# Anchorage
# Regional ITS Architecture

# FINAL REPORT

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# 1. INTRODUCTION

The Municipality of Anchorage (MOA) initiated the development of a regional Intelligent Transportation System (ITS) architecture to manage implementation of a range of technologies that will improve transportation within the municipality. ITS is the use of advanced sensor, computer, electronics, and communications ***technologies*** and management ***strategies*** in an ***integrated*** manner to increase the safety and efficiency of the surface transportation system. An ITS architecture defines the institutional and technical links necessary to plan, design, implement, operate, and maintain ITS. An initial step in the development of the architecture is the identification of user needs. User needs defined in the report are from the perspective of those who operate and maintain transportation systems in the Anchorage metropolitan area, as well as those who use the transportation system in the region.

## 1.1 BACKGROUND

In 2000, the Alaska Department of Transportation and Public Facilities (ADOT&PF) initiated a similar effort to develop a statewide ITS architecture. The statewide initiative also included the development and implementation of roadway weather information systems (RWIS). As the project progressed, it became clear that the development of ITS initiatives in the municipality of Anchorage would benefit, not only from the development of the statewide ITS architecture, but also from the development of a regional ITS architecture that specifically focuses on the needs and requirements of travelers in Anchorage. The development of the regional ITS for Anchorage serves as a logical extension of the statewide initiative, which focuses primarily on the needs, systems, and integration requirements specific to the Anchorage metropolitan area.

## 1.2 PURPOSE

This report documents Anchorage traveler and transportation agency needs that can be effectively addressed by ITS solutions. Defining user needs is a critical first step in identifying data required for a number of ITS development activities, which will be undertaken as part of the project. These activities will be reflected in reports on the following:

- ITS User Services – a set of ITS functions that serves the needs identified in the User Needs Report.
- Long-Range Vision – a description of the ITS elements that will be in place in 10 years and how they will benefit travelers in Anchorage.
- Concept of Operations – a description of how the identified ITS elements will work together in Anchorage.
- ITS Architecture – a formal definition of the ITS elements selected for the Anchorage area, their location, and the information they will exchange.

Further, this effort also identifies and documents any unique transportation needs or conditions in the Anchorage metropolitan region that would require the tailoring or extension of the National ITS Architecture and Standards Program.

### Data Collection Methodology

Transportation user needs in the Anchorage area were identified through a kick-off meeting, breakout sessions, face-to-face interviews, and telephone interviews with various transportation stakeholders in the Anchorage area. Participants included management and operations staff from the following agencies and service providers:

- Municipality of Anchorage – Planning
- Municipality of Anchorage – Health and Human Services
- Municipality of Anchorage – Public Transportation
- Municipality of Anchorage – Information Technology Department
- Municipality of Anchorage – Development Services
- Municipality of Anchorage – Project Management
- Alaska Trucking Association
- United States Army – Fort Richardson (Base Commander and Transportation offices)
- Municipality of Anchorage – Fire
- University of Alaska Anchorage
- Municipality of Anchorage – Emergency Operations Center
- Alaska Department of Transportation and Public Facilities – Planning
- Municipality of Anchorage – Purchasing
- United States Air Force – Elmendorf Air Force Base (Transportation and GIS offices)
- Municipality of Anchorage – Traffic
- Municipality of Anchorage – Street Maintenance
- Alaska State Troopers
- Municipality of Anchorage – Police

In addition to the interviews and workshops, a literary review of previously completed reports and studies was conducted to identify any additional user needs.

## 1.3 CHAPTER ORGANIZATION

Following is a brief description of each section contained in this chapter:

Section 2 of this chapter provides detailed descriptions of identified transportation user needs in Anchorage. These needs have been categorized into the following groups:

- Internal operations and management
- Emergency management
- Inter-agency communications
- Inter-agency data sharing
- Traffic operations
- Traveler information
- Transit management
- Commercial vehicle operations

Section 3 of this chapter describes in detail how the information contained in the User Needs chapter will be used in subsequent project tasks, including the development of:

- User Services Report
- Long-Range Vision Report
- ITS Concept of Operations
- Regional ITS Architecture for Anchorage

Appendix A – lists of needs identified through interaction with stakeholders that do not necessarily have ITS solutions.

Appendix B – lists documents that were reviewed as part of developing this chapter.

# 2. USER NEEDS

Section 2 describes user needs that have been identified by various stakeholders in the Anchorage metropolitan area. User needs were identified during a breakout session of the kick-off meeting, in addition to individual interviews.

## 2.1 INTERNAL OPERATIONS AND MANAGEMENT

Stakeholders in the Anchorage metropolitan area identified several internal operations and management needs. Staff responsible for various statewide operations and management also identified needs that affect travel in the Anchorage metropolitan area. Internal operations and management issues have also been identified as a primary need on a statewide level.

### Material Usage Tracking

Interviewees identified a need to better track and document the use of road maintenance materials for various activities, including snow and ice control and dust control operations. The current documentation process for materials usage involves measuring materials that remain at the end of the season, and what has been recovered through street cleaning. Tracking the use of materials is a critical task that must be undertaken to complete the National Pollutant Discharge Elimination System (NPDES) permitting process. This task would be made more efficient with the ability to determine distribution location, application rates, and total quantities used. In addition, materials used for other maintenance operations, such as the Recycled Asphalt Program (RAP), need to be tracked. RAP is a program that recycles asphalt and places it on unpaved roads within the City of Anchorage.

The capability to track materials would also help in developing benefit cost analysis of various strategies and providing more compelling data for budgets and soliciting funds.

### Maintenance Operations and Vehicle Management

One interviewee identified a need to track the usage of equipment. As with materials usage, this would include both street sweeping and snow and ice control operations.

The need was recognized for an automated process of documenting work activities and identifying other maintenance activities required outside of the primary operation (e.g., repair downed sign). Installing mobile data terminals on maintenance vehicles may provide the solution. In addition to documenting work activities and materials usage, mobile data terminals, like the ones the Anchorage Police Department recently installed in their patrol cars, could enable dispatch to disseminate work order information to operators in real-time.

Further, to automate maintenance vehicle operations and maintenance activities, an interviewee indicated a need to collect vehicle performance data, such as fuel consumption, engine temperature, and oil pressure. Once collected, this data could be processed and used to identify preventative and emergency maintenance needs.

### Snow and Ice Control

The severe climate in Alaska requires the municipality of Anchorage to mitigate the effects of snow an ice on the transportation system. Effective and efficient snow an ice control is one of the focus areas for the municipality’s Street Maintenance Division and has been emphasized on a statewide level as well. ADOT&PF is committed to effective and efficient snow and ice control and is installing RWIS throughout the state.

The need for enhanced snow and ice control strategies is two-fold:

- First, to enhance the ability to collect real-time weather and roadway data so that pro-active decisions can be made. For example, de-icing chemicals may be applied to the roadway if maintenance personnel know that the pavement temperature is likely to fall below freezing and if precipitation and/or moisture are present.
- Second, in addition to using this information to support maintenance activities, a need exists to process this information so it can be provided to the traveling public, both pre-trip and en route. Real-time travel information would help the public make informed decisions, and warn them of closures. The dissemination of traveler information is further discussed in Section 2.6 of this chapter.

**Infrastructure Management and Maintenance**

There is a significant amount of infrastructure within Anchorage that requires varying levels of management and maintenance. The primary need is to accurately identify and inventory transportation assets, including roadways, trails, and drainage systems. This inventory should include mileage, location, attribute details, conduit rating, and maintenance requirements. A common Geographic Information System (GIS) used throughout the municipality would enhance the viability and usefulness of the inventory system. The GIS is described in further detail in Section 2.4 of this chapter.

In addition, one interviewee identified a need to remotely monitor subsurface temperatures around drainage structures. This information is important for maintenance planning (identifying potential problem locations).

Municipality street maintenance staff indicated that they need tolls to pro-actively manage the roadway system in Anchorage. The most notable problem associated with pro-active roadway management is tracking potholes and other surface damage. A system to identify and track damage to the roadway surface will help staff to plan maintenance activities more effectively and will provide them with a risk management tool. In addition, the municipality of Anchorage staff expressed an interest in utilizing ADOT&PF's laser profiling system to identify rutting in pavements.

The need to monitor seismic activities on bridges was cited during the interview process. Seismic monitoring would be beneficial to identify bridges that require emergency maintenance, thus enhancing traveler safety and making maintenance operations more efficient.

## 2.2 EMERGENCY MANAGEMENT

The following emergency management needs were identified in interviews:

**Field communications** – The primary concern among all the emergency management needs is the ability for emergency responders to communicate in the field. Interviewees discussed the lack of a common radio frequency that responders in the field can use during emergency operations. (Note: the municipality has a trunked 800 MHz radio system shared by all of its agencies. All radios have a common talk group programmed for emergency operations. Comments from the interviewees regarding the need for a common radio channel may point to a need for continued information sharing about the 800 MHz system capabilities.) It is widely acknowledged that the most effective emergency response activities are fostered by inter-agency communications, which are generally supported by a well-built communication system. Inter-agency communications is discussed further in Section 2.3 of this chapter.

**Current roadway conditions** – During the interviews, emergency managers said responders would benefit from having access to current roadway conditions when they are in their vehicles, especially for incident information. Useful information included traffic conditions, road closure information, and closed circuit television (CCTV) images. Emergency operations and E911 center staff would also benefit by having access to this information. Providing such information would fulfill two needs:

First, having images from the incident scene would enable responders to mount the most effective response possible (e.g., dispatch the appropriate equipment).

Second, responders need real-time traffic, roadway closure, and construction information provided to them while en route to the scene, as well as prior to leaving the station, to minimize response time. Minimizing response time reduces the impact of the incident, whether it is a traffic accident, or some other emergency (such as a house fire).

**Tsunami warnings** – Interviewees acknowledged the importance of providing accurate and timely Tsunami warnings, including:

Advance public warnings to prepare for Tsunami evacuations.

Real-time information during the actual evacuation operations.

Signal priority for buses would be critical to foster expedient evacuations in the event of a Tsunami. It is also highly important to provide accurate and timely information during earthquakes or windstorms.

## 2.3 INTER-AGENCY COMMUNICATIONS

Inter-agency communications are critical to support a number of transportation functions, including both routine and emergency operations. Improved inter-agency communications was an over-riding need with numerous stakeholders in the Anchorage metropolitan area. The stakeholders desired communication links to improve operations, including:

- Center to center
- Center to vehicle
- Vehicle to vehicle

Specifically, interviewees identified the need to support these communications with the implementation of laptops or mobile data terminals in response vehicles. Using these devices would help to foster the exchange of data during both routine and emergency operations.

## 2.4 INTER-AGENCY DATA SHARING

Shared databases and a common Geographic Information System were cited by numerous stakeholders as the primary desired elements of inter-agency data sharing. Each of these elements are described below.

### Shared Database

Various agencies and divisions in Anchorage have database information that other agencies or divisions need. The information is not accessible to all who are interested, and often, those that receive the information only get it in printed form. Various stakeholders in Anchorage recognized the need, and potential benefits of, sharing databases so needed information can be more accessible and easier to work with. These stakeholders recognize that shared databases can be used to support planning activities or operational decisions in real-time. In addition, shared databases eliminate redundancy in data collection processing and storing, and may also increase accuracy of the data. Stakeholders want to share these primary data elements:

- Collision data
- Traffic count data
- Weather data

**Common Geographic Information System (GIS) Platform**

Numerous stakeholders in Anchorage identified the need for a common GIS platform. Currently, there are a number GIS platforms operated by stakeholders. Usually, an agency identified the need for a GIS and procured it independently without realizing that other agencies were in a similar process. As a result, the GIS platforms in place currently are not fully compatible with one another. Each platform contains data that would be potentially useful to another stakeholder. However, currently the other stakeholder cannot access the data because the GIS platforms are not compatible. Specific applications, or data elements identified that would be of mutual value to a number of stakeholders include:

- Roadways, drainage systems, and trail locations
- Changes or additions to roadways, drainage systems, and trails
- Planned land use changes
- Utility locations
- Resource locations such as fire hydrants, water, sewer, and utilities

A common GIS platform was identified as a need on the statewide level as well.

## 2.5 TRAFFIC OPERATIONS

Enhanced surveillance is a primary need to support traffic operations in Anchorage. Several interviewees indicated a need to view the condition of the roadway network under a variety of circumstances:

- Emergency responders could determine roadway conditions and identify response or evacuation routes in real-time.
- Maintenance personnel could view camera images from around the municipality to more effectively dispatch snowplows.
- The public would benefit from the ability to view camera images to determine snow conditions and to plan routes around major incidents.
- Traffic personnel can use the cameras to investigate signal trouble calls remotely and to improve signal timing.

An effective way to address these needs is to provide video surveillance of both the freeway and arterial networks. Video surveillance would be beneficial to numerous stakeholders to support operations. The potential agencies/equipment that might benefit from video feeds include:

- Municipality of Anchorage – Police
- Municipality of Anchorage – Fire
- Municipality of Anchorage – Emergency Response
- Local media
- ADOT&PF
- Municipality of Anchorage – Traffic
- Municipality of Anchorage – Public Transportation
- Municipality of Anchorage – Maintenance
- Travelers

## 2.6 TRAVELER INFORMATION

Stakeholders in Anchorage indicated that distributing information about the transportation system to travelers could enhance the efficiency and safety of travel. Traveler information needs (as identified by various stakeholders) are defined below. Enhanced traveler information dissemination was also identified as a need on the statewide level.

### Pre-Trip and En Route Traveler Information

Several stakeholders noted that the provision of pre-trip and en route traveler information should be enhanced, including static and real-time information, to increase the efficiency of travel in Anchorage. The primary traveler information needs that were identified include:

- Construction activities
- Road closures
- Traffic
- Weather
- Weight and height restrictions

Numerous solutions for providing this information to travelers was identified, including:

- Internet websites
- Radio and television broadcasts
- Highway advisory radio (HAR)
- Dynamic message signs (DMS)

### Other Information

In addition to providing information to travelers to foster safer and more efficient travel, municipality staff indicated a need to provide transportation program information. For example, they would like to provide information about the Transportation Improvement Program (TIP), and Capital Improvement Program (CIP) on the municipality of Anchorage’s website. This would enable residents to access information on transportation improvements that affect their travel, neighborhood, and property.

In addition, it was recognized that information focused on acclimating new residents to the Anchorage metropolitan area was needed. This need not only included the provision of information related to transportation services, but other services and attractions that are available to the public.

## 2.7 TRANSIT MANAGEMENT

Stakeholders in Anchorage recognized the benefits of providing enhanced transit services to travelers. The following defines the identified needs as they relate to transit management.

**Needs Study for Transit Signal Priority**

Several stakeholders indicated an interest in transit signal priority to improve transit operations in Anchorage, and to assist emergency management when transit vehicles are used for evacuation or triage during a disaster. Signal priority can enhance on-time arrival and ensure service reliability. The municipality is currently in the process of implementing a signal priority system for emergency response.

**Smart Fare Box**

To foster efficiency in operations, stakeholders identified the need to implement a smart fare box system. Essentially the smart fare box would be implemented to automate passenger counting, and obtain fare and run data so that it can be compared to route data. In addition, the smart fare box would automate the collection of origin-destination data. Anchorage Public Transportation can use each of these data elements to continually enhance transit services that are provided in Anchorage.

**Transit Vehicle Management**

Personnel from Anchorage Public Transportation indicated that they could benefit from automating maintenance operations on transit vehicles. Specifically, they could benefit from a system that would transmit engine diagnostics to the maintenance shop. This would enable mechanics in the shop to identify potential equipment problems sooner, thereby potentially reducing overall maintenance costs.

