Entity: Persons, places, and devices that make up an intelligent transportation system (i.e., subsystem or terminator).
3. Functional Area: type of and description of functional area
4. Requirements: Desired functional requirements
5. Status: Existing or planned

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

Bismarck-Mandan RA (Region)			(Region)
Element: **Bis-Man Emergency Vehicles**			
Entity: **Emergency Vehicle**			
Functional Area:	**On-board EV En Route Support** On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.		
Requirement:	1	The emergency vehicle, including roadway service patrols, shall track its current location.	Existing
Requirement:	2	The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.	Existing
Requirement:	3	The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.	Existing
Requirement:	4	The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.	Existing
Requirement:	5	The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.	Existing

9.0 ITS STANDARDS

This section identifies applicable ITS Standards identified for the Bis-Man 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 Bis-Man RA.

Standard Name	Document ID
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
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 CCTV	NTCIP 1205
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
Incident Management Standards Group	IEEE 1512 -2006 IEEE 1512.1-2006 IEEE 1512.2-2004 IEEE 1512.3-2006 IEEE P1512.4
TCIP - Passenger Information (PI) Business Area Standard	NTCIP 1403
TCIP - Scheduling/Run-cutting (SCH) Business Area Standard	NTCIP 1404
TCIP - Spatial Representation (SP) Business Area Standard	NTCIP 1405
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 J2540 SAE J2540/1 SAE J2540/2 SAE J2540/3
Dedicated Short Range Communication at 5.9 GHz Standards Group	ASTM E2213-03 IEEE 1609.1-2006 IEEE 1609.2-2006 IEEE 1609.4-2006 IEEE P1609.3 IEEE P802.11p

10.0 PROJECTS SEQUENCE

This section briefly outlines possible time frames for deploying selected ITS projects in the Bis-Man area. Project timing is based on the Bismarck-Mandan ITS Plan, which identified ITS projects and their possible deployment timeframe. It should be noted that not all of the planned services for the area have been fully developed into ITS projects yet. Additionally, given the uncertainty of funding for ITS projects in the area, approximate deployment time frames are used in place of firm deployment.

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

Service Packages	Time Frame
Archived Data	Medium
Network Surveillance	Short-Medium
Surface Street Control	Short-Medium
Traffic Information Dissemination	Medium
Traffic Incident Management System	Medium-Long
Speed Monitoring	Long
Maintenance and Construction Vehicle and Equipment Tracking	Existing
Roadway Automated Treatment	Medium-Long
Winter Maintenance	Existing
Transit Vehicle Tracking	Existing
Transit Fixed-Route Operations	Existing
Demand Response Transit Operations	Existing
Transit Fare Collection Management	Existing
Transit Security	Existing
Emergency Call-Taking and Dispatch	Short-Medium
Emergency Routing	Short
Wide-Area Alert	Existing

10.1 RA Architecture Maintenance

It should be pointed out that the Bismarck-Mandan MPO will be responsible for maintaining the Bis-Man Regional ITS Architecture through a partnership with the Advanced Traffic Analysis Center. It is envisioned that updates will be conducted every two years or upon the deployment of a major ITS project in the area. Additionally, the ITS project list will be updated as they are programmed into the TIP.

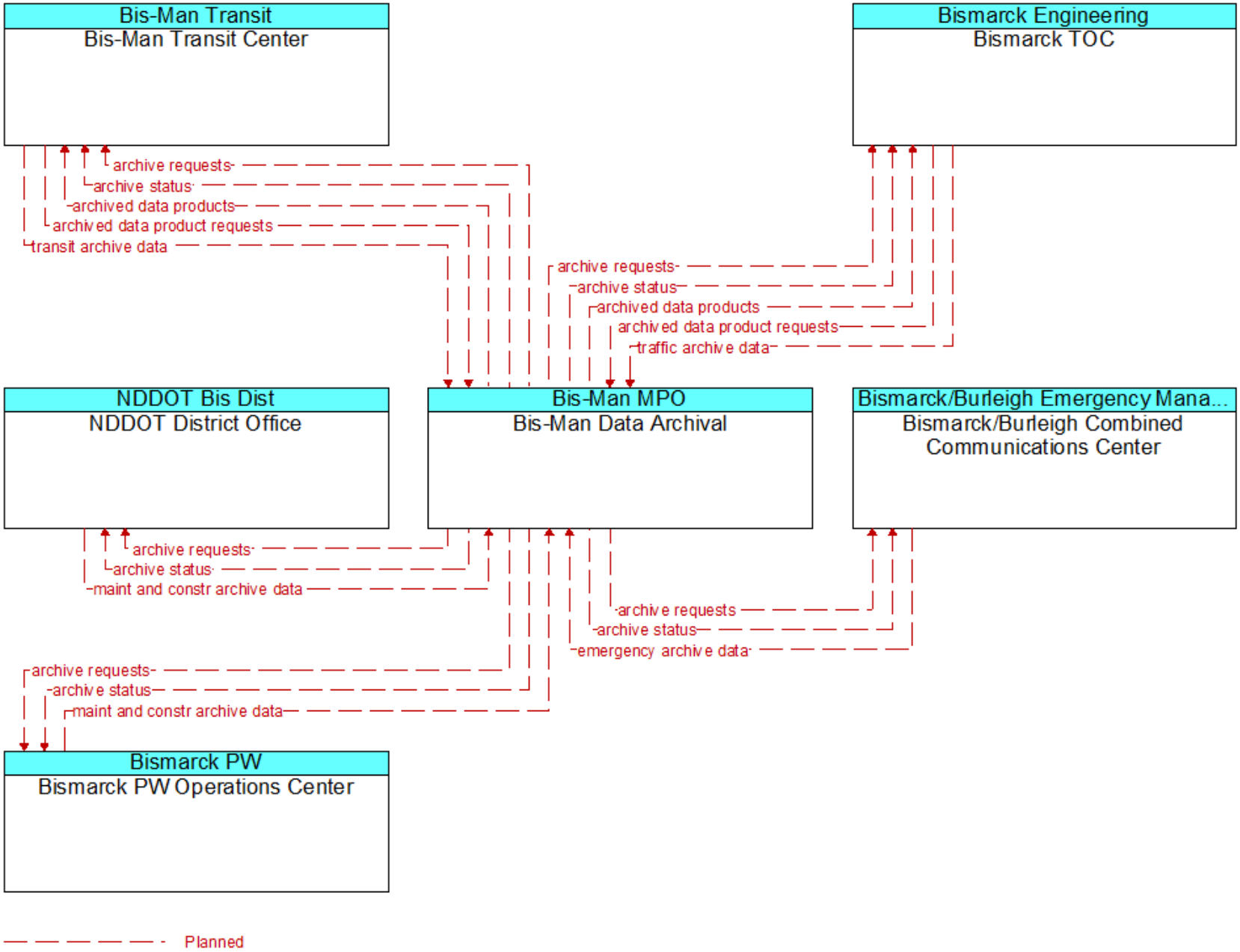
APPENDIX A: BIS-MAN SERVICE PACKAGES AND INFORMATION FLOWS

The Service Package Diagrams are available electronically at:

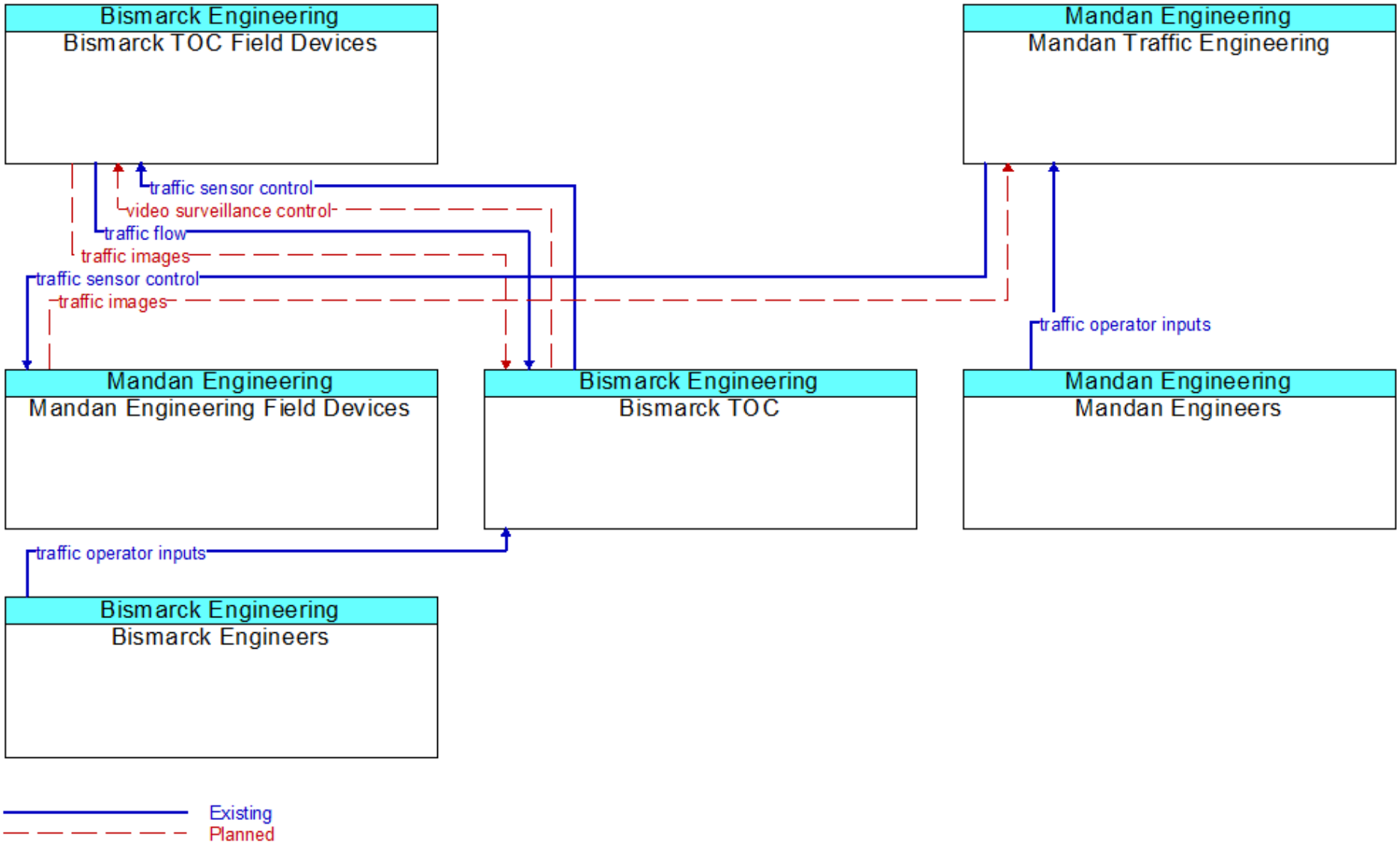
http://www.atacenter.org/regional/bisman/