## 2.8 COMMERCIAL VEHICLE OPERATIONS

Needs pertaining to Commercial vehicle operations have been explored in detail as part of the statewide ITS project. However, as it relates to commercial vehicle operations in Anchorage, commercial vehicle operators would benefit from enhanced traveler advisories. These needs would include information on closures, construction activities, weight restrictions, and traffic information.

# 3. NEXT STEPS

The identification of transportation user needs in is a critical element that feeds into several other components of the regional ITS architecture development for Anchorage. Each of these elements are described below, as well as how the user needs data is used. However, ITS solutions are not applicable to all of the needs that have been identified in this report.

## 3.1 USER SERVICES

The National ITS Architecture identifies User Services, or ITS functions, that meet various user needs. Identifying the User Services is part of creating a vision for ITS in Anchorage. The user needs that are identified in this report, and the knowledge of existing ITS in the Anchorage metropolitan area, will be used to create a User Services Report for the municipality. In addition, the User Services Report will identify functions that the regional transportation agencies provide directly, and those that they should support other agencies in providing (such as enforcement activities).

## 3.2 LONG-RANGE VISION

The development of the ITS Long-Range Vision Report will rely on the identification of user needs and the associated user services selected to address those needs. The Long-Range Vision Report will identify and document the full set of desired and needed ITS elements. The complete set of ITS elements will likely not be in place for many years. The report will include functional strategies that the municipality of Anchorage should implement to meet the transportation needs in the state.

## 3.3 CONCEPT OF OPERATIONS

The Concept of Operations will articulate how systems and user services identified in the long-range vision will interact and operate in an integrated fashion. The Concept of Operations will describe how ITS and ITS data can be used to support the desired functions in Anchorage. The Concept of Operations will be based on the user needs identified in this report.

The Concept of Operations will analyze the current operations ability to collect and disseminate transportation data, and describes deployed and planned ITS systems throughout Anchorage, as well as those throughout the state of Alaska affecting travel in the Anchorage area. The Concept of Operations will also provide an estimate of the communications infrastructure that may be necessary to deliver transportation information in a timely manner.

## 3.4 ITS ARCHITECTURE

An initial step in the planning and management of any ITS deployment is to define an ITS architecture. An ITS architecture defines the institutional and technical links necessary to plan, design, implement, operate, and maintain ITS. The National ITS Architecture, adopted in 1996 and updated in 1999, provides a technical and institutional framework to guide the coordinated deployment of ITS by public agencies and private organizations alike. It defines the functions performed by ITS components and the various ways in which components can be interconnected. Although the architecture is national in scope, it can be localized for regions, corridors, and transportation authorities. It can benefit state and local transportation agencies, like the municipality of Anchorage, by helping them save time and money in achieving maximum benefits through the implementation of integrated ITS.

Development of an ITS architecture for the municipality of Anchorage can advance the inter-agency operations of ITS across jurisdictions and other ITS services that already exist or are scheduled to be implemented in the future. The regional ITS architecture for Anchorage will also identify the logical links to the statewide initiatives. For example, it will incorporate the current development of RWIS on a statewide level.

## 3.5 IMPLEMENTATION PLAN

As a final step in the effort to develop a regional ITS architecture for the municipality of Anchorage, the consultant team will produce an implementation plan. The implementation plan will include:

- The Project Identification section will include a prioritized list of initiatives that will implement the most important aspects of the long-range vision and regional architecture.
- The Funding Identification section will include high-level cost estimates for the initiatives included in the Project Identification section. It will also identify possible funding sources for the ITS initiatives.
- The Deployment Schedule section will identify the best time frames for undertaking the initiatives identified in the Project Identification section. The timeframes will be:
    - 1-3 years
    - 3-6 years
    - 6-10 years
- The Procurement Strategy section will suggest procedures the municipality can use to successfully procure ITS projects.

# 4. APPENDIX A – NON-ITS SOLUTIONS

In addition to operation needs identified by regional stakeholders that could potentially have ITS solutions, needs were also identified that do not necessarily have ITS solutions. These needs included:

- Information/interaction from base commissary
- Alaska household goods movement
- Satellite tracking and communication
- Ability to track commodities usage on the military bases

# 5. APPENDIX B – REFERENCES

1. Year 2001 Update – Anchorage Bowl Long-Range Transportation Plan, May, 2001.
2. Official Streets and Highway Plan – Maps, Policies, and Standards. December, 1996.

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# 1. INTRODUCTION

## 1.1 BACKGROUND

An Intelligent Transportation System (ITS) provides a series of unconventional solutions to today's transportation challenges. When ITS first emerged a few decades ago, it was used as a means to relieve traffic congestion. Today, ITS utilizes communications and electronic infrastructure to improve traveler safety, roadway capacity, and transportation system efficiency. As ITS applications continue to grow and become more complex, they have become more successful through better planning techniques. In 1993, the Federal Highway Administration began to develop the National ITS Architecture for transportation professionals in an effort to deploy ITS in a systematic and effective manner. Today the National ITS Architecture is used as a guide to deploy successful ITS.

The first step to a successful ITS deployment, including the one being developed for the Municipality of Anchorage (MOA), is the identification and proper consideration of user needs. User needs specify issues plaguing travelers or transportation agencies that can be satisfied through ITS. The *User Needs Report,* submitted in August 2001, identifies the user needs for the MOA. The *User Needs Report* has been written using the terminology stakeholders used during the outreach process. The next step is to identify specific ITS functions or User Services that address the documented user needs.

## 1.2 PURPOSE

The purpose of this document is to clearly illustrate that ITS solutions can satisfy stakeholder needs. To show that needs can be satisfied by ITS, this document presents user services documented in the National ITS Architecture. User services describe the ITS-related benefits and/or services that travelers and transportation agencies can expect after the ITS architecture is complete. The National ITS Architecture user services presented here were developed to address the types of needs that stakeholders identified in the interview process. Only the user services defined by the National ITS Architecture that satisfy a user need are provided in this document. This prevents the inclusion of irrelevant user services, and ensures that every ITS-related user need can be satisfied through the National ITS Architecture. The project team will use the ITS services identified here to complete the next steps of the ITS Architecture development process:

- Long-Range Vision will provide a vision for ITS in Anchorage in the future.
- Concept of Operations will define how agencies and systems share data.

## 1.3 CHAPTER ORGANIZATION

This chapter is divided into two main sections:

- First, user needs documented in the *User Needs Report* are reintroduced and a brief summary of each is provided.
- Second, user needs are "mapped" or connected to the applicable user services documented in the National ITS Architecture. Mapping user needs to the user services in the National ITS Architecture will provide an explanation of how each need will be ultimately satisfied. Since user needs were recorded using terminology expressed by stakeholders, they do not directly match the terminology used by the National ITS Architecture. The "mapping" process will rectify this discrepancy by connecting the two different terminology types used.

# 2. SUMMARY OF USER NEEDS

The project team identified Anchorage traveler and transportation agency needs through face-to-face and telephone interviews, breakout sessions, and other related outreach activities. The team then documented these needs in the *User Needs Report*. Identification and understanding of these needs provides the first critical step in creating the Anchorage ITS architecture. Due to their importance, identified needs are summarized in the following sections. The summary descriptions, however, do not provide the same level of detail provided in the *User Needs Report*.

## 2.1 INTERNAL OPERATIONS AND MANAGEMENT

Four specific needs regarding internal operations and management were identified and are discussed below.

### Material Usage Tracking

Stakeholders expressed a need to better track and document the use of road maintenance materials. Tracking materials will improve maintenance activities pertaining to, but not limited to snow, ice, and dust control, and operations associated with the Recycled Asphalt Program (RAP) and National Pollutant Discharge Elimination System (NPDES) permitting processes. Material tracking is also considered beneficial from the standpoint that budgets can be more accurately prepared based on the amount of materials typically used.

### Maintenance Operations and Vehicle Management

Similar to material tracking, stakeholders expressed a need to automatically track equipment, work activities, and maintenance operations. This includes the ability to track vehicle performance data such as fuel consumption, engine temperature, and oil pressure. The data collected will improve operational and management practices.

### Snow and Ice Control

Due to Anchorage's severe climate, stakeholders expressed a need to better control snow and ice on roadways. Stakeholders stated two main needs:

- First, stakeholders would like to gain access to additional real-time weather information.
- Second, stakeholders stated that real-time weather information should be disseminated to travelers both pre-trip and en route. The collection and dissemination of better weather data will improve both maintenance activities and safety.

### Infrastructure Management and Maintenance

There were several needs associated with management and maintenance of infrastructure within the MOA:

- First, a geographic information system (GIS) help identify and inventory assets within the municipality.
- Second, municipality maintenance personnel need to remotely monitor subsurface temperatures around drainage structures.
- Third, better methods to identify road surface damage are needed.
- Lastly, stakeholders expressed a need to monitor seismic activities on bridges.

## 2.2 EMERGENCY MANAGEMENT

Interviewees identified two emergency management needs:

- First, stakeholders saw a need for improved in-field communication among emergency responders. This includes providing in-vehicle access to roadway and incident information.

Although enhanced communications will improve operations, this need is not an ITS element, but rather a link between two elements.

- The second need, emergency vehicle signal pre-emption, however, is a system directly related to emergency management operations. This need is further discussed below.

**Emergency Vehicle Signal Pre-Emption**

Funding for an emergency vehicle signal pre-emption system is currently being explored by the MOA. An emergency vehicle signal pre-emption system gives a steady green indication to an emergency vehicle allowing it to travel through an intersection safely and without delay. Equipment installed on the emergency vehicle emits a signal toward the upcoming traffic signal where sensors detect the emergency vehicle and alter the current signal phase. This will enable more prompt medical service and enhanced safety along roadways where this equipment exists.

## 2.3 INTER-AGENCY COMMUNICATIONS

Routine and emergency communication improvements are needed within the MOA. Specifically, stakeholders would like to have center-to-center, center-to-vehicle, and vehicle-to-vehicle communication links to improve operations. Interviewees indicated that laptops and mobile data terminals installed in response vehicles would benefit emergency responders.

## 2.4 INTER-AGENCY DATA SHARING

Stakeholders would like to share data in an effort to streamline operations and increase efficiency. Stakeholders identified two main needs:

- Create a single database where information can be shared among different agencies and the public
- Establish a common geographic information system platform from which files can be shared

**Shared Database**

Many of the people interviewed mentioned that a shared database, including collision, traffic count, and weather data would be beneficial. Currently, several agencies own and operate separate databases, but information from these cannot be easily transferred from one agency to another. Information stored at a single location that multiple agencies could access will likely reduce data collection, redundancy, and storage; therefore, data will be easier to access and work with.

**Common Geographic Information System (GIS) Platform**

Currently, several agencies within Anchorage own and operate geographic information systems. GIS platforms however, vary among agencies, and data cannot be easily shared. A single GIS platform will allow agencies to share information that previously was not possible. This will reduce data collection efforts.

## 2.5 TRAFFIC OPERATIONS

Many stakeholders considered the ability to remotely view roadway and traffic conditions to be beneficial to several parties in Anchorage, including emergency responders, maintenance personnel, traffic personnel, police, fire, and the general public. At a minimum, video surveillance will improve incident response time, traffic flow, emergency evacuations, and pre-trip travel planning.

## 2.6 TRAVELER INFORMATION

Traveler information may enhance the efficiency and safety of travel in and around the MOA. Stakeholders want to distribute real-time and static information to travelers to increase knowledge and safety on roadways.

**Pre-Trip and En Route Traveler Information**

Stakeholders have a desire to enhance current pre-trip and en route traveler information. Specifically, static and real-time information related to construction activities, traffic, road closures, weather, and vehicle weight and height restrictions is needed. Stakeholders identified the following methods to share this information:

- Internet websites
- Radio and television broadcasts
- Highway advisory radio (HAR)
- Dynamic message signs (DMS)

**Other Information**

Municipality staff indicated a need to provide transportation program information, including that related to the Transportation Improvement Program (TIP) and the Capital Improvement Program (CIP). Some staff members suggested that this information be posted on the MOA's website so it can be available to residents. Transportation services and other attractions can also be posted on this website and may help new residents acclimate themselves to the area.

## 2.7 TRANSIT MANAGEMENT

Stakeholders identified several transit-related needs that ITS can address. Those mentioned pertain to transit signal priority, smart fare box, and transit vehicle management, and are more thoroughly discussed below.

**Needs Study for Transit Signal Priority**

Several stakeholders indicated an interest in transit signal priority to improve transit operations in Anchorage, and to assist emergency management when transit vehicles are used for evacuation or triage during a disaster. Signal priority can enhance on-time arrival and ensure service reliability. The municipality is currently in the process of implementing a signal priority system for emergency response.

**Smart Fare Box**

Smart fare box implementation is needed to enhance transit operations. The smart box will be installed on buses to automatically collect ridership, fare, and origin/destination data. This information will allow transit agencies to make more informed decisions about route and bus scheduling.

**Transit Vehicle Management**

Stakeholders indicated that benefits could be obtained from automated transit vehicle management. Diagnostic information can be automatically transmitted to the maintenance office and may help reduce impacts associated with unscheduled vehicle repairs.

## 2.8 COMMERCIAL VEHICLE OPERATIONS

Stakeholders would like to see additional truck travel advisories, including information on closures, construction activities, weight restrictions, and traffic information. Dissemination of this information will reduce delay times and improve traveler safety.

**Table 2-1: User Needs to National ITS Architecture Element Mapping**

| User Need Group | User Need | User Service | User Service Bundle |
|---|---|---|---|
| Internal Operations and Management | • Materials Usage Tracking | • Maintenance Vehicle Fleet Management | |
| | • Maintenance Operations and Vehicle Management | • Maintenance Vehicle Fleet Management | |
| | • Snow and Ice Control | • Roadway Treatment Management | |
| | • Infrastructure Management and Maintenance | • Roadway Maintenance Conditions and Work Plan Dissemination | |
| Emergency Management | • Incident and Natural Disaster Information and Response | • Emergency Vehicle Management<br>• Pre-Trip Traveler Information<br>• En Route Driver Information | • Emergency Management<br>• Travel and Traffic Management<br>• Travel and Traffic Management |
| Inter-agency Data Sharing | • Shared Database | • Archived Data Function | • Information Management |
| | • Common GIS Platform | • Archived Data Function | • Information Management |
| Traffic Operations | • Traffic Signal Control | • Traffic Control | • Travel and Traffic Management |
| | • Incident Management | • Incident Management<br>• Hazardous Material Incident Response | • Travel and Traffic Management<br>• Commercial Vehicle Operations |
| Traveler Information | • Pre-Trip and En Route Traveler Information | • Pre-Trip Traveler Information<br>• En Route Traveler Information | • Travel and Traffic Management<br>• Travel and Traffic Management |
| | • Real-time Bus Arrival Information | • En route Transit Information | • Public Transportation Management |

| User Need Group | User Need | User Service | User Service Bundle |
|---|---|---|---|
| | • Para-transit Information | • Personalized Public Transit | • Public Transportation Management |
| | • Other Information | • Traveler Services Information<br>• Highway-Rail Intersection | • Travel and Traffic Management<br>• Travel and Traffic Management |
| Transit Management | • Transit Signal Priority | • Public Transportation Management | • Public Transportation Management |
| | • Smart Fare Box | • Public Transportation Management | • Public Transportation Management |
| | • Transit Vehicle Management | • Public Transportation Management | • Public Transportation Management |
| Commercial Vehicle Operations | • Enhanced Traveler Advisories | • Pre-Trip Traveler Information<br>• En Route Traveler Information<br>• Route Guidance<br>• Commercial Fleet Management | • Travel and Traffic Management<br>• Travel and Traffic Management<br>• Travel and Traffic Management<br>• Commercial Vehicle Operations |
| | • Hazardous Material Response | • Hazardous Material Incident Response<br>• Incident Management | • Commercial Vehicle Operations<br>• Travel and Traffic Management |
| Inter-Agency Communications | The need for Inter-Agency Communications does not directly relate to an ITS system but rather provides the link between systems. Inter-Agency Communication is the pathway that enables user services. User Services defined by the National ITS Architecture related only to systems. | | |

# 3. USER SERVICES

User services define what ITS should do from the perspective of the user. In other words, user services define the benefits or services expected from an ITS. Currently, 31 user services have been defined by the U.S. Department of Transportation and ITS America with significant stakeholder input. These user services are identified in the National ITS Architecture where they are classified into seven user service bundles. These user service bundles are as follows:

- Travel and Traffic Management
- Public Transportation Management
- Electronic Payment
- Commercial Vehicle Operations
- Emergency Management
- Advanced Vehicle Safety Systems
- Information Management

User service descriptions for the MOA have been adapted from the National ITS Architecture to ensure consistency with other state and national ITS plans and deployments. In most cases, needs expressed by stakeholders were mapped (i.e., connected) to user services in the National ITS Architecture. In a few cases however, a new user service had to be used to clearly state how user needs will be satisfied.