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

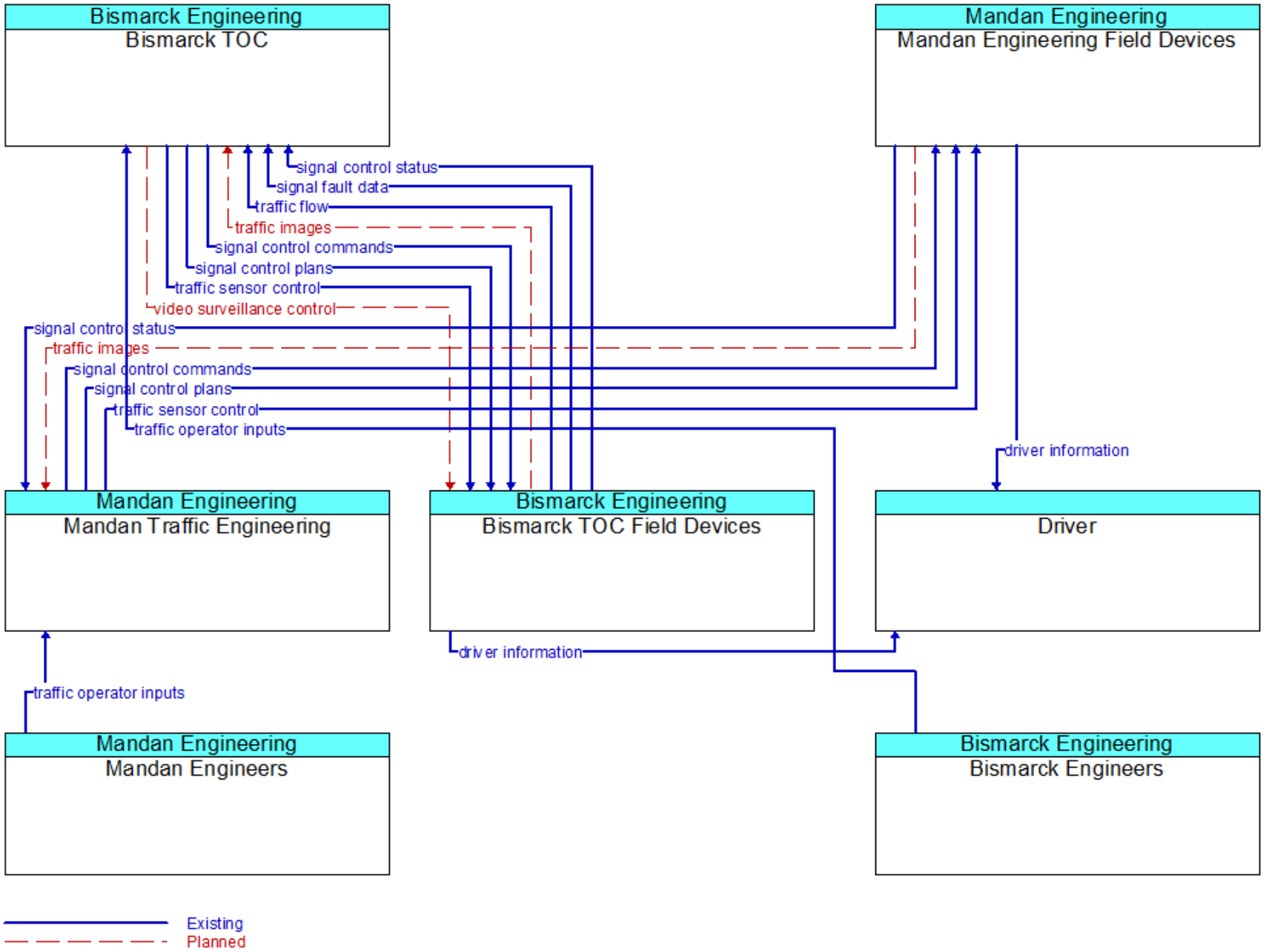
AD2 ITS Data Warehouse



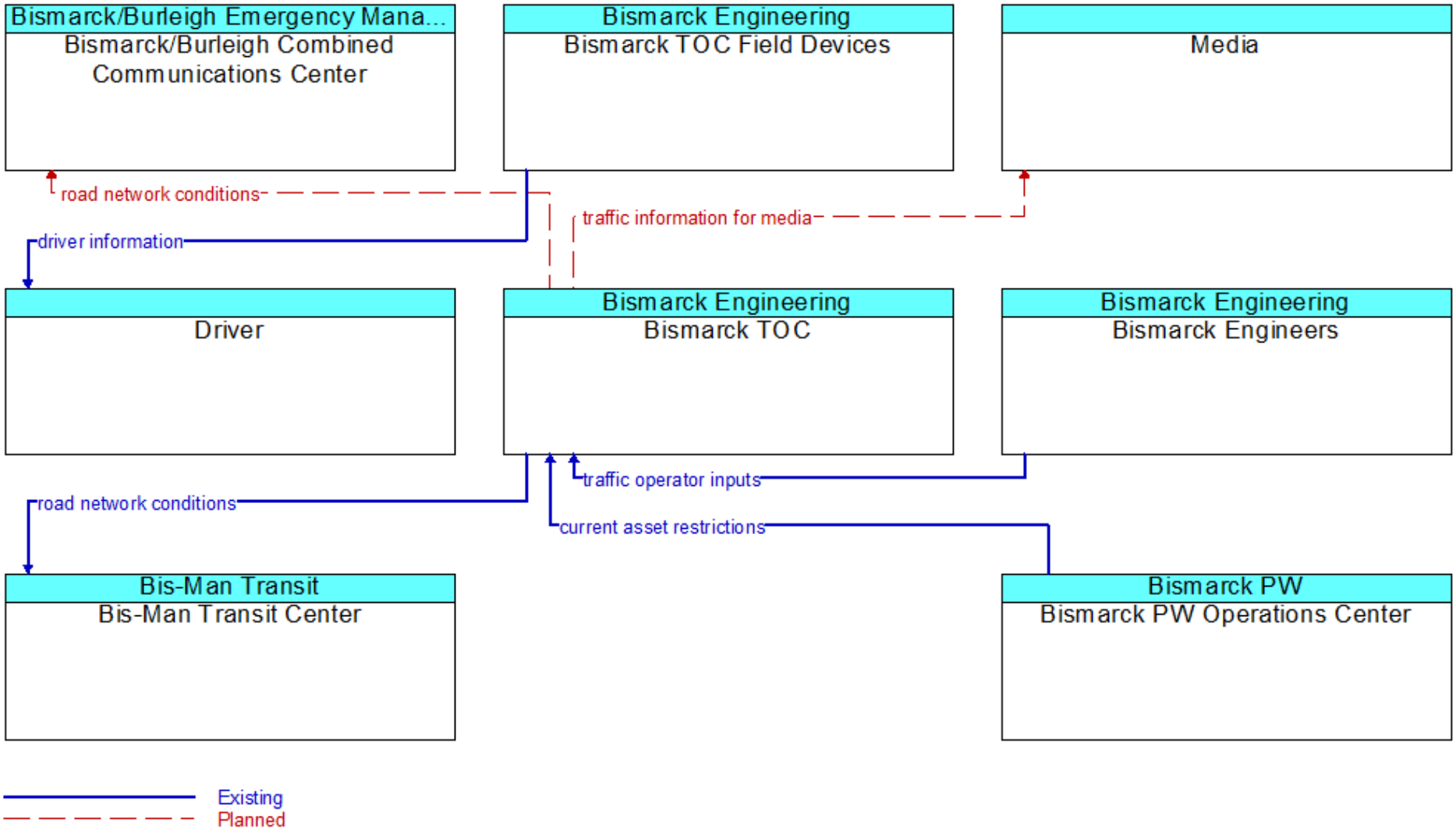
ATMS01 Network Surveillance



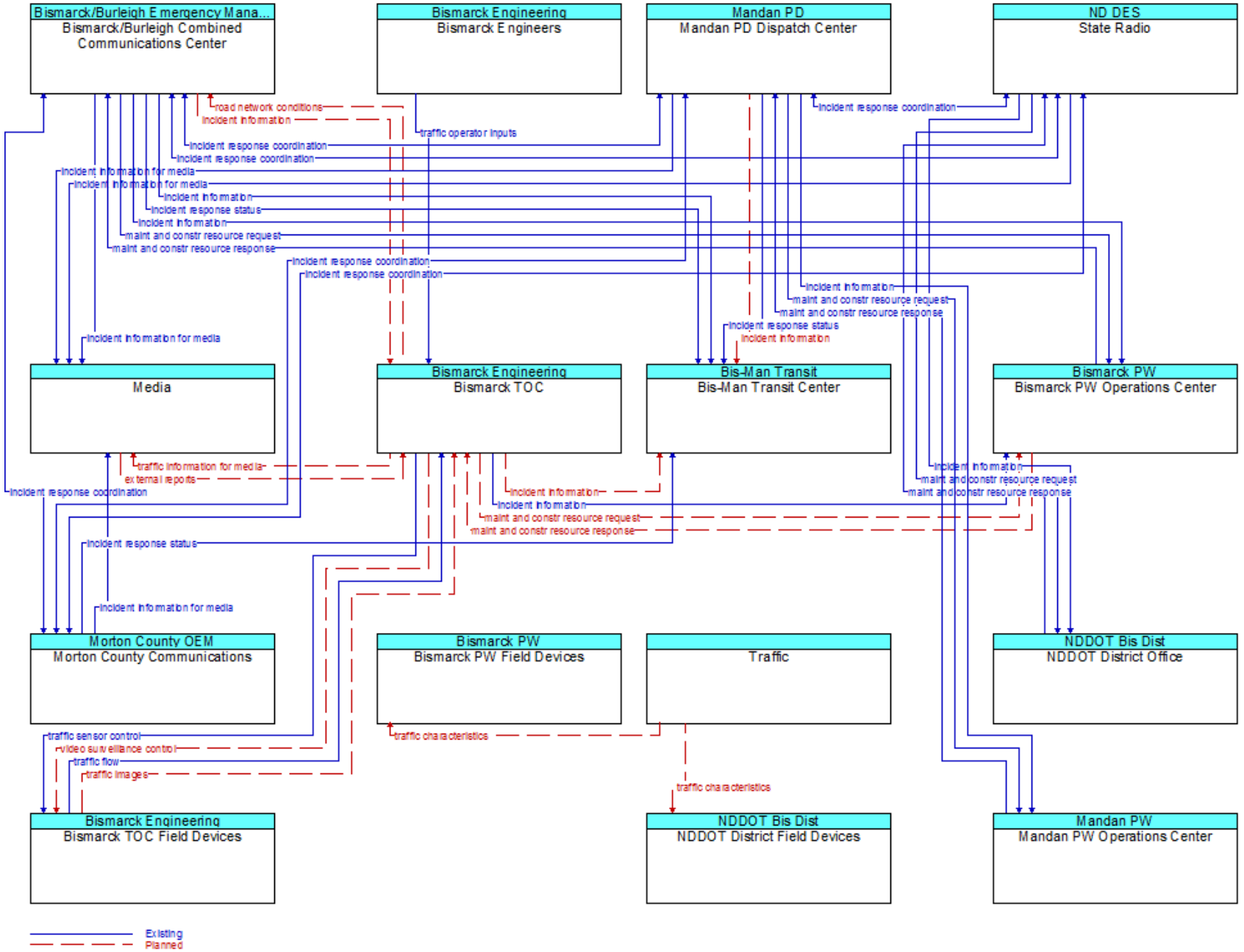
ATMS03 Traffic Signal Control



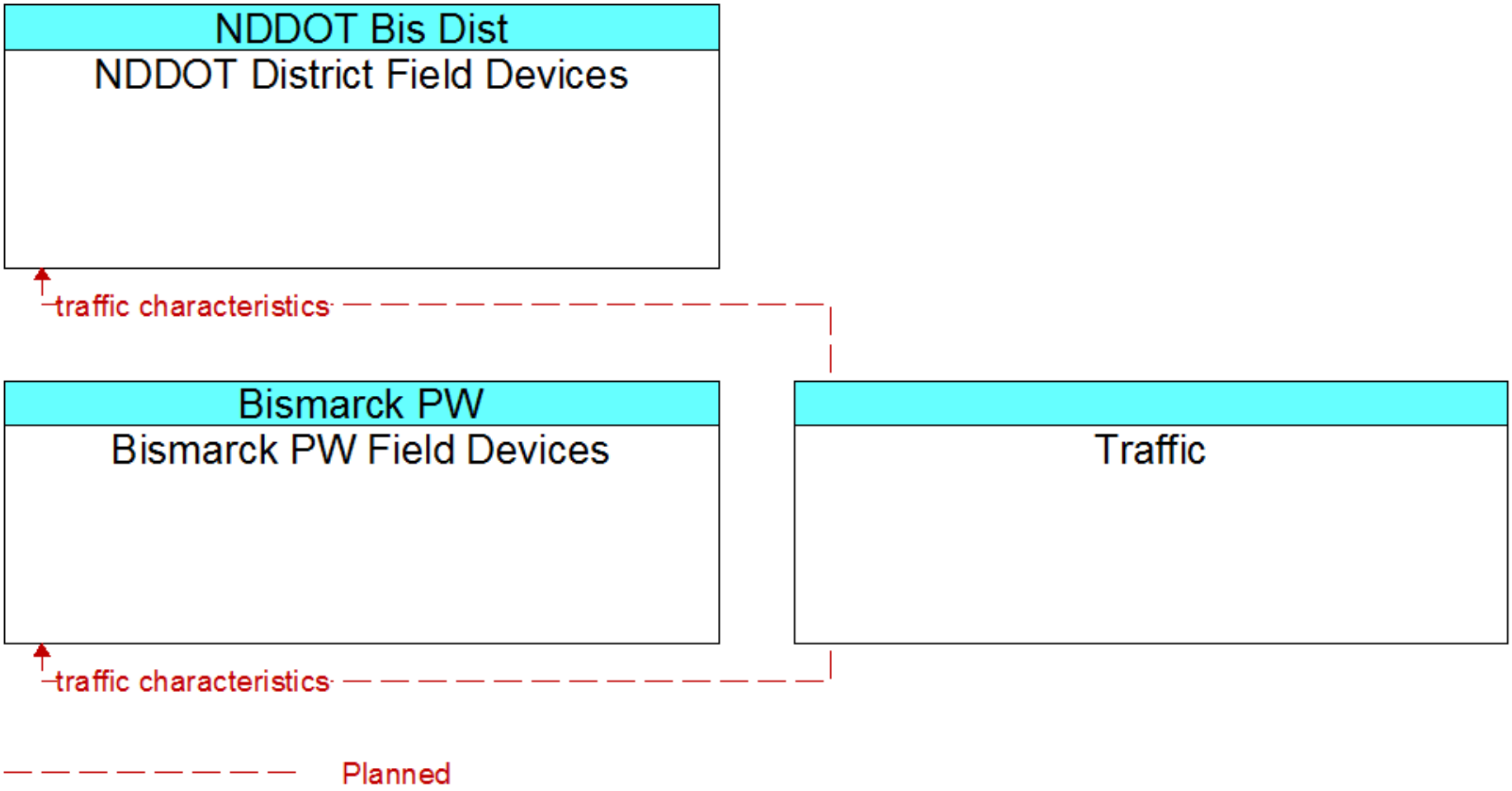
ATMS06 Traffic Information Dissemination



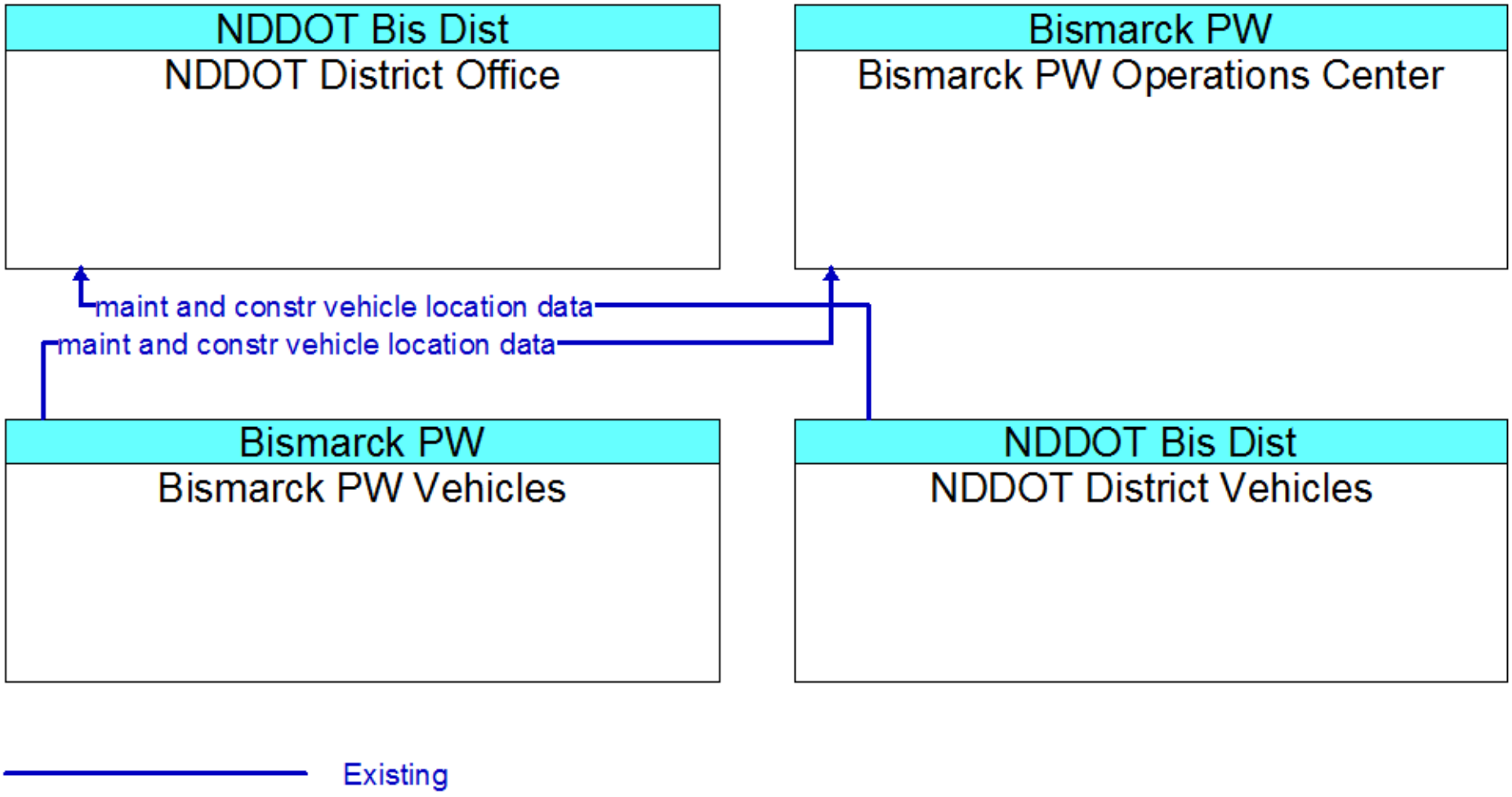
ATMS08 Traffic Incident Management



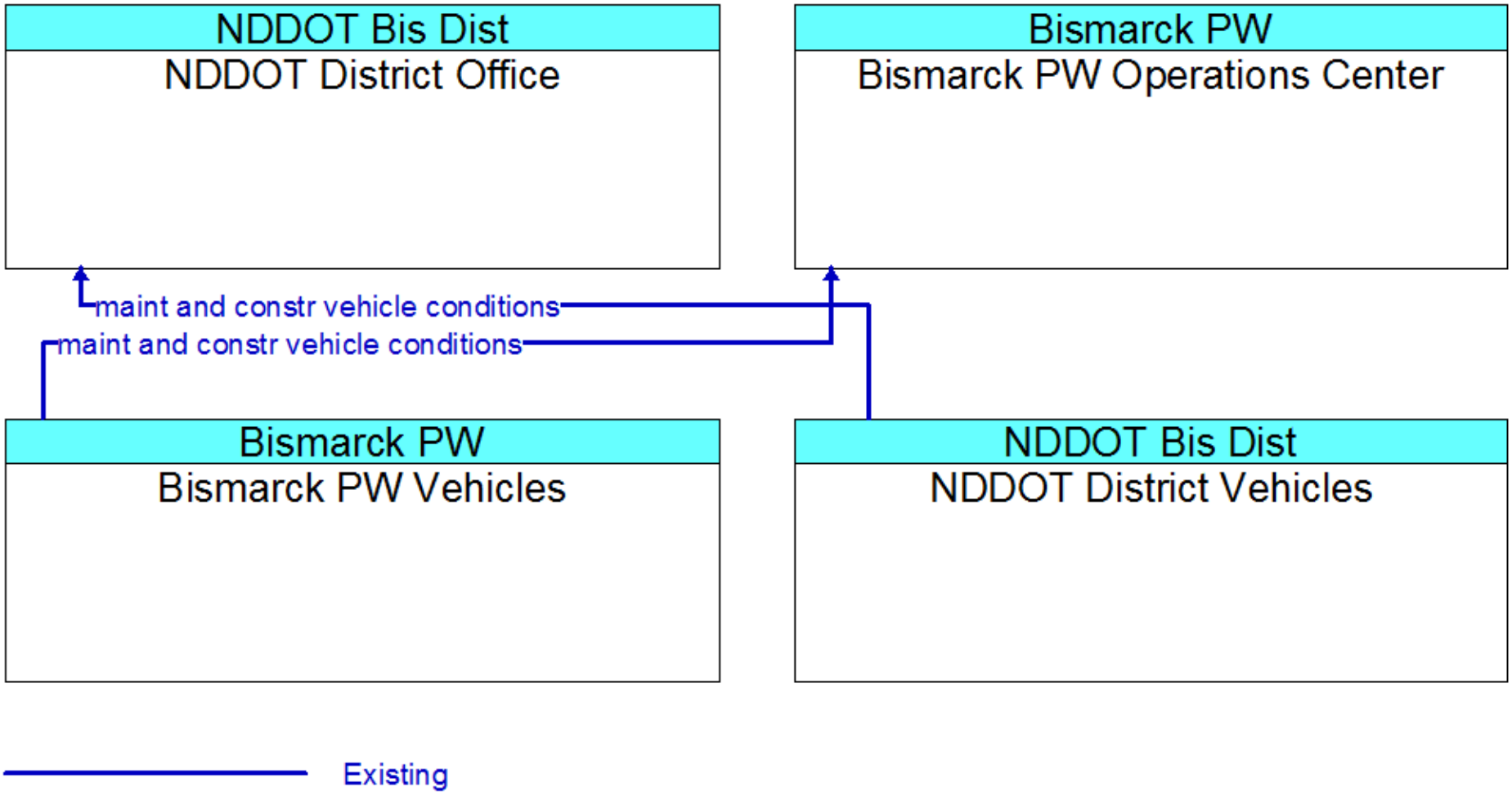
ATMS19 Speed Warning and Enforcement



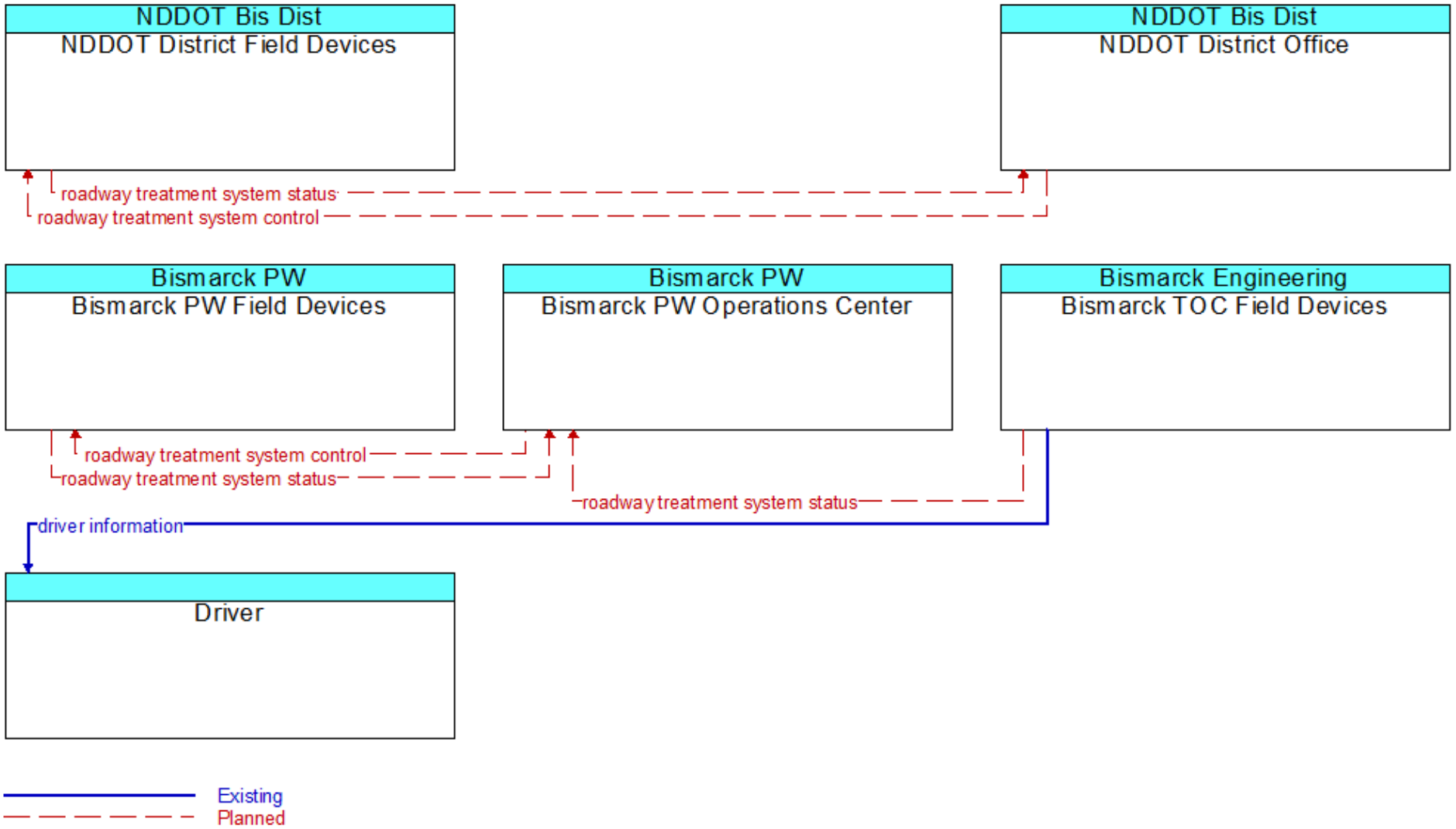
MC01 Maintenance and Construction Vehicle Tracking



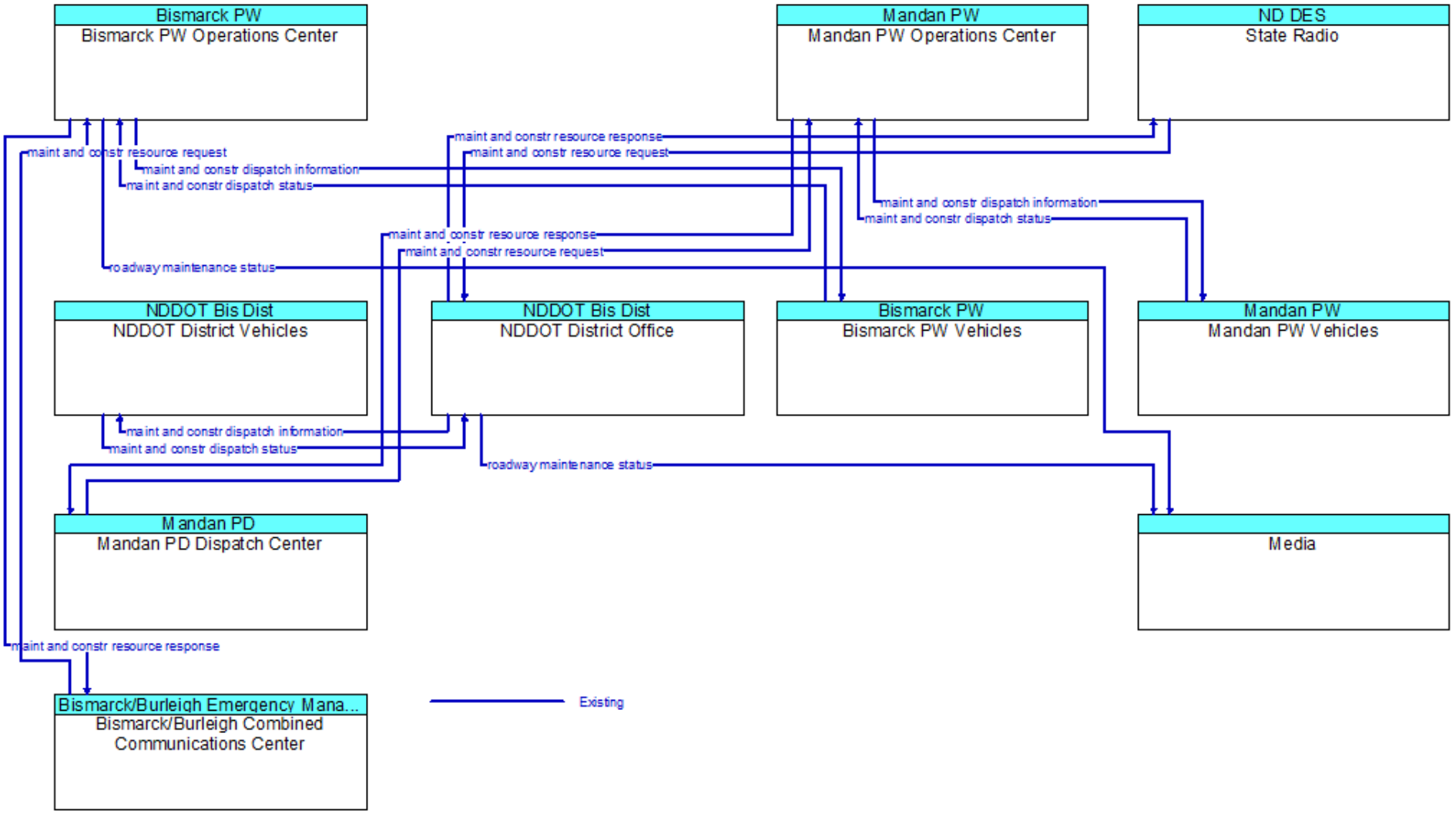
MC02 Maintenance and Construction Vehicle Maintenance