New or updated user service bundles and/or user services may be added to the National ITS Architecture in the future. An example of a new user service bundle that has been created but not yet adopted to the National ITS Architecture focuses on maintenance and construction operations. Although the maintenance and construction operations user service bundle, has yet to be adopted, it may in the future. In addition, user services in the maintenance and construction operations user service bundle are applicable to Anchorage. Therefore, the maintenance and construction operations user service bundle has been included in this report.

The applicable user service bundles and user services that meet Anchorage needs are more thoroughly described in the remainder of this section.

## 3.1 TRAVEL AND TRAFFIC MANAGEMENT

The travel and traffic management user service bundle consists of ten user services, seven of which map to needs expressed by stakeholders both during initial interviews and through further conversations with ARRC to clarify needs. These seven user services are described below.

### Pre-Trip Traveler Information

The pre-trip travel information user service assists travelers in making mode choices, provides travel time estimates, and facilitates decisions prior to trip departure. This user service consists of four primary functions:

*Available services information* – real-time transit information, including but not limited to schedules, routes, fares, and schedule adherence.

*Current situation information* – real-time travel-related information, including but not limited to incidents, construction, traffic, weather, vehicle speeds, and transit vehicle location information.

*Trip planning service* – information needed to plan an upcoming trip. Users can input trip requirements, origin, and destination and receive a customized trip itinerary.

*User access* – ability to access information from remote locations, including but not limited to home, work, or another trip generation location.

This user service will satisfy the need to distribute real-time and static information to travelers. Besides the general public, transit riders, commercial vehicle operators, and emergency response personnel can benefit from pre-trip traveler information. Benefits of this user service include, but are not limited to improved safety and roadway efficiency.

**En Route Driver Information**

The en route driver information user service provides drivers with en route information, which allows alternative routes to be chosen for a given destination based on both traffic and weather conditions. This user service consists of two main functions:

- *Driver advisory* – information on other travel routes and modes that can be used by the driver to avoid areas of congestion.
- *In-vehicle signing* – guidance information provided to the driver when traveling in locations with limited visibility or that are unfamiliar.

The benefits of en route traveler information are similar to those identified under pre-trip travel information. En route traveler information can be disseminated to motorists via HAR, DMS, radio messages, or wireless communication devices.

**Traveler Services Information**

Traveler services information provides travelers with service and facility data to help them prior to embarking on a trip or after the traveler is underway. This will provide the traveler with a "yellow pages" type of capability. The functions which are included in this capability include:

- *Information receipt* – the collection of data from travelers
- *Information access* – the ability to access information about the local area (e.g., nearby gas stations, lodging, parking, and/or restaurants).

**Route Guidance**

The route guidance user service provides directions to drivers based on real-time and static information. Directions are based on current transportation system conditions, including but not limited to road closures, traffic conditions, and local area events. This user service also includes a user interface function that allows users to access information via interactive devices, including voice recognition and touch sensitive screens.

The route guidance user service will be beneficial from a safety and operational efficiency aspect. This user service will meet the need for enhanced commercial vehicle traveler advisories through the diversion of commercial vehicle traffic around incidents.

**Traffic Control**

The traffic control user service provides the capability to efficiently manage the movement of traffic on streets and highways. Four functions are provided:

- Traffic flow optimization
- Traffic surveillance
- Control function
- Provide information

This will also include control of network signal systems with eventual integration of freeway control.

The traffic control user service will specifically satisfy the stakeholders' need to control traffic signals in the MOA. Under this user service, traffic signal control can also include transit signal priority to give more "green-time" to transit vehicles. In addition, this user service allows operators to collect vehicle detector information and enables them to operate and control other ITS field device equipment (e.g., highway advisory radio and closed circuit television (CCTV)). Operation of CCTV, for example, will enable maintenance operators to view the roadway in order to more efficiently dispatch snowplows.

**Incident Management**

ITS shall include an incident management (IM) function. Incident management will identify incidents, formulate response actions, and support initiation and ongoing coordination of those response actions. Six major functions are provided:

- Scheduled planned incidents
- Identify incidents
- Formulate response actions
- Support coordinated implementation of response actions
- Support initialization of response to actions
- Predict hazardous conditions

The IM user service enables operators to identify and determine the extent, severity, and location of an incident. This enhances existing emergency response though proper deployment of personnel and equipment. CCTV images can be used in the IM user service and a description of the visual observation can be transmitted to personnel en route and in the field. The IM will partially satisfy the need for improved hazardous material incident response.

**Highway-Rail Intersection**

ITS shall include a highway-rail intersection (HRI) function to control highway and rail traffic in at-grade HRIs. Two subservices are supported:

**Standard speed rail subservice** – applicable to light rail transit, commuter rail, and heavy rail trains with operational speeds up to 79 miles per hour (mph)

**High speed rail subservice** – applicable to all passenger and freight trains with operational speeds from 80 to 125 mph.

The highway rail-intersection user service will enhance transportation safety by providing advisories to motorists and train operators before approaching a highway-rail intersection. Motorists will be advised of approaching trains, and traffic control devices in and around the HRI will be used to prevent motorists from entering the HRI, reducing the chance of a vehicle/train collision. Likewise, train operators will be advised of the status of the highway-rail intersection and provided with a “Blocked” or “Not Blocked” response. These advisories will provide the time needed to slow and stop the train if a “Blocked” indication is given.

## 3.2 PUBLIC TRANSPORTATION MANAGEMENT

The public transportation user service bundle consists of four user services. These three public transportation management user services will partly satisfy ITS-related needs for Anchorage:

**Public Transportation Management**

The public transportation management user service allows for the management of staff, equipment, and other transit-related activities. This user service enables automation of many activities to increase transit operation performance. For example, transit vehicle diagnostics can be automatically monitored to determine when the vehicle should be maintained. The public transportation user service can also automate the collection of passenger and fare data and enable transit signal priority.

**En Route Transit Information**

The en route transit information user service provides travelers with real-time transit and high-occupancy vehicle information allowing travel alternatives to be chosen once the traveler is en route. It consists of three major functions:

- Information distribution
- Information receipt
- Information processing

This capability integrates information from different transit modes and presents it to travelers for decision making.

The en route transit information user service will provide transit users at bus stops with real-time bus arrival information. Transit users can use this information to efficiently plan their wait at transit stops. For example, with this information a transit user will know when he/she needs to be at the bus stop, therefore, he/she can pass the majority of the time elsewhere (e.g., nearby building, or doing something else (e.g., placing a quick call).

#### Personalized Public Transit

Personalized public transit user service provides real-time paratransit services to disabled persons or those without transit services available. This user service will enable:

- A transit user to request a trip
- A transit operator to locate and assign a vehicle to pick up a transit user
- Voice and data communication between a transit driver and the transit agency

### 3.3 COMMERCIAL VEHICLE OPERATIONS

The commercial vehicle operations user service consists of six user services. Two of these user services are required to meet the needs of stakeholders in Anchorage. Additional commercial vehicle operations user services are included in the statewide ITS architecture.

#### Commercial Fleet Management

The commercial fleet management user service will provide real-time traffic and routing information to commercial vehicle operators and dispatchers. This information can be communicated to commercial vehicle operators in response to incidents, closed routes, and weather or other event before the commercial vehicle operator reaches the affected area so the commercial vehicle can be re-routed around the affected area and potential delays can be avoided.

#### Hazardous Material Incident Response

The hazardous material incident response user service shall provide important real-time information related to this type of incident to the appropriate response agency for timely notification and removal. Information, including time and location of the incident and the type of materials involved, can be disseminated. Information can also be communicated to law enforcement, emergency medical providers, and similar agencies to assist with traffic diversion and emergency response.

### 3.4 EMERGENCY MANAGEMENT

The emergency management user service bundle consists of the emergency notification and personal security and emergency vehicle management user services. The latter will in part satisfy stakeholder needs.

#### Emergency Vehicle Management

The emergency vehicle management user service is divided into three systems:

- The first system is used to manage the emergency vehicle fleet and determines and dispatches the best suited emergency vehicle to the scene of an incident.
- The second system provides route guidance to vehicles responding to an incident.
- Lastly, a traffic signal priority system enables more timely travel to and from the incident for emergency vehicles as well as for public transportation vehicles used during disaster response.

## 3.5 INFORMATION MANAGEMENT

The archived data function is the only user service in the information management user service bundle.

### Archived Data Function

The archived data function user service provides functions associated with the control, archival, and distribution of transportation and ITS-related data. Multiple agencies can acquire shared data through a common interface under the functions provided by this user service. The shared data can be updated frequently, and used for planning, safety, operation, or research. The archived data function user service can be used in Anchorage to fulfill the need to collect, store, and share accident, traffic, weather, and same platform GIS data.

This user service will enable interagency and agency-to-public communications. GIS, traffic, and weather data can be communicated between agencies, and selected transportation documents, including the TIP and CIP, can be posted for public access. This will reduce data delivery time and operational costs.

## 3.6 MAINTENANCE AND CONSTRUCTION OPERATIONS USER SERVICE

As mentioned previously, this user service bundle has yet to be included in the National ITS Architecture. This bundle, however, is useful in defining the ITS functions needed to meet the unique needs expressed by stakeholders. Three of the four user services contained in this user service bundle will partly satisfy stakeholder needs. These user services are described below.

### Maintenance Vehicle Fleet Management

The maintenance vehicle fleet management user service provides the functionality to manage maintenance vehicle operations. Specific functions supported by this user service include the following:

- Vehicle tracking
- Vehicle dispatching
- Portable system resource management
- Work detail assignment and recording
- Materials application and usage tracking
- Vehicle-to-vehicle and vehicle-to-center communications

### Roadway Treatment Management

The roadway treatment management user service provides the functionality to:

- Remotely sense weather and pavement conditions that could potentially impact normal operations and compromise traveler safety
- Initiate the most appropriate action in response. Specific functions supported by this user service include the following:
    - Detect snow and ice
    - Detect bridge scour
    - Detect avalanches

- Detect flooding and debris flow
- Determine weather conditions
- Roadside-to-center communications

**Roadway Maintenance Conditions and Work Plan Dissemination**

This user service is responsible for scheduling maintenance activities through identification of infrastructure conditions. This task involves center-to-vehicle dispatching to improve vehicle dispatching.

# 4. NEXT STEPS

As noted in Section 1.2, the identification and definition of user services that satisfy ITS-related needs constitute an initial step in planning the deployment of ITS solutions in Anchorage. User services provide the framework upon which the long-range vision and the concept of operations will be based. Development of the long-range vision is the next step in this project, followed by developing the concept of operations and the development of the physical ITS architecture and the implementation plan.

# 5. REFERENCES

1. The National ITS Architecture: A Framework for Integrated Transportation into the 21st Century. Version 3.0.2. Department of Transportation. *http://www.iteris.com/itsarch/* Accessed December 2001.

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# 1. INTRODUCTION

This document defines the Intelligent Transportation System (ITS) vision for the Municipality of Anchorage (MOA). The ITS vision is based on current and future user needs and requirements that have been previously established by stakeholders and defined in the User Needs document. These user needs were then "mapped" to User Services in the National ITS Architecture to ensure conformity with a nationally accepted approach. The next step, the ITS Vision, will illustrate how future ITS deployments will affect transportation system users, and the various stakeholders in Anchorage.

Understanding how the parts or elements of an ITS come together to improve travel is often difficult to do when it is described on a system-by-system basis. This fact, combined with unfamiliar terminology often associated with ITS, may make it hard to "paint a picture" of how system integration will occur. This document will resolve the confusion associated with the proposed ITS deployments. To begin, the goals of the ITS plan are presented. Next, the ITS elements that makeup the future ITS are individually described. These definitions will form the foundation, needed to understand how these elements will come together to form an integrated system. Finally, two hypothetical scenarios are provided to show how motorists will use these systems in the future. These scenarios provide a realistic account of how traveler safety and mobility will improve with the proposed ITS, given a certain set of underling circumstances.

# 2. GOALS

The ITS plan is supportive of the mission of the various departments of the city of Anchorage and the surrounding communities within the Anchorage Metropolitan Area Transportation Study (AMATS) region. The following describes the goals of the ITS plan. Figure 3-1 represents the relationships between the goals. Developing a strong community is at the center of the goals. Meeting the community's safety and security needs helps to protect the core community values. Because all services must be provided effectively, that goal forms the outer ring.

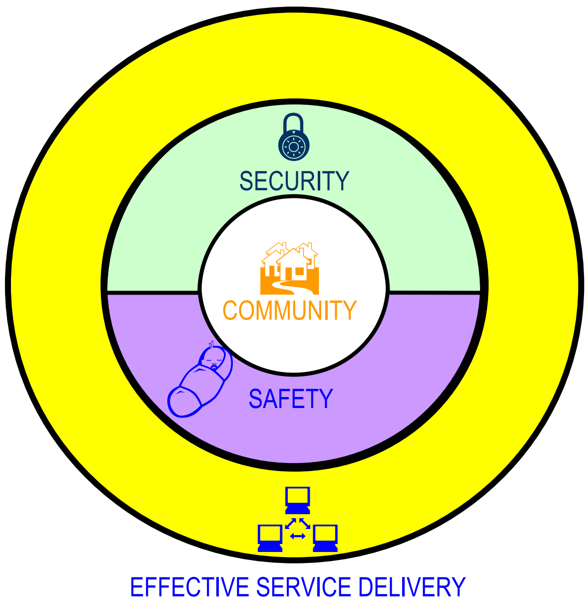


**Figure 3-1: Anchorage ITS Goals**

## 2.1 ENSURING PUBLIC SAFETY

One of the most important of all government services is that of ensuring the safety of the public. In the context of the ITS plan, this goal relates to ensuring safe travel on all modes. To achieve this goal, risks to public safety are reduced by:

- Reducing the presence of snow and ice on the roadway,
- Informing the public of hazards so they may avoid them, and
- Clearing crashes from the roadway as quickly as possible to reduce the potential for secondary crashes.

## 2.2 SUPPORTING PUBLIC SECURITY

Public security in the context of this ITS plan relates to monitoring, managing, and mitigating potential and actual major incidents and emergencies to ensure that they have the least impact on public safety. Ideally, the goal is to eliminate all man-made security hazards, and to reduce the impact of any natural disasters.