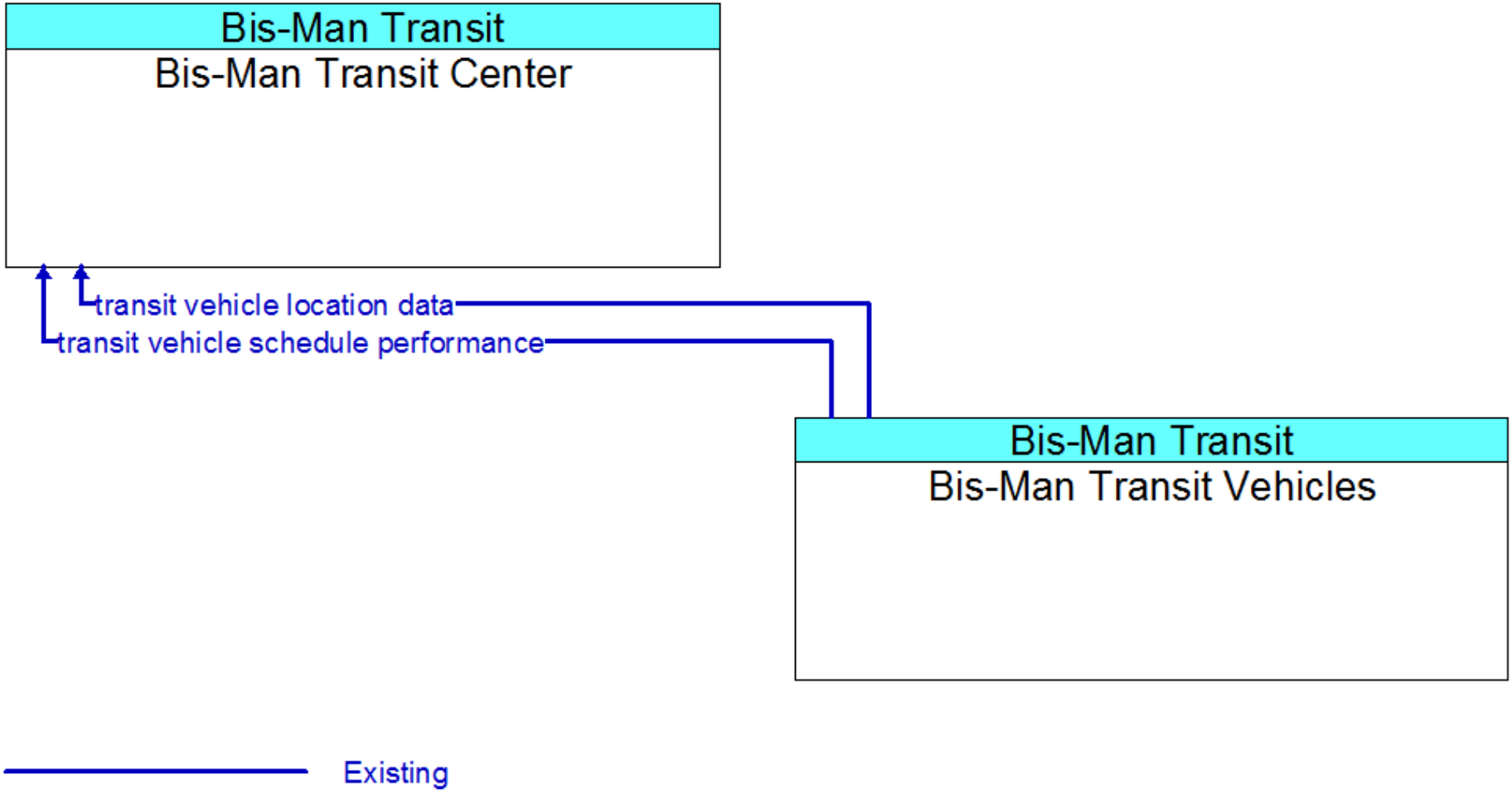
MC05 Roadway Automated Treatment



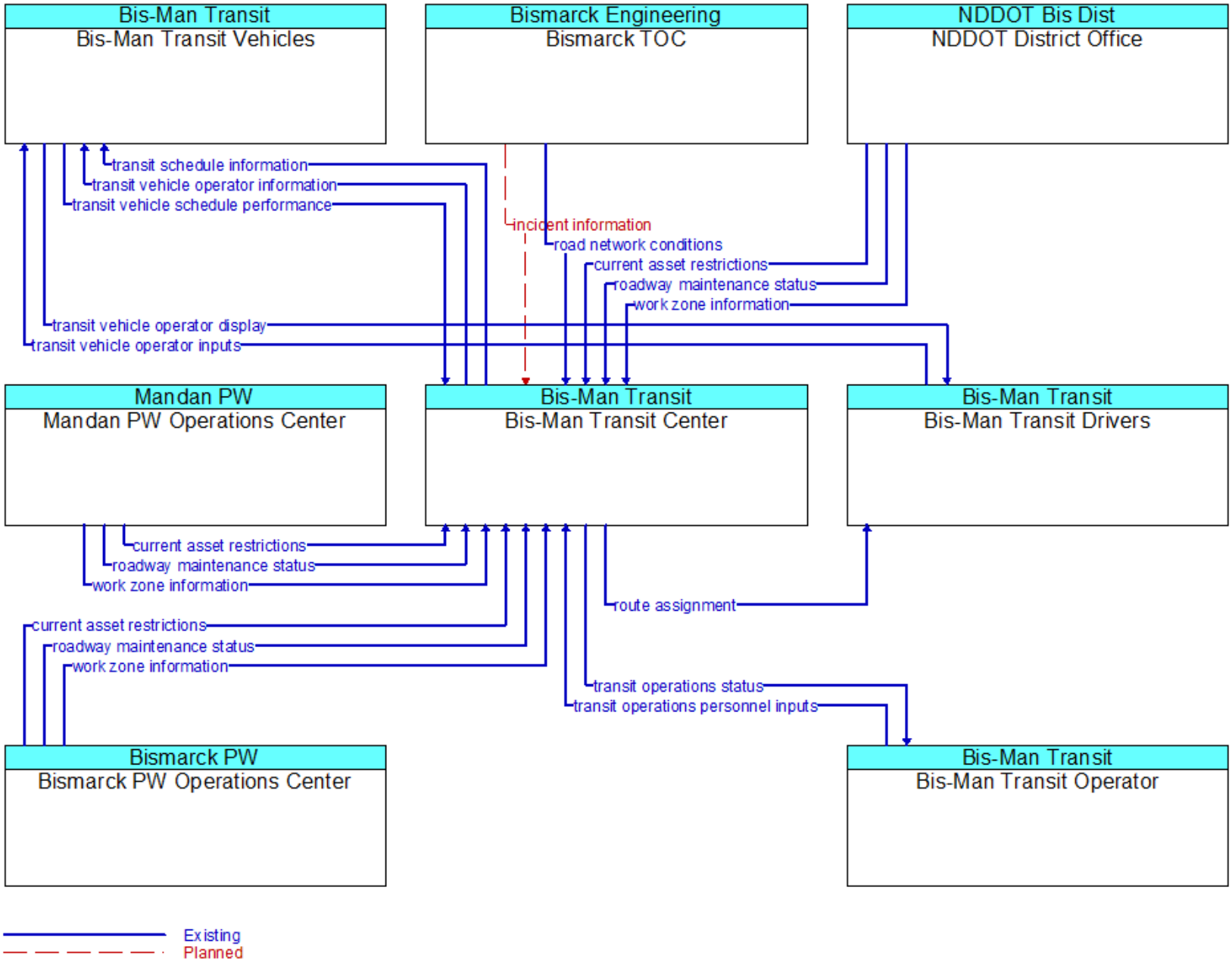
MC06 Winter Maintenance



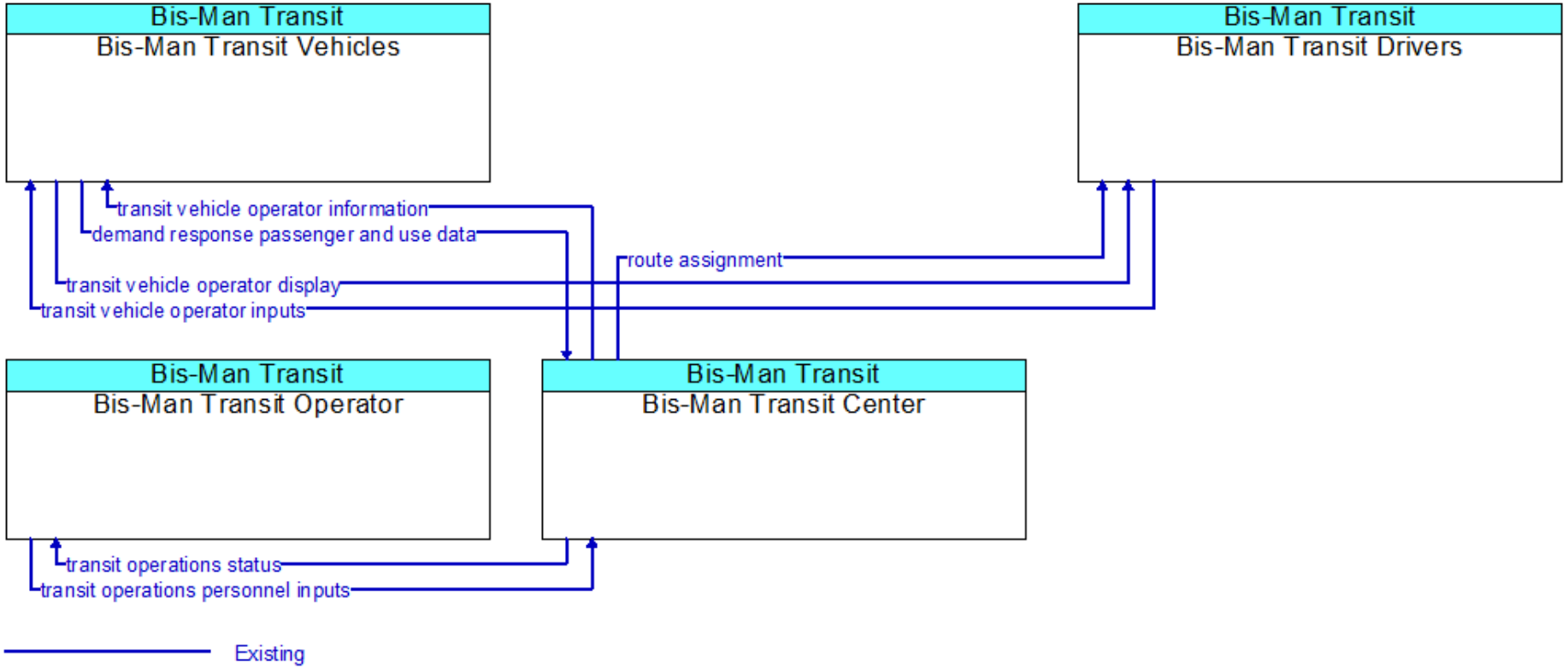
APTS01 Transit Vehicle Tracking



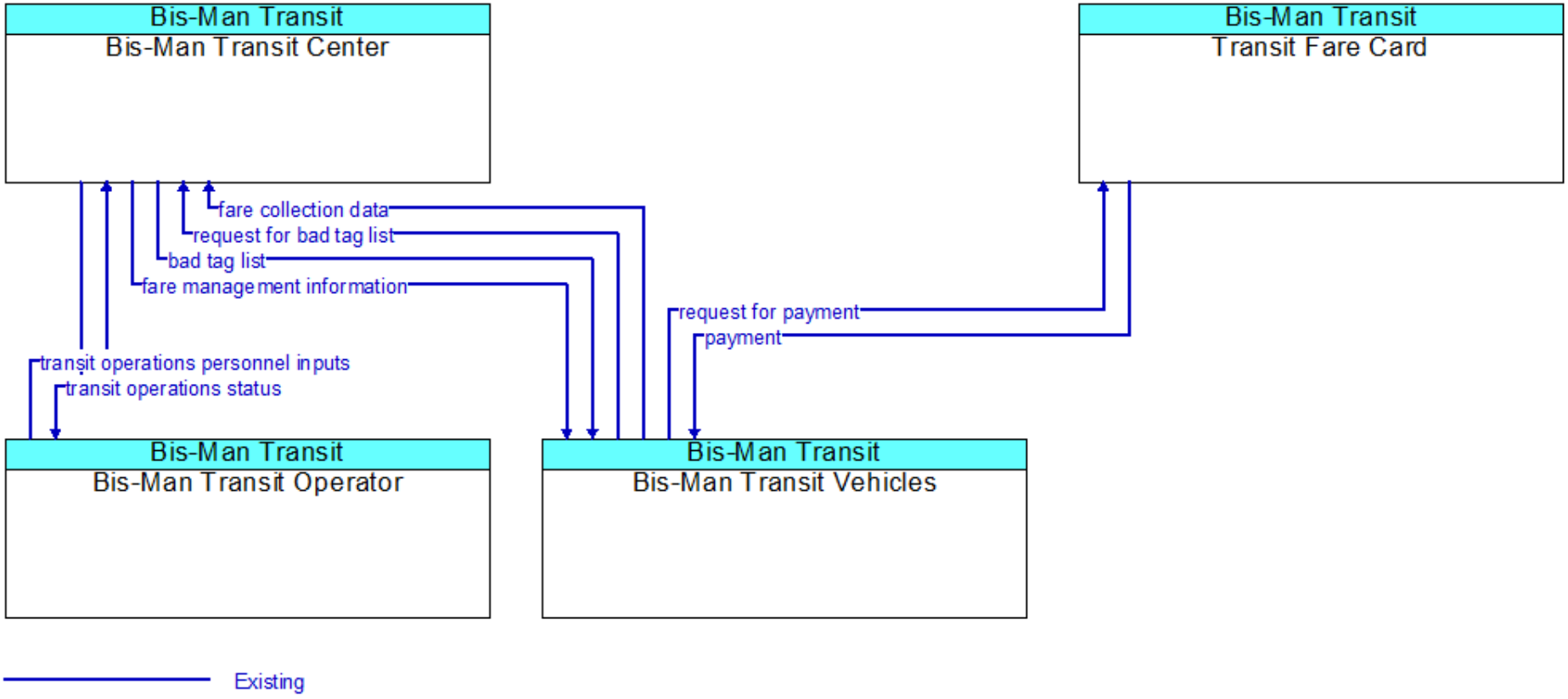
APTS02 Transit Fixed-Route Operations



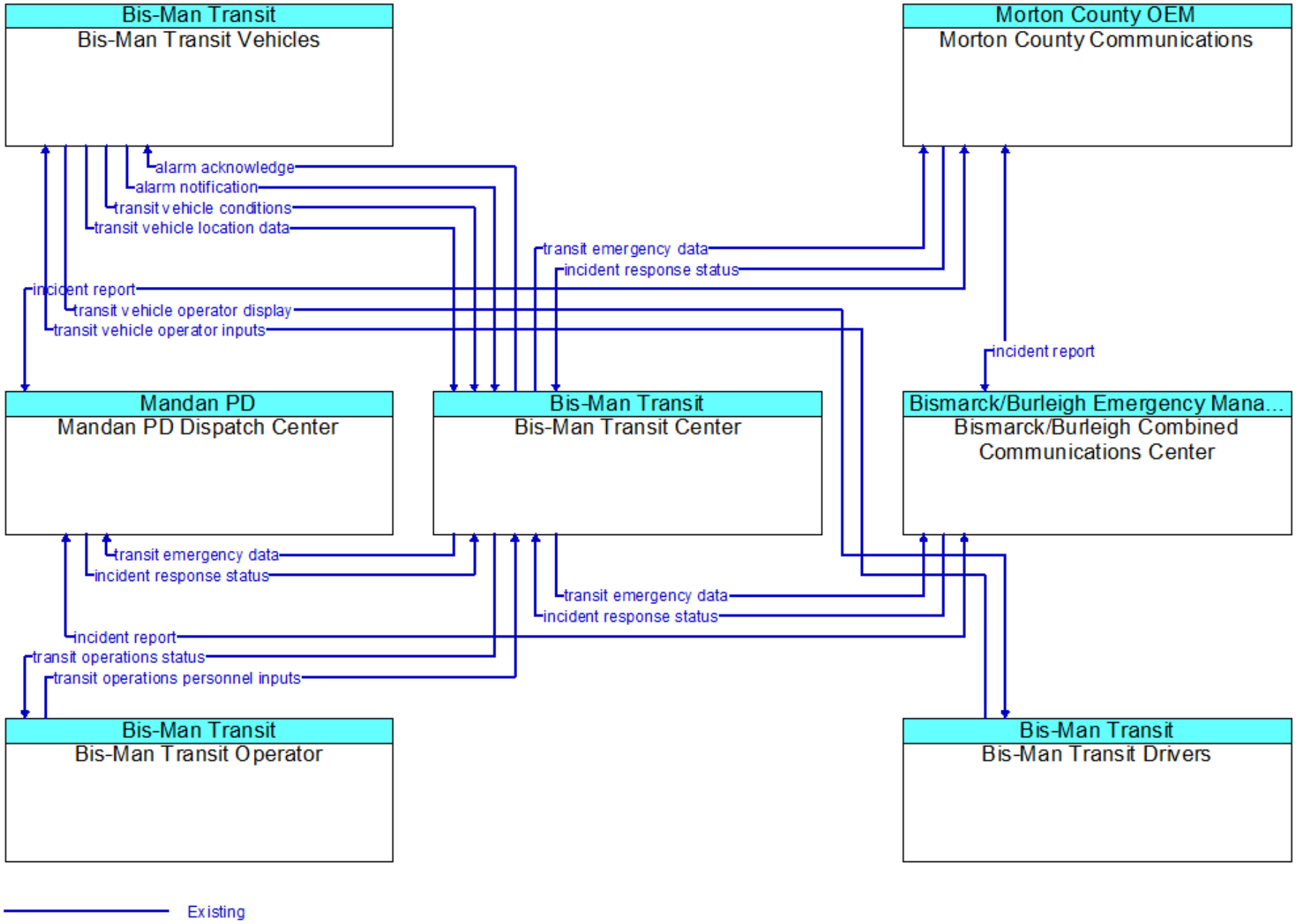
APTS03 Demand Response Transit Operations



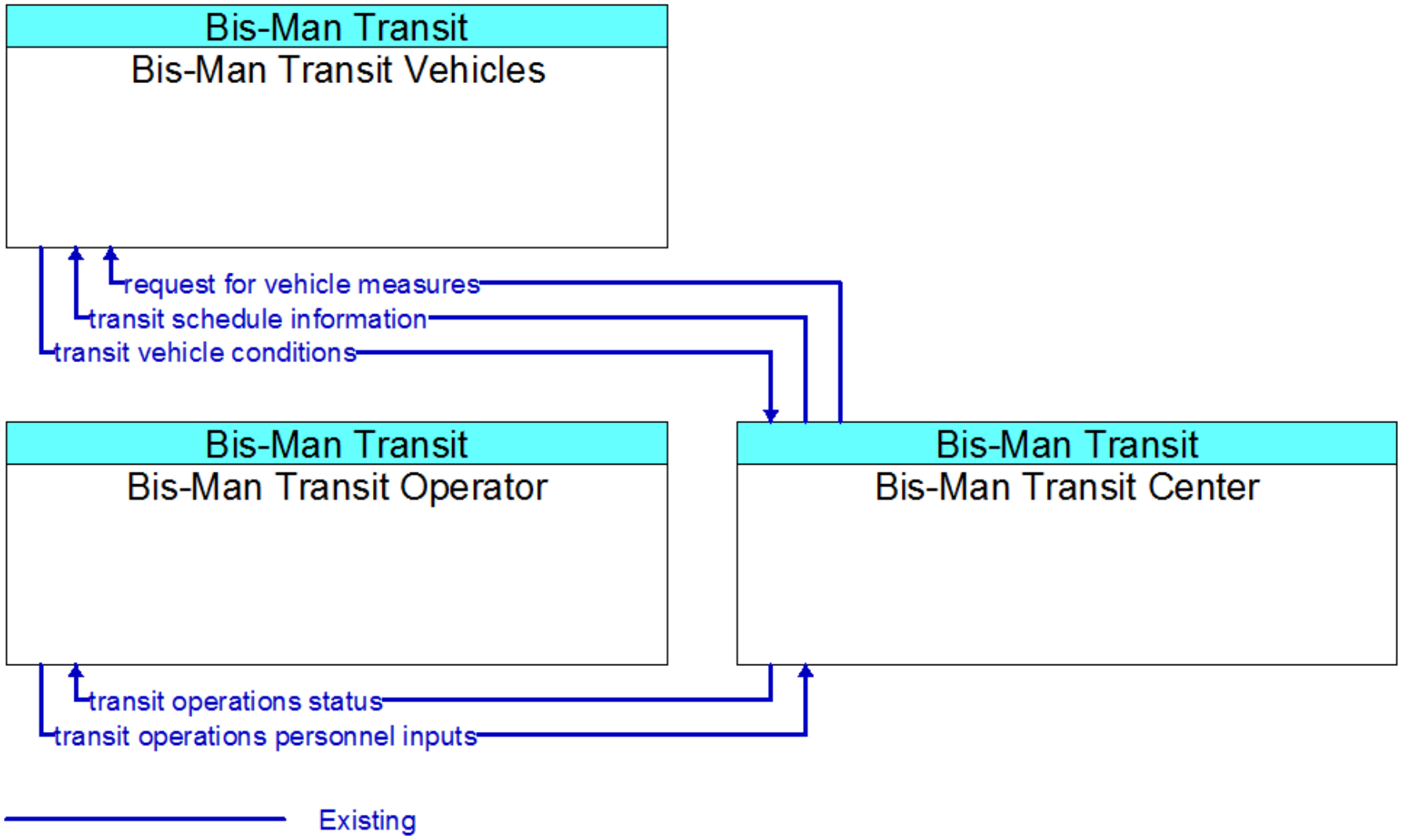
APTS04 Transit Fare Collection Management