## 2.3 SUPPORTING THE COMMUNITY VISION

The Anchorage 2020 Plan outlined a clear Community Vision (see box), and this ITS plan goal is to support that vision. Providing services via ITS that contribute to an enhanced quality of life in the AMATS region is included in the ITS vision.

***Community Vision (From the Anchorage 2020 Plan)***

- A diverse, compassionate community where each individual is valued, and children, families and friendships flourish.
- A northern community built in harmony with our natural resources and majestic setting.
- A thriving, sustainable, broad-based economy supported by an efficient urban infrastructure.
- A safe and healthy place to live where daily life is enriched by a wealth of year-round recreational and educational opportunities.
- A caring, responsive government that is accessible and equitable for all its citizens.
- An active learning community with abundant cultural amenities.

## 2.4 DELIVERING SERVICES EFFECTIVELY

The city of Anchorage has demonstrated its commitment to the effective delivery of public services by implementing a set of performance measures for every department within the city. An emphasis on e-commerce is also being implemented by the city. This goal relates to implementing ITS that is:

- Able to make existing service delivery more efficient
- Providing a new, important service that we could not provide before without today's technology
- Cost effective
- Focused on customer service

***Office of Planning, Development and Community Services Vision:***

*"Building a better community through innovation, technology and customer service."*

# 3. FUTURE ITS ELEMENTS

This section describes the ITS-related elements planned for the MOA. The ITS strategy for Anchorage consists of four key program areas as illustrated in Figure 3-2. The ITS-related elements associated with each program area are described and the associated benefits with regard to travel and safety in Anchorage discussed. Real-world examples of how these elements come together to improve mobility and traveler safety are provided in Section 4.

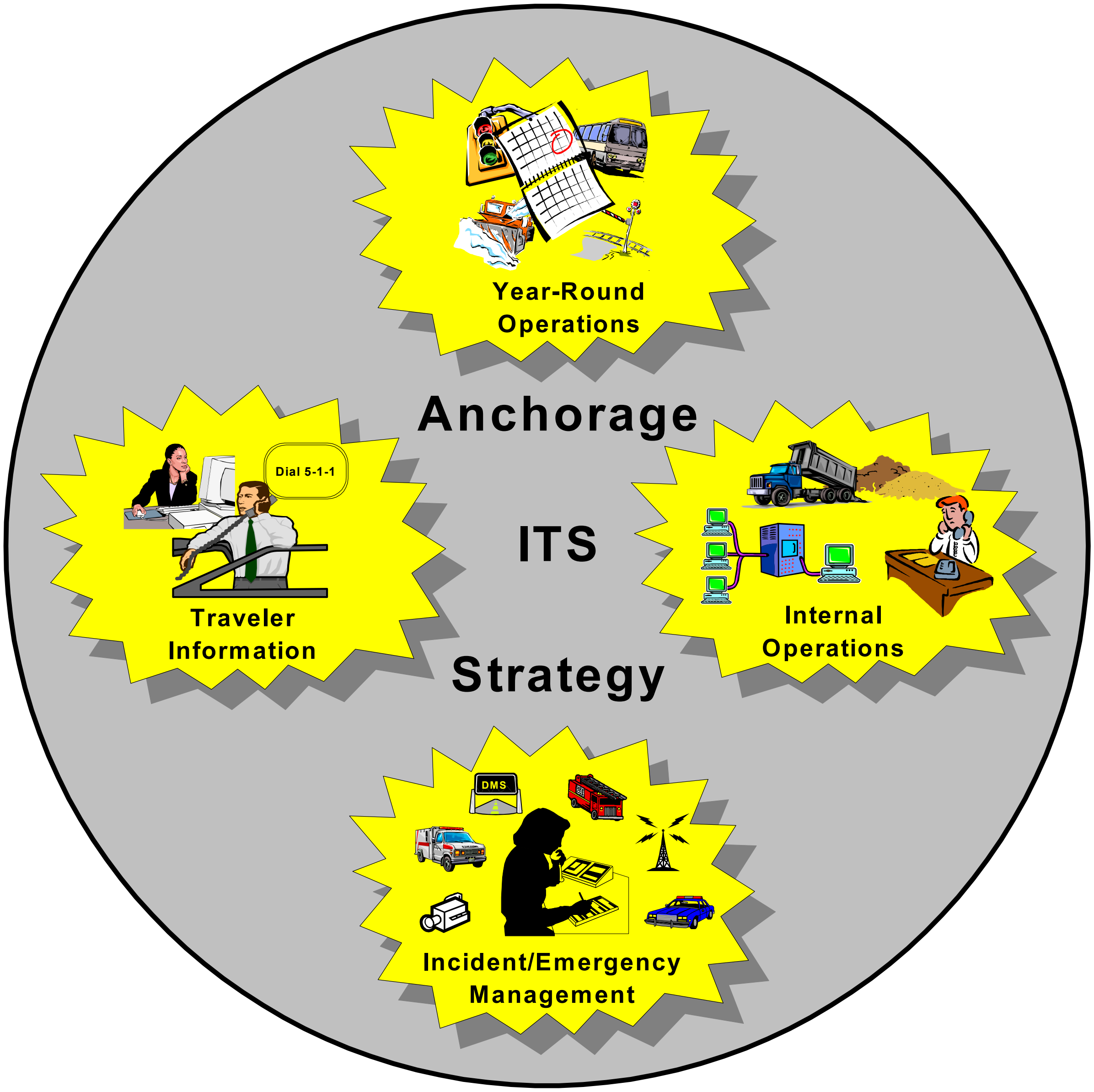


**Figure 3-2: Anchorage ITS Strategy**

## 3.1 YEAR ROUND OPERATIONS

There are several ITS elements that will be used year round to help improve operations within the MOA. These systems will provide information that will improve mobility and traveler safety in and around Anchorage. Year-round ITS elements include the following.

### Weather and Pavement Sensors

Roadway Weather Information Systems (RWIS) installed along the roadside measure ambient air temperature, type and amount of precipitation, wind speed and direction, and relative humidity. Weather sensors installed in the pavement measure pavement temperature, and help monitor the amount of ice-fighting chemical remaining on the road surface. Pavement temperature sensors mounted on vehicles such as snow plows and buses can also be a valuable source of weather information.

### Smart Snowplows

Smart Snowplows are equipped with several systems that enhance roadway safety, and enhance snow and ice control operations. First, smart snow plows are equipped with automatic vehicle location (AVL) sensors that are used to locate and track snow plows. Second, snow plows are equipped with sensors that detect the presence of magnets along the edge of the roadway. This provides snowplow operators with an image of the roadway that can be used to safely steer the snowplow in the most extreme “white-out conditions.” Lastly, sensors on the snowplow can detect and record pavement temperatures, allowing the plow operator to treat the roadway as needed. This will significantly reduce the amount of chemical used and the amount of particulates released into the air.

Smart snowplows as well as other maintenance vehicles, may be equipped with systems to monitor vehicle performance. These sensors collect various diagnostic information, including engine temperature and oil pressure, and transmit this information to the maintenance vehicle facility. This will enhance roadway safety, and will limit significant maintenance issues in the future.

### Integrated Traffic Signal System

The future ITS in Anchorage will include an advanced traffic control system to allow the MOA to control their traffic signals remotely from an operations center. Operators will be able to monitor, verify, and change signal timing patterns from a fixed facility. This will improve operations, since operators will not be required to visit the site to make these changes. In addition, operators can easily pre-empt signal timing to give emergency responders “green time” throughout their trip. Timing patterns can also be adopted to fit the travel patterns of traffic arriving and leaving stadiums or other large venues.

### Needs Study for Transit Signal Priority

Transit Signal Priority Systems interact with traffic signals in the field to extend “green time” to transit vehicles. Sensors connected to the traffic signal detect signals emitted by the system on the transit vehicle. The interaction between the two systems extends traffic signal “green-time” enabling transit vehicles to pass through the intersection where they would otherwise have to stop. This reduces delay time and helps achieve schedule adherence. Customers perceive that their trip is either quicker or more reliable, thereby enhancing their transit experience. This attracts new riders while retaining the existing ones, and enhances emergency response when transit vehicles are used during disasters for evacuation, triage, etc.

**Highway-Rail Intersection (HRI) Warning System**

HRI warning systems are used to reduce train/vehicle collisions through advance warning. Specifically, these systems provide timely warnings to notify drivers that a train is approaching and likewise train operators receive notification that a vehicle is in the HRI. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Sensors in the roadway infrastructure assess vehicle locations and speeds near an intersection. Using this information, a warning is determined and communicated to the approaching vehicle using a short-range communications system. Less sophisticated HRI systems may include visual displays or flashing signs that give motorists advanced warning of an approaching train.

**Smart Fare Box**

Smart Fare Box Systems are installed on transit vehicles and are used to collect ridership, fare, and origin-destination information. These systems will streamline transit operations, and enable better route assignment, equipment usage, and route planning.

**Transit Vehicle Management**

Transit On-board Vehicle Management Systems automatically detect vehicle mechanical problems and report them to the transit agency's maintenance department. Sensors are installed on-board transit vehicles and transmit diagnostic information to the maintenance facility in almost real-time. This significantly enhances transit operations and roadway safety. Prior to the implementation of these systems, vehicle problems often remained undiscovered until the vehicle became damaged or inoperable. A transit vehicle management system, reports these problems earlier, giving maintenance personnel time to fix the vehicle and dispatch it when maintenance services are completed.

## 3.2 INCIDENT AND EMERGENCY MANAGEMENT SYSTEMS

Identifying and reporting incidents soon after they occur can decrease response time, improve safety, and minimize delays and other traffic related effects. The impact of incidents on travel safety and roadway efficiency can be minimized through several ITS technologies. These technologies enhance incident identification, verification, notification, and response. Thus, these systems enable operators to dispatch appropriate personnel and equipment quickly, clearing incidents and treating victims in an efficient and timely manner.

**Hazardous Materials Tracking and Reporting**

Weigh stations are equipped with systems which enable operators to process manifests and weigh their vehicles without stopping. This will enable staff at the weigh station to identify commercial vehicles carrying hazardous materials and, if necessary, divert them to alternate routes. Weigh station staff can input HazMat information in the condition acquisition and reporting system (CARS) (See Section 3.3) where it can be accessed by other authorized users.

**Closed Circuit Television (CCTV)**

CCTV is used to monitor and confirm congestion, incidents, weather, and road surface conditions. CCTV cameras will greatly enhance incident management operations through quick identification and verification of incidents. This enables quick dispatch of appropriate equipment needed to the clear the incident, treat injured persons, and clear or treat the roadway.

**Vehicle Detection**

Vehicle detection sensors enable operators to monitor traffic volumes and congestion from a remote location. Traffic data can be stored in a database and used to enhance transportation operations, maintenance, and planning processes.

**Dynamic Message Signs (DMS)**

Fixed and portable DMS are used along freeways and major arterials to report incident information to motorists and to guide motorists around affected areas. Signs can also provide alternative routing directions or other pertinent messages.

**Highway Advisory Radio (HAR)**

HAR provides audible warnings to drivers well in advance of an impacted area.

The incident management technologies described above can have a beneficial impact on several areas of transportation, including commercial vehicle operations and emergency management. Incident management technologies make it easier to inform commercial vehicle operators of incidents in a timely fashion, so an adequate amount of time is given to divert the vehicle around the incident. Likewise, emergency management dispatchers can use or benefit from incident management technologies by visually confirming and determining the extent of an incident. Dispatchers can relay this information to emergency responders in the field so an appropriate route can be selected and necessary preparation made before arriving at the scene.

## 3.3 TRAVELER INFORMATION SYSTEMS

In the future, travelers will utilize land-line and wireless communications for obtaining travel-related information. Wireless communications will provide access to traveler information at all times and in most locations.

**5-1-1**

Recently launched in the Cincinnati/Northern Kentucky metropolitan area, the 5-1-1 telephone traveler information service is gaining popularity with other states, and is expected to be widely implemented in the future. Drivers can call the 5-1-1 number on their mobile communication device (e.g., cell phones) to obtain near real-time traveler information.

**Internet**

The Internet is a vital medium for distribution of pre-trip traveler information. Whether at home, work, or another fixed location, information on the Internet can be easily accessed, to plan a trip. Filtered traveler information from the CARS database will be provided to travelers via the Internet. In addition to this information, users will also be able to gain access to the Capital and Transportation Improvement Plans.

**Wireless Web**

In the future, motorists will likely be able to obtain pre-trip and en-route traveler information via a personal digital assistant or other device that supports wireless web browsing. On-board devices will be fully equipped with web-based Traveler Information Systems. This will allow drivers to obtain directions to their destination, including but not limited to the nearest gas station or restaurant, without stopping.

## 3.4 SYSTEMS FOR INTERNAL OPERATIONS

ITS can help facilitate better internal operations. ITS provides the capability for agencies to minimize the use of financial and physical resources. The following technologies will help streamline operations, reduce costs, and improve the safety and efficiency of the roadway network.

### Mobile Data Terminals (MDTs)

MDTs can greatly enhance internal agency communication in the MOA. These systems will provide personnel in the field with greater flexibility to collect and report information. This will enhance in-field operations and will alleviate the burden traditionally placed on dispatchers at a fixed facility. MDTs also provide easier means to disseminate information from the field to the operation center.

### Material Usage Tracking

Tracking the amount of ice- and snow-fighting chemicals, fuel, and other resources consumed by various maintenance activities will significantly enhance operations in Anchorage. Tracking the use of resources year after year will allow more precise resource ordering, thus reducing overspending.

### Asset Management

An Asset Management System stores pavement and infrastructure condition information so it can be used more effectively. This information can be integrated into a geographic information system and used to easily identify the condition of infrastructure at desired locations. This allows funding to be allocated among roadways and/or structures in most need of repair.

### Automatic Vehicle Location (AVL)

AVL sensors installed on transit, maintenance, and emergency response vehicles will communicate with global positioning systems (GPS) to provide dispatchers with real-time vehicle locations and movements. This information can enable dispatchers to assign vehicles to a location (e.g., avalanche or transit stop) based on the current location of an available vehicle. This technology can also be used to quickly locate a stalled or disabled vehicle and to provide real-time bus arrival information to transit users via the Internet, kiosks, or message boards at transit stops.

### Shared Traveler and Traffic information Database

Individual agency data is a valued asset not only to the agency itself but to other agencies as well. A shared traveler and traffic information database will enable agencies to share their electronic data (e.g., crash data) in exchange for other agency data. This will enhance operations of each participating agency, by reducing data collection costs, and increasing data usefulness.

### Condition Acquisition and Reporting System (CARS)

CARS is a web-based software tool that allows authorized staff (i.e., police, city officials, DOT personnel, or other users) to input accident, construction, delay, and other roadway and weather information into statewide databases. Users of the system can store information on active incidents (e.g., hazardous material spills, crashes, or natural disasters) or planned incidents (e.g., events, construction activities, road closures) in the database quickly using pull down menus, or manually using text entries. This information is then plotted and illustrated graphically for quick reference. This information can then be passed along to the traveler via the Internet, HAR, DMS, or other communications channel.

### Common Geographic Information System (GIS)

A GIS enhances data analysis by displaying text and numerical information in spatial format. This enables quick and easy identification of patterns in the data as it pertains to specific areas in the municipality and surrounding areas. In addition, a GIS also offers advanced functionalities including buffers and queries that help users analyze a data set.

Many agencies in Anchorage own a geographic information system, but GIS information is not currently exchanged. Different GIS programs and lack of inter-agency cooperation contribute to difficulties in information exchange. A common GIS system can enable exchange of usable map layer files between agencies, resulting in enhanced information exchange.