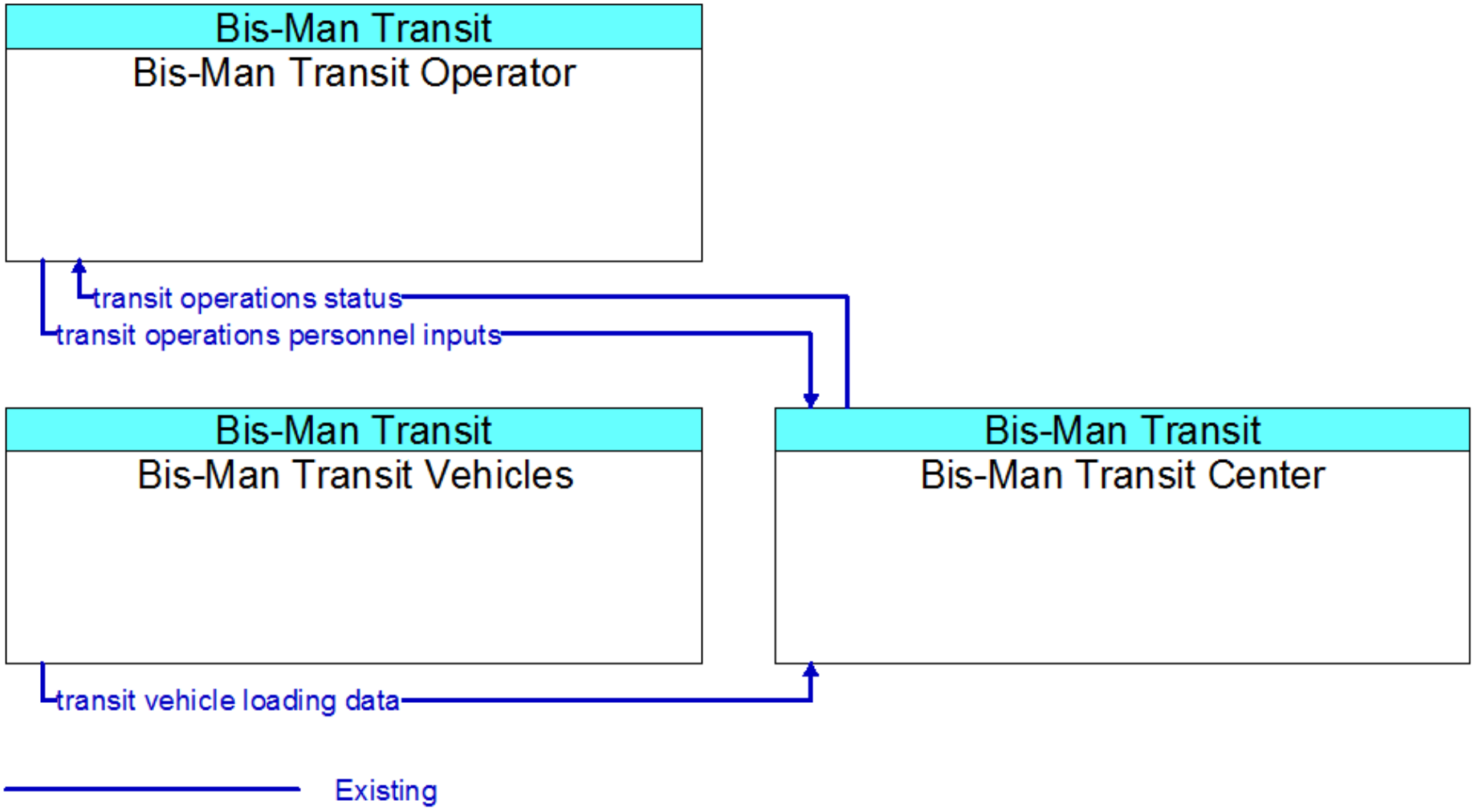
APTS05 Transit Security



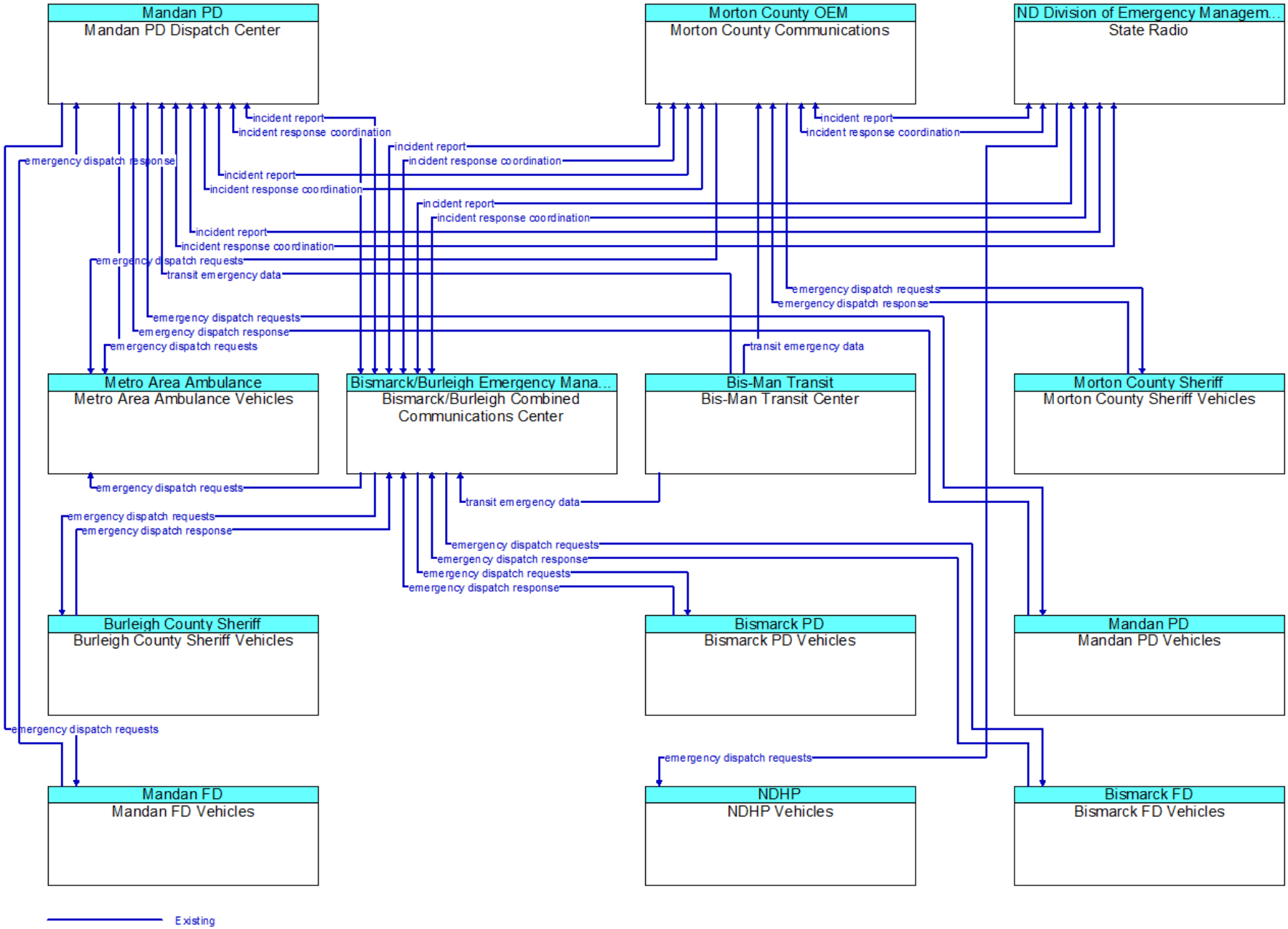
APTS06 Transit Fleet Management



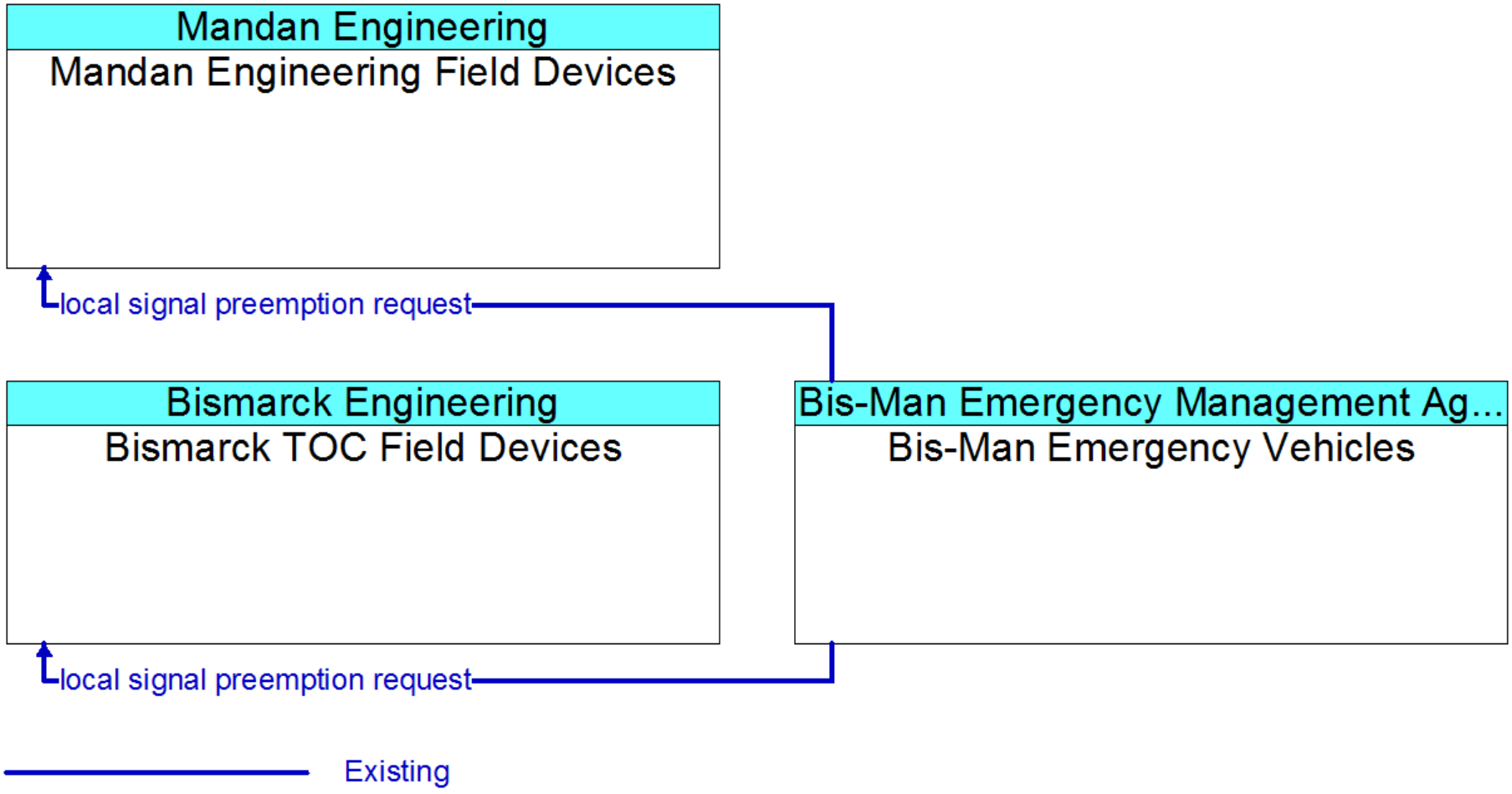
APTS10 Transit Passenger Counting



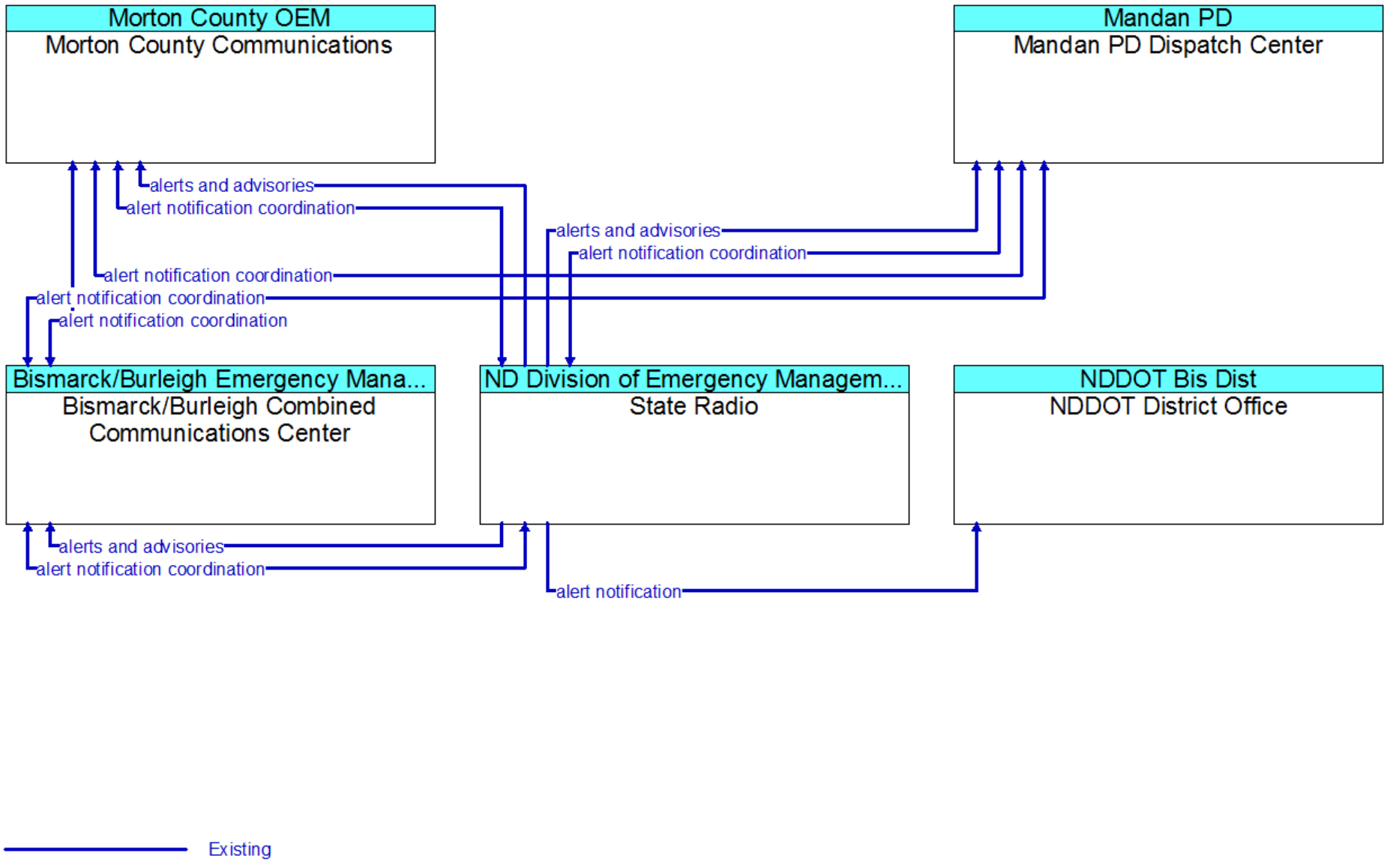
EM01 Emergency Call Taking and Dispatch



EM02 Emergency Routing



EM06 Wide Area Alert



APPENDIX B: BIS-MAN FUNCTIONAL REQUIREMENT

Functional Requirements
Bismarck-Mandan RA (Region)

Architecture			Status
Bismarck-Mandan RA (Region)			(Region)
Element: **Bis-Man Emergency Vehicles**			
Entity: **Emergency Vehicle**			
Functional Area:	**On-board EV En Route Support** On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.		
Requirement:	1	The emergency vehicle, including roadway service patrols, shall track its current location.	Existing
Requirement:	2	The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.	Existing
Requirement:	3	The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.	Existing
Requirement:	4	The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.	Existing
Requirement:	5	The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.	Existing
Requirement:	6	The emergency vehicle shall provide the personnel on-board with dispatch information, including incident type and location, and forward an acknowledgment from personnel to the center that the vehicle is on its way to the incident scene.	Existing
Requirement:	7	The emergency vehicle shall send patient status information to the care facility along with a request for further information.	Existing
Element: **Bis-Man Transit 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:	3	The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.	Planned
Requirement:	5	The center shall collect transit operational data for use in the generation of routes and schedules.	Existing
Functional Area:	**Transit Center Paratransit Operations**		

Architecture	Status
Bismarck-Mandan RA (Region)	(Region)
Element: **Bis-Man Transit Center**	
Entity: **Transit Management**	
Functional Area: **Transit Center Paratransit Operations** Management of demand response transit services, including paratransit. Planning and scheduling of these services. Supports automated vehicle dispatch and automatically updates customer service operator systems.	
Requirement: 1 The center shall process trip requests for demand responsive transit services, i.e. paratransit. Sources of the requests may include traveler information service providers.	Existing
Requirement: 2 The center shall monitor the operational status of the demand response vehicles including status of passenger pick-up and drop-off.	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: 2 The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information.	Existing
Requirement: 4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.	Existing
Requirement: 6 The center shall process requests for transit fares to be paid in advance.	Existing
Functional Area: **Transit Center Security** Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.	
Requirement: 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.	Planned
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.	Planned
Element: **Bis-Man Transit Vehicles**	
Entity: **Transit Vehicle**	
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 track the current location of the transit vehicle.	Planned
Requirement: 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.	Existing

Architecture			Status
Bismarck-Mandan RA (Region)			(Region)
Element: **Bis-Man Transit Vehicles**			
Entity: **Transit Vehicle**			
Functional Area: **On-board Transit Trip Monitoring** Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.			
Requirement:	4	The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, running times, etc.	Existing
Functional Area: **On-board Paratransit Operations** On-board systems to manage paratransit and flexible-route dispatch requests, including multi-stop runs. Passenger data is collected and provided to the center.			
Requirement:	1	The transit vehicle shall manage data input to sensor(s) on-board a transit vehicle to determine the vehicle's availability for use in demand responsive and flexible-route transit services based on identity, type, and passenger capacity.	Planned
Requirement:	2	The transit vehicle shall receive the status of demand responsive or flexible-route transit schedules and passenger loading from the transit vehicle operator.	Existing
Requirement:	3	The transit vehicle shall provide the transit vehicle operator instructions about the demand responsive or flexible-route transit schedule that has been confirmed from the center.	Planned
Requirement:	4	The transit vehicle shall provide the capability to log passenger boardings and alightings and make passenger use data available to the transit center.	Planned
Functional Area: **On-board Transit Fare Management** On-board systems provide fare collection using a travelers non-monetary fare medium. Collected fare data are made available to the center.			
Requirement:	1	The transit vehicle shall read data from the traveler card / payment instrument presented by boarding passengers.	Existing
Requirement:	10	The transit vehicle shall provide fare statistics data to the center.	Existing
Functional Area: **On-board Passenger Counting** On-board systems collect transit vehicle loading data and make it available to the center.			
Requirement:	1	The transit vehicle shall count passengers boarding and alighting.	Planned
Requirement:	2	The passenger counts shall be related to location to support association of passenger counts with routes, route segments, or bus stops.	Planned
Requirement:	3	The passenger counts shall be timestamped so that ridership can be measured by time of day and day of week.	Planned
Requirement:	4	The transit vehicle shall send the collected passenger count information to the transit center.	Planned
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.			

Architecture		Status
Bismarck-Mandan RA (Region)		(Region)
Element: **Bis-Man Transit Vehicles**		
Entity: **Transit Vehicle**		
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).	Planned
Functional Area: **On-board Maintenance** On-board systems to collect and process transit vehicle maintenance data including mileage and vehicle operating conditions for use in scheduling future vehicle maintenance.		
Requirement:	1 The transit vehicle shall collect and process vehicle mileage data available to sensors on-board.	Existing
Requirement:	2 The transit vehicle shall collect and process the transit vehicle's operating conditions such as engine temperature, oil pressure, brake wear, internal lighting, environmental controls, etc.	Existing
Requirement:	3 The transit vehicle shall transmit vehicle maintenance data to the center to be used for scheduling future vehicle maintenance.	Existing
Element: **Bismarck PW Field Devices**		
Entity: **Roadway**		
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: **Bismarck PW Operations Center**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Vehicle Tracking** Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.		
Requirement:	1 The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction.	Existing

Architecture		Status
Bismarck-Mandan RA (Region)		(Region)
Element: **Bismarck PW Operations Center**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Vehicle Tracking** Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.		
Requirement:	2 The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment.	Existing
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:	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: **Bismarck PW Vehicles**		
Entity: **Maintenance and Construction Vehicle**		

Architecture		Status
Bismarck-Mandan RA (Region)		(Region)
Element: **Bismarck 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 track its current location.	Existing
Requirement:	2 The maintenance and construction vehicle shall send the time stamped vehicle location to the controlling center.	Existing
Functional Area: **MCV Vehicle System Monitoring and Diagnostics** On-board sensors capable of monitoring the condition of each of the vehicle systems and diagnostics that can be used to support vehicle maintenance.		
Requirement:	1 The maintenance and construction vehicle shall collect vehicle diagnostics and operating status data from the maintenance vehicle platform including engine temperature, mileage, tire wear, brake wear, belt wear, and other operational status measures as well as the status of maintenance and construction-specific systems on the vehicle.	Existing
Requirement:	2 The maintenance and construction vehicle shall use the diagnostic and status information to support scheduling vehicle maintenance, monitoring safety status, and informing the vehicle operator of the conditions.	Existing
Functional Area: **MCV Environmental Monitoring** On-board systems that collect environmental and road condition data (including road surface or air temperature, wind speed, and road traction information - spatially located and time stamped) from sensors on-board the maintenance vehicle or located at the roadway.		
Requirement:	1 The maintenance and construction vehicle shall collect environmental data from on-board sensors, including air temperature, wind speed, surface temperature, traction conditions, etc.	Existing
Requirement:	2 The maintenance and construction vehicle shall transmit environmental sensor data to the center. The sensor data includes location and timestamp information.	Existing
Functional Area: **MCV Winter Maintenance** On-board systems that support snow plow operations and other roadway treatments (e.g., salt spraying and other material applications). Supports information sharing between snow plows.		
Requirement:	3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.	Existing
Requirement:	4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.	Existing
Requirement:	5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.	Existing

Architecture			Status
Bismarck-Mandan RA (Region)			(Region)
Element: **Bismarck 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:	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:	8	The center shall maintain traffic signal coordination including synchronizing clocks throughout the system.	Planned
Element: **Bismarck TOC Field Devices**			
Entity: **Roadway**			
Functional Area: **Roadway Basic Surveillance** Field elements that monitor traffic conditions using loop detectors and CCTV cameras.			
Requirement:	1	The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.	Existing
Requirement:	2	The field element shall collect, process, and send traffic images to the center for further analysis and distribution.	Existing
Requirement:	4	The field element shall return sensor and CCTV system operational status to the controlling center.	Existing
Requirement:	5	The field element shall return sensor and CCTV system fault data to the controlling center for repair.	Existing
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 under center control.	Existing
Requirement:	6	The field element shall return traffic signal controller operational status to the center.	Existing
Requirement:	7	The field element shall return traffic signal controller fault data to the center.	Existing
Functional Area: **Roadway Signal Preemption** Field elements that receive signal preemption requests from approaching emergency vehicles and overrides the current operation of the traffic signals			
Requirement:	1	The field element shall respond to signal preemption requests from emergency vehicles.	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

Architecture			Status
Bismarck-Mandan RA (Region)			(Region)
Element: **Bismarck TOC Field Devices**			
Entity: **Roadway**			
Functional Area: **Roadway Traffic Information Dissemination** Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).			
Requirement:	4	The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.	Planned
Requirement:	5	The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair.	Planned
Functional Area: **Roadway Data Collection** Field elements to collect traffic, road, and environmental conditions information for use in transportation planning, research, and other off-line applications. Includes the sensors, supporting roadside infrastructure, and communications equipment.			
Requirement:	1	The field element shall collect traffic, road, and environmental conditions information.	Planned
Requirement:	3	The field element shall collect sensor status and sensor faults from roadside equipment and send it along with the recorded data to a center for archival.	Planned
Element: **Bismarck/Burleigh Combined Communications 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:	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.	Planned
Functional Area: **Emergency Dispatch**			

Architecture			Status
Bismarck-Mandan RA (Region)			(Region)
Element: **Bismarck/Burleigh Combined Communications Center**			
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:	4	The center shall track the location and status of emergency vehicles responding to an emergency based on information from the emergency vehicle.	Existing
Requirement:	5	The center shall store and maintain the emergency service responses in an action log.	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:	4	The center shall receive asset restriction information to support the dispatching of appropriate emergency resources.	Existing
Element: **Mandan Engineering Field Devices**			
Entity: **Roadway**			
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 under center control.	Existing
Functional Area: **Roadway Signal Preemption** Field elements that receive signal preemption requests from approaching emergency vehicles and overrides the current operation of the traffic signals			
Requirement:	1	The field element shall respond to signal preemption requests from emergency vehicles.	Existing
Element: **Mandan PD Dispatch Center**			
Entity: **Emergency Management**			
Functional Area: **Emergency Call-Taking**			

Architecture			Status
Bismarck-Mandan RA (Region)			(Region)
Element: **Mandan PD 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:	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
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:	4	The center shall track the location and status of emergency vehicles responding to an emergency based on information from the emergency vehicle.	Existing
Requirement:	5	The center shall store and maintain the emergency service responses in an action log.	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.			

Architecture		Status
Bismarck-Mandan RA (Region)		(Region)
Element: **Mandan PD Dispatch Center**		
Entity: **Emergency Management**		
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: **Mandan 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:	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
Bismarck-Mandan RA (Region)			(Region)
Element: **Mandan Traffic Engineering**			
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.	Planned
Requirement:	4	The center shall collect traffic signal controller fault data from the field.	Planned
Element: **Morton County Communications**			
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:	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
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:	4	The center shall track the location and status of emergency vehicles responding to an emergency based on information from the emergency vehicle.	Existing
Requirement:	5	The center shall store and maintain the emergency service responses in an action log.	Existing

Architecture		Status
Bismarck-Mandan RA (Region)		(Region)
Element: **Morton County Communications**		
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:	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**		
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).	Existing
Requirement:	4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.	Existing
Requirement:	5 The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair.	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
Functional Area: **Roadway Speed Monitoring and Warning**		

Architecture		Status
Bismarck-Mandan RA (Region)		(Region)
Element: **NDDOT District Field Devices**		
Entity: **Roadway**		
Functional Area: **Roadway Speed Monitoring and Warning** Vehicle speed sensors that detect excessive vehicle speeds, optionally based on conditions and vehicle type, 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
Element: **NDDOT District Office**		
Entity: **Maintenance and Construction Management**		
Functional Area: **MCM Vehicle Tracking** Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.		
Requirement:	1 The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction.	Existing
Requirement:	2 The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment.	Existing
Requirement:	3 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for maintenance and construction vehicle tracking.	Existing
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

Architecture			Status
Bismarck-Mandan RA (Region)			(Region)
Element: **NDDOT District 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:	6	The center shall collect real-time information on the state of the regional transportation system from other centers including current traffic and road conditions, weather conditions, special event and incident information and use the collected information to support winter maintenance operations.	Existing
Requirement:	8	The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.	Existing
Requirement:	9	The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.	Existing
Element: **NDDOT District 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 track its current location.	Existing
Requirement:	2	The maintenance and construction vehicle shall send the time stamped vehicle location to the controlling center.	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:	5	The center shall store and maintain the emergency service responses in an action log.	Existing
Requirement:	9	The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.	Existing

Architecture		Status
Bismarck-Mandan RA (Region)		(Region)
Element: **State Radio**		
Entity: **Emergency Management**		
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