# 4. THE ITS VISION

## 4.1 TRAVELER INFORMATION SCENARIO

*It's the year 2012 and Steve Lindstrom, Vice President of Operations with the Northwest Frontier Fishing Company out of Seattle, Washington, needs to go to Anchorage in late September on business to meet with local boat operators and discuss upcoming fishing season staffing needs. Steve needs to spend three days in Anchorage—Tuesday, Wednesday, and Thursday—and decides to make hotel and rental car reservations for the trip. On a cool and windy Monday afternoon, Steve flies out of SeaTac Airport for Anchorage. Because he is flying on one of Boeing's new Sonic Cruiser jets, he makes the trip to Anchorage in less than three hours—Wow!*

*Upon arrival at Anchorage International Airport, he proceeds through baggage check and secures his rental car. Immediately adjacent to the rental car area are a series of five-foot-tall electronic kiosks. These kiosks provide real-time traffic conditions, web-based trip planning for the People Mover transit system, and other traveler information for such items as hotels, restaurants, and destination resorts.*

*After viewing the real time traffic conditions page, Steve makes his way to the rental car holding lot. The car he reserves has on-board telematics*[1] *whereby Steve can plot his origin (the airport rental car lot) and destination (the hotel). The system guides him on the quickest path between the two points, and he is able to get from the airport to his hotel without the need of a paper map. The system also comes equipped with an on-board global positioning system (GPS), which can interface with the on-board computer to accurately pinpoint where his car in the greater Anchorage area. This system is tied to a database, which provides audio information about restaurants, retail establishments, recreation sites, and other information. Through this system, he was able to find the location of a restaurant that serves a good steak dinner in downtown Anchorage. Being in the fishing industry for many years, Steve has long grown tired of eating fish.*

*While en-route to the hotel, Steve encounters a road re-surfacing project that is taking place on Minnesota Drive and local traffic is backed up approximately a quarter of a mile. Luckily, the State DOT has installed a portable dynamic message sign upstream and provided a detour route for through travelers. The coordinates for this route are sent off to the traffic operations center and are converted into the municipality's geographic information system (GIS) and web-based output file is uploaded to the web server. The system came equipped with the ability to send a traffic alert warning to Steve's screen in his rental car. Steve reaches over and touches the screen and the detour message (with suggested alternative route) comes up both in visual and audio formats. Since Steve is a safe and conscientious driver, he listens to the detour message and through the integration of his onboard GPS, is able to take the audio directions and follow the detour route.*

*Why is this section of the highway being resurfaced at this time? Data from the recycled asphalt system has informed the state that this section of the state highway needs repair presently to minimize further damage to the roadway and to vehicles. Based on good planning, there is budget to complete the resurfacing at this location prior to the onset of winter. The maintenance project is in its last week and traffic operations should be back to normal by the weekend.*

*As Steve is unpacking in his hotel room, he monitors the Weather Channel on the television. Weather forecasters are predicting a severe early winter storm to hit Anchorage within the next 12-24 hours. At the State Operations Center at Ft. Richardson, detailed weather information has been provided to the state's roadway weather information system (RWIS). The RWIS website has been updated with the latest weather report. The following morning, it starts to snow lightly. After he looks out the window to see how the roads are (they're clear), Steve checks the website and determines*

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1 Telematics is an emerging market of automotive communications technology that combines wireless voice and data to provide location-specific security, information, productivity, and in-vehicle entertainment services to drivers and their passengers.

*that he can make it to his first meeting across town by car. Upon returning to the hotel later in the afternoon, it is snowing more heavily and the winds are approaching 20 miles per hour. Steve anguishes about having to drive in this weather.*

*By the next morning, the storm has taken a turn for the worse. Visibility is minimal due to the blowing snow. The snowplows have already been dispatched but can't keep up with the amount of snow that is falling. Prior to leaving his room for his second day of meetings, he listens to the traffic reports on the radio and the "picture" outside is not good. Traffic on the streets is barely moving and there are a number of reports that cars have stalled or slid off of roads. He turns on to the TV and consults the municipality's traffic channel, which provides continuous real-time images of the highway system via a distributed network of closed circuit television cameras (CCTV).*

*After viewing the images on the TV and consulting the RWIS site, he determines that traveling by car is too risky and decides to take the bus to his meeting. He consults the People Mover website and using their Trip Planner tool, is able to determine which bus he needs to take to get to his meeting. Luckily for Steve, a bus stop with a shelter is located just outside the front door of his hotel. It has a reader board that announces when his particular bus will arrive. Looking at the reader board, Steve realizes that the bus won't reach the hotel location for another 15 minutes. He takes the time to order a cup of coffee, pick up a local newspaper, and relax in the warmth of the hotel lobby until the bus arrives.*

*The buses, which have GPS/automatic vehicle location (AVL) capabilities, can transmit location data and automatic passenger counts, make stop announcements on board the bus, and transmit CCTV images back to the central dispatch center, all in real-time mode. Data from this system has helped People Mover transit system plan better service and reduce operating costs.*

*The advanced weather information via RWIS provides the municipality public works personnel with information to more effectively stage snow removal operations. The CCTV images are fed back to a central operations center where staff work with public safety and maintenance/operations personnel to respond to incidents caused by the storm. Messages to field operations personnel are dispatched to onboard mobile data terminals (MDTs) installed in their trucks. Preprogrammed message sets help to reduce the need for voice communication channels thereby freeing up more radio channels for emergency personnel (police and fire) where needed.*

*Systems to track snow and ice have been in place for five years and public works staff is using output reports to support operations. In fact, data gathered from the system has helped the municipality plan ahead and store enough de-icing chemicals to handle a severe winter storm like the one currently taking place in the Anchorage area. This data has led to the savings of on average $200,000 per year in operations costs since the system was established five years earlier. The system paid for itself within the first year of operation.*

*The staff easily accesses much of the data supporting the municipality maintenance and operations functions. Efforts a few years ago to integrate files and build off of a common GIS base layer has made it much easier to conduct "what if" scenarios during the storm. Sure, there was a struggle to coordinate the data files from a number of departments. However, a study eight years earlier stated that the municipality could coordinate its databases and GIS among its many Departments and achieve greater functionality to provide more analyses to support planning, operations, and maintenance functions citywide. It took a few years to fix the data so that it was coordinated and to set up the maintenance procedures for new and edits layer files. However, despite the time it took to do the work, there is general consensus that the integration project is a success across all municipality departments. Folks wouldn't have it any other way.*

*One common "what if" scenario that is being played out using the GIS is the impacts of run-off of melted snow on the municipality's drainage system. Three years earlier a severe winter storm followed by a warm period saw extreme flooding. The drainage system in some locations was over-taxed, but staff did not have data to help them mitigate the emergency. It was determined that a drainage GIS could have helped the municipality better respond to the incident. Efforts were made at* *that time to link this set of drainage files to the broader municipality-wide system to ensure consistency and reduce the need to build the system from the ground up, saving thousands of dollars in the process.*

*By Thursday, the storm has subsided and municipality snow removal teams are hard at work plowing snow and distributing sand and de-icing chemicals on the major thoroughfares. Steve has had a successful trip and is able to take his car back to airport. He leaves with the memory of experiencing a strong winter storm, but content in the realization that he was able to get around and get his work done. Little does he know that a great deal of technology worked behind the scenes to enrich his experience.*

## 4.2 EARTHQUAKE INCIDENT SCENARIO

*A tired, but enthusiastic state trooper named Amy begins the day at her house in Eagle River. It is a calm sunny day in the low 40's. On her way to work, she drops off her two-year-old son at daycare. Her son was up frequently the night before and she didn't get much sleep. Ah, the joys of parenthood! After dropping her son off, she heads for her job as manager of the dispatch unit for the state patrol, which is headquartered at Fort Richardson.*

*Later that afternoon, around 3:30 p.m., a severe earthquake hits the region. The quake, with a magnitude of 7.2 on the Richter scale, is centered 5 miles northwest of Wasilla. Because the epicenter of the quake is five miles below the surface, the damage isn't as extensive as it could have been. Amy and her co-workers are a "little shook up", but no injuries are reported. The dispatch center communications system is operational. Within seconds, the dispatchers are getting flooded with calls.*

*The municipality of Anchorage and other federal and state government agencies have immediately initiated their earthquake response plan. It is determined that the central operations center at Fort Richardson has received minor damage and the LAN is still operational. Cellular phone service demand is extreme and most people cannot make calls. Interestingly, five years earlier, a multi-agency committee was established to coordinate protocols on the use of radio channels during emergencies. Those protocols were made a part of the disaster plan. Their foresight is being rewarded as the radio system is working perfectly and there is adequate supply of voice channels to facilitate communication. Messaging capabilities are also engaged with public safety personnel via mobile data terminals installed in their vehicles.*

*Highway operations personnel at Ft. Richardson are monitoring closed circuit television cameras at key highway and bridge locations. Operators have the ability to use the pan, tilt and zoom features of the cameras to pinpoint incidents and determine the nature of problems on the highway system. A train derailment near Minnesota Drive and W. Tudor Road has caused an accident with some automobiles involved. Cameras in this location have helped determine that there are possible injuries and the local hospital is alerted. Paramedic personnel are dispatched to the scene. The paramedic vehicles come equipped with cameras that can provide a wireless video feed back to the hospital. Because of this capability, doctors are better able to determine the nature of the injuries and prescribed treatment instructions to paramedics on the scene.*

*Personnel at various operations centers are using a coordinated GIS to analyze scenarios such as impacts to the utility infrastructure (namely, sewer, water, electrical and others) to ascertain possible by-pass routes around damaged systems. Fortunately, there was a backup redundant GIS server in place as the primary server was damaged in the earthquake. Electrical power was out in Palmer and utility crews have been dispatched to repair the downed electrical lines.*

*On the roadside, the Fort Richardson operations have begun dispatching trucks with emergency supplies to disaster spots around the area. En route, the trucks receive up-to-the-minute travel and disaster response information via mobile data terminals onboard their vehicles.*

*Severe traffic is backing up city streets. Initially, the traffic signals in the downtown area are not functioning and travelers see only flashing red lights. Within an hour, the central traffic operations center got the signal control system under control and functioning normally. Traffic is anything but normal. Gridlock conditions still exist on many of the city's major arterials. However, bus vehicles equipped with transit signal priority equipment are able to communicate with signal controllers on the street. Signals from the buses to the controllers call for longer green times, thereby allowing the buses to move more quickly through congested intersections.*

*In other areas not equipped with transit signal priority capability, excessive starts and stops are putting a strain on bus engines. One bus is experiencing high engine temperatures, and breakdown is imminent. This information is fed directly to the People Mover maintenance department where another bus is deployed to intercept the ailing bus and to transfer passengers in a timely manner. Once the bus operator informs the perplexed passengers about why they need to transfer buses, they are greatly relieved that they won't get stranded on a disabled bus.*

*Across town, the Knik River Bridge has received structural damage and large commercial vehicles and buses are temporarily precluded from crossing. The state's structural engineers have inspected the bridge and determined that heavy loads on the bridge pose a high risk to the facility. Dynamic message signs (DMS) are immediately deployed upstream to warn travelers of this fact. To facilitate the flow of heavyweight vehicles, the folks back at Fort Richardson, use their GIS to define an appropriate detour route. Signage and traffic control crews are dispatched to the area to install temporary DMS that inform travelers of the detour. This message is also broadcast over Highway Advisory Radio.*

*Amy is able to get through to the daycare facility back in Eagle Harbor. Her neighbor, Susan, was able to pick up her son and take him back home until Amy could leave the office. Because of the emergency, Amy has to work two extra hours, but it could have been worse. The upfront planning, coordination, and technology has been working well, despite the earthquake. The general situation has stabilized within a few hours after the quake.*

*Months later, various personnel from the military, state and municipality receive commendations from the Governor and the head of the Federal Emergency Management Agency (FEMA) for their professional response to the emergency. Amy's team received a commendation from the Governor for their efforts in keeping the lines of communication open with essential State Patrol field officers and other support personnel. Amy was especially proud, as her son and family were in attendance to see her get the commendation.*

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# 1. INTRODUCTION

This Concept of Operations is one of six documents that have been developed for the Municipality of Anchorage (MOA) as part of its effort to create a regional Intelligent Transportation System (ITS) plan and architecture.

## 1.1 PURPOSE

The purpose of the concept of operations is to fully define operational and institutional relationships, as well as communication elements of the municipality's regional ITS architecture. An analysis is provided of future functionality and ITS deployments that will continue to increase the safety and efficiency of travel in the Anchorage area and improve internal MOA operations.

This document partially ensures that ITS projects are not deployed in an isolated or "stove-pipe" manner that limits the functionality of ITS deployments. An integrated ITS enhances the operational efficiency and safety of transportation systems in the region and provides transportation operation and maintenance personnel with a means to exchange real-time data and information.

In addition, this document provides a baseline analysis of the operational ITS capabilities and needs in the Anchorage region, and identifies potential opportunities for integration.

This concept of operations also identifies:

- Transportation operations and management needs that ITS should address
- Future ITS elements to be installed
- Assessments of impacts to future ITS deployments on existing systems
- Analysis of computer and communication systems needed to realize the ITS vision

## 1.2 CONFORMITY WITH THE NATIONAL ITS ARCHITECTURE

On April 8, 2001, The United States Department of Transportation (USDOT) in cooperation with the Federal Highway Administration (FHWA), published a final rule that specifically addresses the conformity requirements of the National ITS Architecture and standards in the planning, development, and implementation of ITS projects. Around the same time, the Federal Transit Administration (FTA) issued an ITS Architecture Policy Statement that mirrors very closely requirements in the FHWA Final Rule. Both the FHWA Final Rule and FTA policy require that ITS projects conform to the National ITS Architecture and applicable standards when using highway and mass transit funds from the Highway Trust Fund.

The focal point of the ITS Architecture and Standards Conformity Final Rule is to ensure that current and future opportunities to integrate ITS across modes and multiple jurisdictions for the purpose of improving transportation operations are not overlooked in project development. Note that conformity with the National ITS Architecture does not require state and local agencies within the Anchorage region to link each of their internal functions, nor does it require that they link to or share data with other operating agencies. The Final Rule and Policy encourages operating agencies to consider the possibilities and make opportune choices to provide safe and efficient transportation services to travelers.

The process employed in the development of the concept of operations for the MOA and its partner agencies, as well as the other architecture documentation, provides the required process and documentation to meet the intent of the Final Rule and Policy. To that end, this process focuses on the operational needs of the MOA, their regional partners, potential partners, and the information needed to make decisions about the future of the ITS in the region.

## 1.3 CHAPTER ORGANIZATION

Section 2 provides a detailed description of the methodology that was implemented to develop the concept of operations.

Section 3 describes the ITS Vision for the MOA. This section presents a user's futuristic perspective of how ITS will be deployed to meet the transportation needs, goals, and objectives of the Anchorage region. In addition to identifying the ITS Vision for the Municipality, this report also considers other stakeholder's transportation needs, goals, and objectives, and their role in providing integrated ITS functions.

Section 4 provides an operational analysis of ITS functions in the Anchorage region. This section defines the information that is shared among agencies. It also maps current ITS functions to those identified in the National and State of Alaska ITS Architectures.

Section 5 provides a comparison evaluation of data currently available, and data required to support future operational requirements. It also provides an analysis of legacy systems that could potentially help realize the ITS vision.

Section 6 provides an analysis of existing communication systems that are currently available to support ITS services identified in the ITS vision. This section also identifies gaps between the available communication systems and systems that are needed to support the ITS vision for the municipality.

Section 7 presents a summary of findings.

# 2. METHODOLOGY

This section defines the methodology used in the development of the Anchorage ITS Concept of Operations. This methodology fully considers the requirements of the National ITS Architecture and Standards Conformity Final Rule and Policy.

## 2.1 STAKEHOLDER INVOLVEMENT

A focal point of the National ITS Architecture Final Rule and Policy is to involve each of the stakeholders that will be responsible for, or affected by, the operation and management of transportation systems in the MOA. The process of ensuring stakeholder involvement as part of this project was fostered by interactive workshops, a series of one-on-one interviews, and telephone interviews. These activities primarily focused on identifying current and future operational needs, and viable potential solutions of the MOA and its regional partners.

Stakeholders affected by, or responsible for systems in the MOA are identified below.

- ADOT&PF Traffic & Safety (Central Region)
- ADOT&PF Bridge Office
- ADOT&PF Traffic Materials
- ADOT&PF Maintenance
- ADOT&PF Highway Data Section
- Fort Richardson Army Base
- Elmendorf Air Force Base
- Emergency Medical Services
- Department of Motor Vehicles
- Alaska Division of Air Quality (ADEC)
- University of Alaska – Anchorage
- Alaska State Troopers
- Alaska Railroad Corporation
- ADOT&PF Central Region Planning
- ADOT&PF Statewide Planning
- ADOT&PF Division of Emergency Services
- ADOT&PF Commercial Vehicle Enforcement
- Alaska Trucking Association
- Alaska Division of Tourism
- MOA Street Maintenance
- MOA Planning
- MOA Traffic Engineering
- MOA IT Department
- MOA Project Management
- MOA Emergency Operations Center
- MOA Purchasing Department
- MOA Public Transportation
- MOA Fire
- MOA Police
- MOA Planning
- MOA Public Works Technical Services
- MOA Health & Human Services
- MOA Port of Anchorage
- State Emergency Management Center

## 2.2 METHODOLOGY

This concept of operations has been developed partially based on outreach conducted during the State of Alaska Department of Transportation ITS Statewide Deployment Strategy effort, and continued during this effort to develop an ITS architecture for the MOA. The project team provided additional dialogue with Anchorage and other stakeholders throughout the region as part of the effort to identify user needs for developing the municipality's ITS architecture. The concept of operations is being developed to define the institutional responsibilities and steps necessary to accomplish the ITS vision for the region.

An extensive outreach process has been accomplished through interactive workshops and a series of one-on-one interviews and telephone interviews. Figure 4-1 illustrates the relationship of each step of the methodology employed in developing the concept of operations for the municipality. Each of the steps in the concept of operations development is described below.

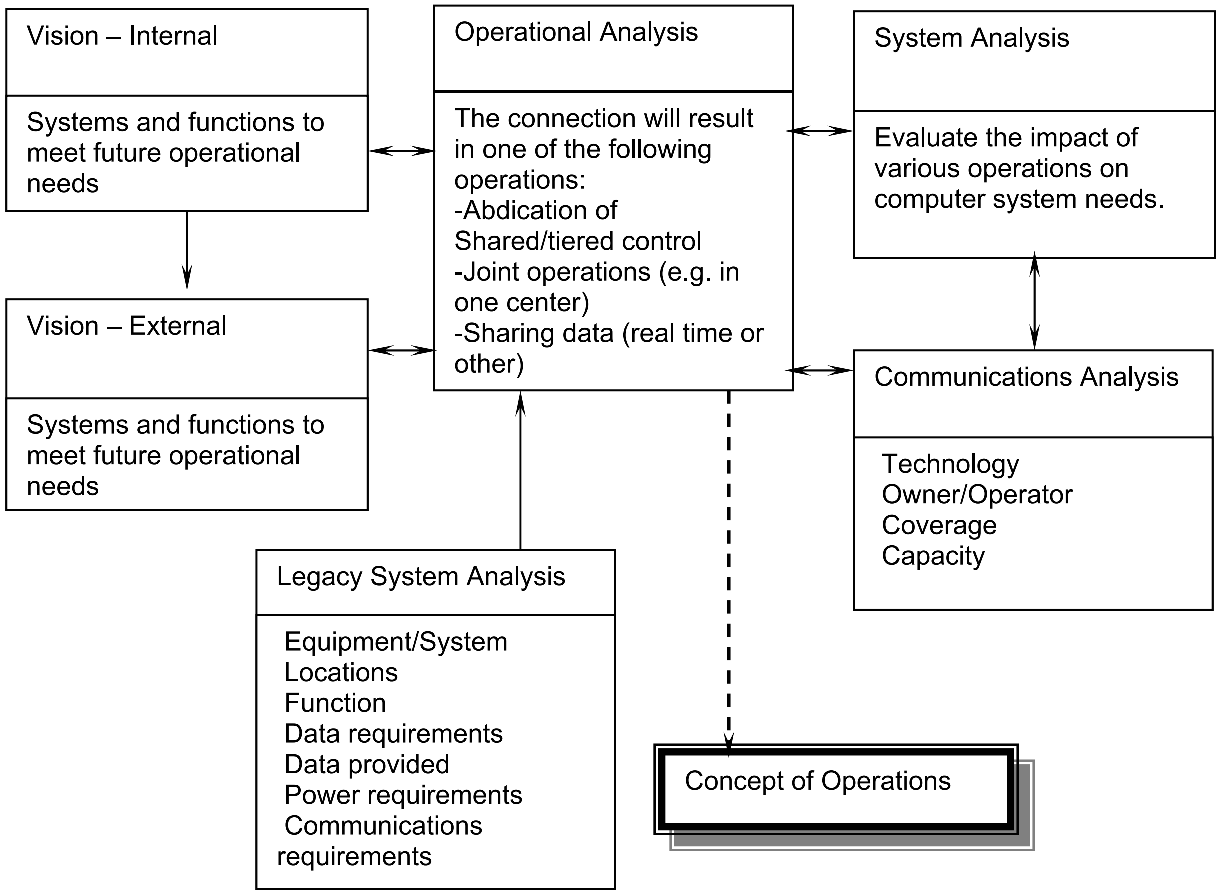



**Figure 4-1: Concept of Operations Development Methodology**

**Vision – Internal to Municipality**

Development of the ITS Vision helps define how the municipality would like to function in the long-term. Additionally, it has provided a high-level analysis of the infrastructure, services, and information flows that will be required to realize the transportation goals and objectives in the region. The development of the ITS Vision has relied heavily on input and interaction with the municipality and its stakeholders.

**Vision – External Stakeholders**

Understanding the ITS from the perspective of external stakeholders was a critical step in the development of the ITS vision. Realizing the ITS vision set forth for Anchorage will require the involvement of multiple public and private entities. Therefore, involving external stakeholders in the development of the ITS Vision provided the opportunity to identify information flows that will help to support the integration of ITS functions.

**Operational Analysis**

The operational analysis led to the development of the concept of operations. Analysis of current functions determined what functions would need to be implemented in the future to fully realize the ITS Vision.

After baselining current functions, the concept of operations was validated in a workshop environment through operational scenarios. Operational scenarios were developed to emulate both normal and emergency operations. The focus of the operational scenarios was to answer the following questions:

- What actions do the MOA and other stakeholders partake in given a certain situation?
- What information is required to support operations?
- How is ITS used to support operations?
- How could ITS potentially enhance operations in the future?

**Systems Analysis**

As part of the systems analysis, computer system architectures (such as distributed and client-server) were reviewed for their ability to support the ITS Vision. In addition, processing power needs were considered (for example, polling and processing data at once per second versus once per minute).

**Legacy Systems Analysis**

Legacy systems analysis is important for a number of reasons. First, the analysis enables a determination to be made regarding whether they will be able to support the ITS functions identified in the ITS vision. Consequently, the analysis provides a baseline to determine what systems or functions will need to be deployed in the future to realize the ITS Vision. Legacy systems are characterized at a high level in this analysis in terms of:

- Type of system or equipment
- Functional description of the system or equipment
- Locations of system or equipment deployments
- Data provided by the system
- Power requirements of the system or equipment
- Communication systems requirement

**Communications Analysis**

Analysis of existing communications systems is important to determine if the existing communication systems can support the ITS functions identified in the ITS Vision. This analysis also provides a baseline to determine what additional communications systems will be required to support the ITS Vision. Existing communications systems are characterized in this analysis in terms of:

- Deployed communications technology
- System owner/operator
- Units deployed (e.g., number of circuits, fiber links)
- System capacity

# 3. GOALS

The ITS plan is supportive of the mission of various departments of the MOA and the surrounding communities within the Anchorage Metropolitan Area Transportation Study (AMATS) region. The following describes the goals of the ITS Plan. Figure 4-2 represents the relationships between the goals. The center goal is developing a strong community. Meeting the community's safety and security needs helps to protect the core community values. Because all services must be provided effectively, that goal forms the outer ring.

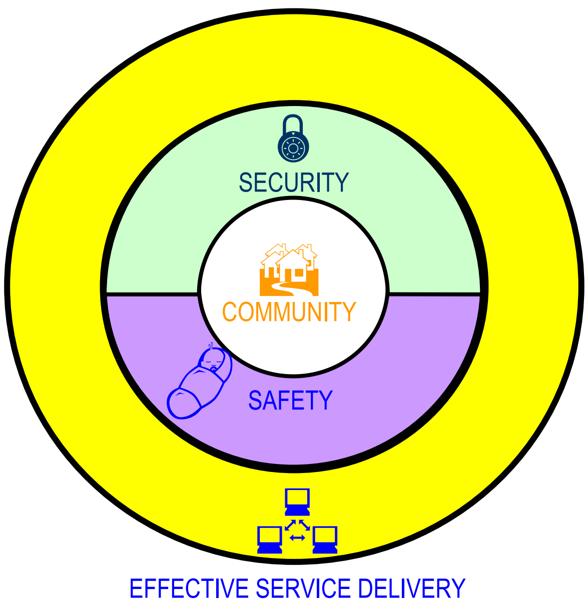



**Figure 4-2: Anchorage ITS Goals**

## 3.1 ENSURING PUBLIC SAFETY

One of the most important of all government services is that of ensuring the safety of the public. In the context of the ITS Plan, this goal relates to ensuring safe travel on all modes. To achieve this goal, risks to public safety are reduced by:

- Reducing snow and ice on the roadway,
- Informing the public of hazards to be avoided, and
- Clearing crashes from the roadway as quickly as possible to reduce the potential for secondary crashes.

## 3.2 SUPPORTING PUBLIC SECURITY

Public security in the context of this ITS plan relates to monitoring, managing, and mitigating potential and actual major incidents and emergencies to ensure that they have the least impact on public safety. Ideally, the goal is to eliminate all man-made security hazards, and to reduce the impact of any natural disasters.

### 3.3 SUPPORTING THE COMMUNITY VISION

The Anchorage 2020 Plan outlined a clear Community Vision (see box), and this ITS plan goal is to support that vision. The ITS vision includes providing services via ITS that enhance the quality of life in the AMATS region.

**Community Vision (From the Anchorage 2020 Plan)**

- A diverse, compassionate community where each individual is valued, and children, families and friendships flourish.
- A northern community built in harmony with our natural resources and majestic setting.
- A thriving, sustainable, broad-based economy supported by an efficient urban infrastructure.
- A safe and healthy place to live where daily life is enriched by a wealth of year-round recreational and educational opportunities.
- A caring, responsive government that is accessible and equitable for all its citizens.
- An active learning community with abundant cultural amenities.

### 3.4 DELIVERING SERVICES EFFECTIVELY

The MOA has demonstrated its commitment to the effective delivery of public services by implementing a set of performance measures for every department. The municipality is also emphasizing e-commerce. This goal relates to implementing ITS that is:

- Able to make existing service delivery more efficient
- Providing a new, important service not possible without today's technology
- Cost effective
- Focused on customer service

Office of Planning, Development and Community Services Vision:
"Building a better community through innovation, technology and customer service."

# 4. KEY PROGRAM AREAS

This section describes the ITS Strategy (i.e., Key Program Areas) planned for the MOA. The ITS Strategy for Anchorage consists of four key program areas, as depicted in Figure 4-3. The ITS-related elements of each program area are described and the associated travel and safety benefits are discussed.

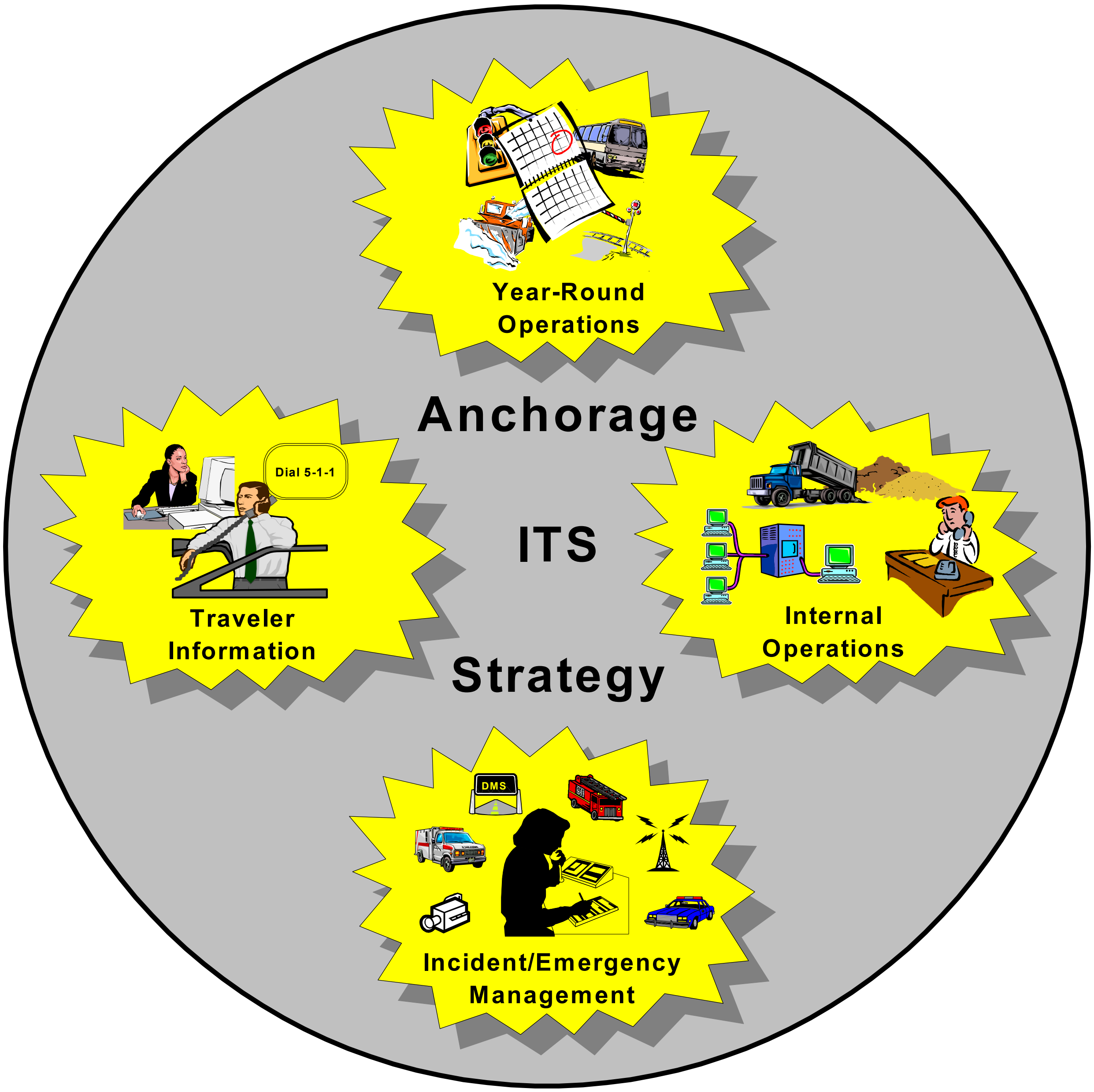



**Figure 4-3: Anchorage ITS Strategy**

## 4.1 YEAR ROUND OPERATIONS

There are several ITS elements that will be used year round to help improve operations within the MOA. These systems will provide information that will improve mobility and traveler safety in and around Anchorage. Year-round ITS elements are described below.

### Weather and Pavement Sensors

Roadway Weather Information Systems (RWIS) installed along the roadside measure ambient air temperature, type and amount of precipitation, wind speed and direction, and relative humidity. Weather sensors installed in the pavement measure pavement temperature, and help monitor the amount of ice-fighting chemical remaining on the road surface. Pavement temperature sensors mounted on vehicles such as snowplows and buses can also provide a valuable source of weather information.

### Smart Snowplows

Smart snowplows are equipped with several systems that enhance roadway safety and snow- and ice-control operations:

- First, smart snowplows are equipped with Automatic Vehicle Location (AVL) sensors that are used to locate and track snowplows.
- Second, snowplows are equipped with sensors that detect the presence of magnets along the edge of the roadway. This provides snowplow operators with an image of the roadway that can be used to safely steer the snowplow in the most extreme "white-out conditions."
- Lastly, sensors on the snowplow can detect and record pavement temperatures, allowing the snowplow operator to treat the roadway as needed. This will significantly reduce the amount of chemical used and the amount of particulates released into the air.

Smart snowplows and other maintenance vehicles may be equipped with systems to monitor vehicle performance. These sensors collect various diagnostic information, including engine temperature and oil pressure, and transmit it to the maintenance vehicle facility. This enhances roadway safety and limits significant maintenance issues in the future.

### Traffic Signal System

The ITS in Anchorage includes an advanced traffic control system to allow the MOA to control their traffic signals remotely from an operations center. Operators are able to monitor, verify, and change signal timing patterns from a fixed facility. This will improve operations since operators are not required to visit the site to make these changes. In addition, software installed locally at traffic signals enables traffic signal pre-emption to give emergency responders "green time" when responding to an emergency. Timing patterns can also be adopted to fit the travel patterns of traffic arriving and leaving stadiums or other large venues.

### Highway-Rail Intersection (HRI) Warning and Pre-emption Systems

HRI warning and pre-emption systems are used to increase safety and reduce potential train/vehicle conflicts. HRI warning systems determine the probability of a collision at an equipped intersection (either highway-highway or highway-rail) and provide timely warnings to drivers and train operators. The equipment at the HRI may also be interconnected with adjacent signalized intersections to adapt local control to highway-rail intersection activities. Sensors in the roadway infrastructure assess vehicle locations and speeds near an intersection. Using this information, a warning is determined and communicated to the approaching vehicle through a short-range communications system. Pre-emption systems improve safety by automatically changing a traffic signal indication to red when a train approaches.

**Needs Study for Transit Signal Priority**

Transit Signal Priority Systems interact with traffic signals to extend "green time" to transit vehicles furnished with the necessary equipment. Sensors connected to the traffic signal detect a signal emitted by equipment on the transit vehicle. The extended "green-time" enables transit vehicles to pass through the intersection where they would normally have to stop. This reduces delay time and helps achieve schedule adherence. Customers perceive that their trip is either faster or more reliable, thereby enhancing their transit experience. This attracts new riders and retains existing ones. Transit signal priority can also assist with emergency management when transit vehicles are used for evacuation or triage during a disaster.

**Smart Fare Box**

Smart Fare Box Systems are installed on transit vehicles and used to collect ridership, fare, and origin-destination information. These systems streamline transit operations and enable better route assignment, equipment usage, and route planning.

**Transit Vehicle Management**

Transit onboard vehicle management systems automatically detect vehicle mechanical problems and report them to the transit agency's maintenance department. Sensors installed onboard transit vehicles transmit diagnostic information to the maintenance facility in almost real-time, significantly enhancing transit operations and roadway safety. Prior to the implementation of these systems, vehicle problems often remained undiscovered until the vehicle became damaged or inoperable. A transit vehicle management system; however, reports these problems earlier, giving maintenance personnel time to repair and dispatch the vehicle when maintenance services are completed.

## 4.2 INCIDENT AND EMERGENCY MANAGEMENT SYSTEMS

Identifying and reporting incidents soon after they occur can decrease response time, improve safety, and minimize delays and other traffic-related effects. The impact of incidents on travel safety and roadway efficiency can be minimized through several ITS technologies. These technologies enhance incident identification, verification, notification, and response. Thus, these systems enable operators to dispatch appropriate personnel and equipment quickly, clearing incidents and treating victims in an efficient and timely manner.

**Hazardous Materials Tracking and Reporting**

Weigh Stations are equipped with systems that enable operators to process manifests and weigh their vehicles without stopping. This will enable staff at the weigh station to identify commercial vehicles carrying hazardous materials and if necessary divert them to alternate routes.

**Closed Circuit Television (CCTV)**

CCTV is used to monitor and confirm congestion, incidents, weather, and road surface conditions. CCTV cameras will enhance incident management operations through fast identification and verification of incidents. This enables quick dispatch of appropriate equipment needed to the clear the incident, treat injured persons, and clear or treat the roadway.

**Vehicle Detection**

Vehicle detection sensors enable operators to monitor traffic volumes and congestion from a remote location. Traffic data can be stored in a database and used to enhance transportation operations, maintenance, and planning processes.

**Dynamic Message Signs (DMS)**

Fixed and portable DMS are used along freeways and major arterials to report incident information to motorists and to guide motorists around affected areas. Signs can also provide alternative routing directions or other pertinent messages.

**Highway Advisory Radio (HAR)**

HAR provides audible warnings to drivers well in advance of an impacted area.

The incident management technologies described above can have a beneficial impact on several areas of transportation, including commercial vehicle operations and emergency management. Incident management technologies make it easier to inform commercial vehicle operators of incidents with adequate time to divert the vehicle around the incident. Likewise, emergency management dispatchers can use or benefit from incident management technologies to visually confirm and determine the extent of an incident. Dispatchers can relay this information to emergency responders in the field so they can select an appropriate route and make necessary preparation before arriving at the scene.

## 4.3 TRAVELER INFORMATION SYSTEMS

In the future, travelers will utilize landline and wireless communications for obtaining travel related information. Wireless communications will provide access to traveler information at all times and in most locations.

**5-1-1**

The 5-1-1 telephone traveler information service, recently launched in the Cincinnati/Northern Kentucky metropolitan area, is gaining popularity with other states and is expected to be widely implemented in the future. Drivers can call the 5-1-1 number on their mobile communication device (e.g., cell phones) to obtain near real-time traveler information. Currently, each region within the state of Alaska uses a different travel advisory number. 5-1-1, would tie each region together, and offer a simple number that is easy to remember and could be used anywhere in the state.

**Internet**

The Internet is a vital medium for distribution of pre-trip traveler information. Whether at home, work, or another fixed location, information on the Internet can be easily accessed, and offers the information needed to plan a trip.

**Wireless Web**

In the future, motorists will likely be able to obtain pre-trip and en route traveler information via a personal digital assistant or other device that supports wireless web browsing. Onboard devices will be fully equipped with web-based Traveler Information Systems. This will allow drivers to obtain directions to their destination, including but not limited to the nearest gas station or restaurant, without stopping.

## 4.4 SYSTEMS FOR INTERNAL OPERATIONS

ITS can help facilitate better internal operations, allowing agencies to minimize financial and physical resources. The following technologies will help streamline operations, reduce costs, and improve safety and efficiency of the roadway network.

## 4.5 INTERNAL OPERATIONS

**Mobile Data Terminals (MDTs)**

MDTs can greatly enhance internal agency communication in the MOA, providing personnel in the field with greater flexibility to collect and report information. This will enhance in-field operations and alleviate the burden traditionally placed on dispatchers at a fixed facility. MDTs also provide an easier means to disseminate information from the field to the operation center.

**Material Usage Tracking**

Tracking the amount of ice- and snow-fighting chemicals, fuel, and other resources consumed by various maintenance activities will significantly enhance operations in Anchorage. Tracking the use of resources year after year will allow a more realistic amount of resources to be ordered, thus reducing overspending.

**Asset Management**

An Asset Management System stores condition information for pavement and infrastructure so it can be used more effectively. This information can be integrated into a geographic information system (GIS) and used to easily identify the condition of infrastructure at desired locations. This allows funding to be allocated among roadways and/or structures in the most need of repair.

**Automatic Vehicle Location (AVL)**

AVL sensors installed on transit and maintenance vehicles will communicate with Global Positioning Systems (GPS) to provide dispatchers with real-time vehicle locations and movements. This information can enable dispatchers to assign vehicles to a location (e.g., avalanche or transit stop) based on the current location of an available vehicle. Maintenance vehicles can use this information to locate streets that have/have not been cleaned or plowed, reducing costs and the time needed to complete these activities. This technology can also be used to quickly locate a stalled or disabled vehicle and to provide real-time bus arrival information to transit users via the Internet, kiosks, or message boards at transit stops.

**Shared Traveler and Traffic information Database**

Individual agency data is a valued asset not only to the agency itself but to other agencies as well. A shared traveler and traffic information database will enable agencies to share their electronic data (e.g., GIS, crash data) in exchange for other agency data. This will enhance operations of each participating agency by reducing data collection costs, and increasing data usefulness.

**Condition Acquisition and Reporting System (CARS)**

CARS is a web-based software tool that allows authorized staff (i.e., police, city officials, ADOT personnel, or another user) to input accident, construction, delay, and other roadway and weather information into statewide databases. Users of the system can store information on active incidents (e.g., hazardous material spills, crashes, or natural disasters) or planned incidents (e.g., events, construction activities, road closures) in the database quickly using pull-down menus, or manually using text entries. This information, plotted and illustrated graphically for quick reference, should be filtered before passing it along to the traveler via the Internet, HAR, DMS, or another communication channel.

**Common Geographic Information System**

A GIS enhances data analysis by displaying text and numerical information in spatial format to enable quick and easy identification of patterns in the data for specific areas in the municipality and surrounding areas. A GIS also offers advanced functions, including buffers and queries to help users analyze a data set.

Many agencies in Anchorage own a geographic information system, but do not exchange information. Information exchange is hindered by lack of uniform programs and inter-agency cooperation. A common GIS System can enable exchange of usable map layer files between agencies, resulting in enhanced information exchange.

# 5. OPERATIONAL ANALYSIS

This section provides a comprehensive analysis of current ITS operations within the municipality. This analysis fully considers ITS functions operated by the municipality and other stakeholders throughout the region. Significant emphasis is placed on the exchange of information among stakeholders. This section also provides a baseline comparison of current operations to potential future operations identified in the ITS vision.

## 5.1 CURRENT OPERATIONS

Functions performed by the municipality and partner agencies are described in this section. Information contained in this section was derived from an earlier statewide assessment, as well as face-to-face and one-on-one interviews.

**Municipality of Anchorage – Traffic Engineering**

The municipality's Traffic Engineering Division provides safe and efficient movement of vehicles, pedestrians, and bicycles. This division designs, implements, and maintains traffic signals, pavement markings, and signing for the municipality. Currently, there are 249 traffic signals, and all but nine have dedicated communications. Additionally, the Traffic Engineering Division provides support to the Alaska Department of Transportation and Public Facilities (ADOT&PF) for maintenance of traffic signal systems on the Kenai Peninsula and the Matanuska Susitna Valley. It is also the central point for collection and processing of crash data in the Anchorage Bowl, and jointly monitors a count and data collection program.

Information shared between the municipality's Traffic Engineering Division and other agencies includes:

- Traffic and crash data (municipality's Planning Department)
- Traffic counts for air quality (Health Department)
- Crash data collected to help identify problem locations (Police Department)
- Traffic volume and crash data to the public, when requested
- Road closures, re-route, and parade permit information with street maintenance

**Municipality of Anchorage – Information Technology Department**

The Information Technology Department is responsible for creating, storing, and providing access to GIS databases for different divisions within the municipality.

**Municipality of Anchorage – Project Management**

The municipality's Project Management Division provides stormwater management for flooding and surface water protection. Part of this agency's responsibility is to help document maintenance operations by tracking materials used to control snow and ice.

The Project Management Division often interacts and exchanges data and information with other divisions within the municipality, including the following:

- Street maintenance
- Capital Improvement Team (CIP)
- Planning
- Development
- Parks

A common GIS platform would greatly enhance information exchange between the Project Management Division and the agencies listed above. It would also enhance exiting operations, enabling the Project Management Division to better perform the following functions:

- Track roadway changes resulting from construction or maintenance activities
- Inventory the use of materials
- Determine the level of maintenance vehicle use, for developing a benefit/cost analysis to compare different operational strategies
- Develop database of drainage systems

**Municipality of Anchorage – Emergency Management**

Located in Anchorage's Emergency Operations Center, the municipality's Emergency Response Division coordinates with other municipal agencies and emergency service providers to provide effective and timely response to local disasters and emergency situations. Coordination includes data sharing with the state Emergency Operations Center (EOC) and National Weather Service. The Emergency Management Division also provides information to the media, for quick delivery to the public.

Plans to enhance activities associated with the Emergency Response Division include:

- Installation of MDTs in ambulances and fire trucks
- Computer-Aided Dispatch system for fire
- Development of a GIS
- Advanced national seismic system
- Advanced tsunami warning system

**Municipality of Anchorage – Purchasing Department**

The municipality's purchasing department is responsible for acquiring the necessary supplies and services needed to maintain efficient operations within the municipality. One goal of the purchasing department is to track materials for snow and ice removal. This ensures that only the necessary supplies are purchased in order to conserve funds. The Purchasing Department is also responsible for disposal of unused materials.

**Municipality of Anchorage – Public Transportation**

The municipality's Public Transportation Division is responsible for providing public transportation services to Anchorage residents. Currently, the Public Transportation Division is involved in two significant ITS efforts:

- First, the division is planning to install GPS vehicle location systems on their buses to provide stop enunciator capability.
- Second, the bus system plans to add full AVL for transit management and traveler information.

Besides these two efforts, the Public Transportation division, would like to participate in a municipality-wide GIS, using layers to plot the location of bus stops.

**Municipality of Anchorage – Office of Planning, Development, & Public Works Project Management & Engineering Department**

These two departments are responsible for handling capital improvement projects for the municipality. These projects are associated with roads, buildings, and parks, but not water resources and utilities. These two departments provide ADOT&PF with information related to Right of Way acquisition and permitting, pre-construction, and design.

**Municipality of Anchorage – Street Maintenance**

The municipality's Street Maintenance Division maintains the drainage system and roughly 700 miles of paved and unpaved roadway in the municipality. In addition, the maintenance department handles drainage issues, maintains approximately 250 miles of trails in roughly 40 parks, and is responsible for the Recycled Asphalt Program (RAP).

The Street Maintenance Division receives information and data from several local agencies. From the municipality's Asset Management System, the Street Division receives data that helps track material usage. The Maintenance Division combines this information with historic weather data to determine the cost of snow removal. The Maintenance Division receives maintenance-related calls from the public, resulting in work orders sent to maintenance crews before the start of each workday.

**Municipality of Anchorage Police Department**

The mission of the Anchorage Police Department is to:

- Provide enforcement and public safety, and
- Provide security through education.

Anchorage Police primarily interact with the Alaska State Patrol, the Department of Transportation, Fire, and the municipality's traffic office. They are responsible for providing data, including collision and criminal reports.

**Municipality of Anchorage Fire Department**

Due to Anchorage's location and rugged environment, the Anchorage Fire Department offers specialized services for use in specific types of emergencies. The Anchorage Fire Department has the following teams:

- dive team
- mountain team
- crash team
- water rescue team, and
- a hazardous materials team.

To provide better services to the public, the department has also entered into mutual aid agreements with these agencies:

- State of Alaska International Airport Aircraft/Rescue/Fire
- Elmendorf Air Force Base Fire Department
- Fort Richardson Fire Department
- Girdwood Volunteer Fire Department, and
- Chugiak Volunteer Fire Department.

During fire season, the department also lends support to other south-central communities threatened by wildfires.

**Alaska Trucking Association**

The Alaska Trucking Association oversees more than 190 motor carriers operating in the state of Alaska. They send member carriers weather, weight restriction, and road closure information via e-mail or fax. Much of this information is sent to the association from the ADOT&PF, where it is then passed along to the carriers. Besides ADOT&PF, the association also interacts with the USDOT and the Department of Motor Vehicles.

**United States Air Force – Elmendorf Air Force Base**

The Elmendorf Air Force Base interacts with several agencies in the MOA. Vehicle count data is exchanged between the base and state/municipality. In October 2000, the base started to share databases with Fort Rich, the National Guard, the municipality, and engineering firms. Beside data exchange, they also coordinate with fire for emergency response and with the Anchorage School District.

**United States Army – Fort Richardson**

The Fort Richardson Army Base coordinates with the ADOT, the Anchorage School District, the Elmendorf Air Force Base, and with several emergency response agencies. The agency and the information/data that is exchanged with the Army Base is provided below.

- Weather, road condition, and road weight constrictions provided by ADOT;
- Closure information exchanged between the base and The U.S. Air Force Base at Elmendorf;
- Relevant information pulled from fire, police, and Bureau of Land Management & Forest Service radio; and
- School closure information is obtained directly from the school district, or indirectly through communication with the Elmendorf Air Force Base.

**University of Alaska Anchorage**

The University of Alaska at Anchorage (UAA) works on research projects brought forward by the ADOT&PF. The UAA is currently working with ADOT&PF on "Payload," a three-phased project that will identify potential ITS applications for freight and cargo movement, evaluate the feasibility of potential applications, and prioritize potential applications.

**ADOT&PF Central Region Traffic and Safety**

The Traffic & Safety staff's main function is to support the work of preliminary design, design, construction, and maintenance staff. The staff provides expertise in signing, striping, signals, lighting, traffic control, and safety. In addition, they provide recommendations and analysis for geometrics, intersection capacity, signal warrants, lighting warrants, sight distance, channelization, capacity, traffic control plans, guardrail warrants, and speed limits.

The traffic engineering analyses performed by this office are supported by traffic data provided by the planning department, including count and speed data. In addition, this office coordinates with the MOA on traffic signal operations. They also receive accident data from headquarters that is updated once a year for the prior year.

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**ADOT&PF Bridge Office**

The Bridge Design section is a statewide unit. There are two primary functions carried out by this office:

- Provision of design services and consultant oversight for new bridge and/or bridge rehabilitation construction projects
- Provision of a broad range of services associated with the State's existing inventory 916 public highway bridges, including those in the Anchorage region

From an operational perspective, this office is responsible for collecting and monitoring data related to bridge scour. Scour data, collected every two-hours, is transmitted once a day. Readings are taken every fifteen minutes during floods.

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**ADOT&PF Traffic Materials – Preliminary Engineering**

Preliminary Design and Environmental (PD&E) staff is primarily responsible for:

- Initial planning and programming of projects by providing the planning staff with cost estimates and comments on engineering and environmental aspects of the proposed project
- Interaction with the project manager and representatives from maintenance and construction, refining the project scope and developing a Scoping Management Plan.

This group also uses data provided by statewide planning. This data is primarily used to develop the safety improvement program and to observe environmental impacts.

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**ADOT&PF Maintenance**

The primary function of the maintenance department is to maintain roadways. This includes routine and emergency maintenance, as well as snow and ice removal. During the summer, maintenance activities generally entail:

- Resurfacing and chip sealing,
- Clearing culverts and maintaining drainage,
- Patching potholes, and
- Activities to prolong pavement life.
- They assist state troopers upon request in event of major incidents. The maintenance department also provides and uses weather information.
- Maintenance departments throughout the State of Alaska have agreements with cities that enable them to share each other's equipment.

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**ADOT&PF – Highway Data Section**

The highway data section collects traffic count and weigh in motion data. This data is provided to meet federal-reporting requirements, to the traffic group to support design, AND to other government agencies to support their own planning purposes.

The count program is conducted under contract. Both ADT and turning movement counts are also conducted. The state collects data on Borough roads that may affect state facilities. There is a summer count program that collects 400 to 600 counts per year, depending on the weather, using tube counters in the region. About 100 of these are in Anchorage.

Automated traffic recorders (ATRs), deployed throughout the Anchorage region to collect traffic volumes and classification data, are connected via dial-up, and downloaded once or twice per week. Some of these ATRs are equipped with sensors that are buried into the roadbed and sub-grade for temperature monitoring. This information helps in posting load restrictions. The temperature information is downloaded once or twice per week, and is sent to local maintenance offices. A summary report is created for the region maintenance and operations office.

The Highway Data Section develops and publishes Annual ADT maps to provide data for developers, local public sector agencies, ADOT Design Group, and residents.

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**Alaska Division of Motor Vehicles**

The Division of Motor Vehicles registers and titles motor vehicles and licenses drivers statewide. They also administer the safety responsibility law and the driver improvement point system, and collect motor vehicle registration taxes. Both driver licensing and vehicle registration information is shared with the Alaska State Troopers.

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**Alaska Division of Air Quality**

The mission of the Division of Air Quality is to improve air quality and keep pollutants below national ambient air quality standards. Essentially, this Division is responsible for protecting the health and welfare of the citizens in the State of Alaska.

From ADOT&PF, the Division of Air Quality receives vehicle miles of travel (through the Highway Performance Monitoring System (HPMS)) and seasonally adjusted ADT. Currently, air quality initiatives are primarily focused on the Anchorage Bowl. In addition, the Division of Air Quality provides ADOT&PF with emission inventory and vehicle mix information, primarily for modeling and environmental assessment.

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**Emergency Medical Services**

The primary goal of EMS is to decrease morbidity/mortality through appropriate medial care, appropriate use of data, emergency transport, and injury prevention. When responding to incidents, EMS is in radio contact with hospitals and dispatch. While on-scene, EMS interacts and communicates with both police and fire personnel.

Additional data that is shared with other entities includes:

- Population-based trauma registry
- Crash data for ADOT is linked with the trauma registry and provides outcomes with circumstances of accidents
- EMS provides the data contained in the trauma registry to Output of Anchorage Safe Community

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**Alaska Highway Safety Planning Agency**

The primary function of the Alaska Highway Safety Planning Agency is to enhance the health and well-being of motorists and transportation service providers through road safety. The agency typically focuses on the following program areas:

- Operator/occupant protection
- Alcohol/DUI enforcement, education, and enforcement

The agency has an outreach function through partner organizations to focus on safety and injury prevention. The primary goal of this organization is to distribute information to the public. In addition, the agency is the keeper of the Fatal Accident Reporting System (FARS) database. This does not include information related to non-fatal crashes. The agency also provides blood-alcohol content information to other operating entities.

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**Alaska Division of Tourism**

The Division of Tourism promotes visitation to Alaska with the objective of using the visitor industry as an economic development tool. The Division of Tourism maintains a website that includes attractions, tourism information, maps, and links to the local Convention and Visitor's Bureaus.

(This information was gathered during the Alaska Statewide Deployment Strategy interviews.)

**Alaska State Troopers**

The primary functions of the Alaska State Troopers are to provide law enforcement and public safety services. They are responsible for a broad range of enforcement duties, which can be significant because they are also responsible for search and rescue on a statewide level and there are vast areas with no other law enforcement agencies. However, within the MOA, the Anchorage Police Department is the primary enforcement agency. Entities that Alaska State Troopers regularly share data with include:

- Other police agencies throughout the state via the Alaska Public Safety Network, including information to supporting search-and-rescue efforts, intelligence data, and information exchanges with the FBI
- Health & Social Services (EMS)
- ADOT – radio traffic, roadway conditions crash reports to ADOT
- ADOT maintenance – in the event of major accidents

While managing major accidents, they also interact with fire departments and HAZMAT enforcement agencies

(This information was gathered during both the Anchorage interviews and the Alaska Statewide Deployment Strategy interviews.)

**Table 4-1: Operational Analysis**

| Operating Agency | Transportation Function | Transportation Data | Data Sources |
|---|---|---|---|
| MOA – Traffic Engineering | • Traffic Control Design, Maintenance and Operations<br>• Asset Management | • Crash Data<br>• Traffic Volume Data<br>• Road Closures | • State Crash Database<br>• APD<br>• ADOT&PF<br>• Traffic Engineering |
| MOA –IT Department | • GIS Management and Data Storage | • GIS (Roads, Trails)<br>• Permit | • Traffic<br>• Elmendorf AFB<br>• State EOC<br>• Planning<br>• ADOT<br>• Fire<br>• AWWU<br>• MOA Parks<br>• MOA Project Management |
| MOA – Project Management | • Storm Water Management | • Amount of Maintenance Materials | • Maintenance<br>• Capital Improvement Team<br>• Planning<br>• Development<br>• Parks |
| MOA – Purchasing | • Acquisition and Management and supplies and services | • Inventory of materials | |
| MOA – Public Transportation | • Provide Public Transportation Services | • Collision/Incident Information<br>• Transit schedules<br>• Fare information | • Dispatchers/drivers<br>• Internal databases |

| Operating Agency | Transportation Function | Transportation Data | Data Sources |
|---|---|---|---|
| MOA – Transportation Planning | • Computer Modeling for Transportation Planning | • GIS Road Network (TRANSCAD)<br>• Traffic Volume Data<br>• Transit Data<br>• Vehicle Classification Data | • MOA Traffic<br>• ADOT&PF |
| MOA – Planning, Public Works & Engineering | • Responsible for Capital Improvement Projects within MOA<br>• GIS Management and Data Storage | • ROW Acquisition<br>• Environmental Impact Data<br>• GIS (Roads) | • ADOT&PF<br>• Fish and Wildlife<br>• Capital Improvement Team<br>• Planning<br>• Public Works<br>• Parks<br>• Traffic<br>• Fire<br>• AWWU |
| MOA – Emergency Response | • Emergency Response Coordination | • Weather/Incident Information | • Police<br>• Fire<br>• Planning<br>• Public Works<br>• National Weather Service<br>• Department of the Interior<br>• Forest Service<br>• Department of Defense<br>• Environmental Conservation<br>• Utilities<br>• Emergency Services<br>• FEMA<br>Railroad |

| Operating Agency | Transportation Function | Transportation Data | Data Sources |
|---|---|---|---|
| MOA – Street Maintenance | • Street Sweeping<br>• Snow and Ice Removal<br>• Drainage<br>• Asset Inventory Reporting | • Maintenance Operational Data | • Parks Department<br>• MOA Traffic<br>• MOA PM&E |
| MOA Police | • Provides public safety and enforcement | • Collision Reports<br>• Criminal Analysis Data | • Alaska State Troopers<br>• ADOT<br>• Fire<br>• Air Force and Army Base |
| Alaska Trucking Association | • Assists motor carriers in the State of Alaska | • Weight restrictions<br>• Road closures<br>• Weather advisories | • ADOT&PF<br>• DMV<br>• USDOT |
| Elmendorf Air Force Base | • Infrastructure support | • Vehicle Counts<br>• GIS Data | • MOA<br>• State of Alaska<br>• MOA School District<br>• Fort Richardson |
| Fort Richardson Army Base | • Infrastructure support | • Weather advisories<br>• Road Conditions and weight restrictions<br>• GIS Data | • Elmendorf AFB<br>• ADOT<br>• Fire<br>• MOA and State Police<br>• Alaska Rail |
| University of Alaska at Anchorage | • Serves as research center for transportation, power, and communications | | |
| ADOT&PF Traffic and Safety (Central Region) | • Traffic Engineering Analysis<br>• Traffic Signal Operations | • Traffic Count Data<br>• Speed Data<br>• Accident Data | • ADOT&PF Planning Department<br>• ADOT&PF Headquarters |

| Operating Agency | Transportation Function | Transportation Data | Data Sources |
|---|---|---|---|
| ADOT&PF Bridge Office | • Design Services<br>• Inventory of Bridges<br>• Scour Detection | • Scour and Flood Data | • Field equipment |
| ADOT&PF Maintenance | • Routine Maintenance<br>• Snow and Ice Removal Incident Management | • Incident data<br>• Roadway conditions<br>• Weather conditions and forecasts | • National Weather Service<br>• Alaska State Troopers |
| ADOT&PF Highway Data Section | • Traffic Data Collection<br>• Weigh in Motion Data | • Traffic Count Data<br>• Speed Data<br>• Accident Data | • Field equipment |
| Alaska Division of Motor Vehicles | • Driver's Licensing<br>• Vehicle Registration | • Enforcement Data | • Alaska State Troopers |
| MOA – Fire | • Emergency Response | | |
| Alaska Division of Air Quality | • Initiates Programs to Improve Air Quality | • VMT<br>• ADT | |
| Emergency Medical Services | • Incident Management | • Incident Location<br>• Crash and Victim Condition | • Alaska State Troopers<br>• Fire |
| Alaska Highway Safety Planning Agency | • Improve Traffic Safety through outreach | • Traffic Volumes<br>• Death Certificate Information<br>• Crash Data<br>• License and Registration Information | • EMS<br>• ADOT&PF<br>• DMV<br>• Health and Social Services |
| Alaska Division of Tourism | • Provide Traveler Information | • Ferry Schedule Data<br>• Ferry Reservation Information | • AHMS |

| Operating Agency | Transportation Function | Transportation Data | Data Sources |
|---|---|---|---|
| Alaska State Troopers | • Provide Public Safety and Enforcement | • Incident Data<br>• Intelligence Data<br>• Crash Data<br>• Traffic Conditions<br>• Weather and Roadway conditions | • ADOT&PF Planning<br>• Local Agencies<br>• Fish and Game<br>• Alaska State Troopers |
| Alaska Railroad Corporation | • Provides Public Transportation and Freight Services<br>• Provides Traveler Information<br>• Responsible for Highway/Rail Intersection Advanced Warning Implementation | • Collision/Incident Information<br>• HRI Warning Information<br>• Schedule Information<br>• Fare Information<br>• Internal Operations – GPS Tracking of Trains | • ARRC Operations |

## 5.2 NEEDED FUTURE OPERATIONAL STRATEGIES

To realize the ITS vision provided in the previous section various additional operational strategies will need to be implemented by both the municipality and their stakeholders. Table 4-2 summarizes the functions that will be required in the future to realize the vision. In addition, this table illustrates the relationship of required functions to the program area. The first column identifies the ITS program area supported by the function. The second column identifies the functions that are identified in the vision. The third column identifies the current status of the functions that are required to support the ITS strategy. The fourth column identifies the functions that will need to be implemented in the future.

**Table 4-2: Required Future Operational Strategy**

| ITS Program Area | ITS Strategy and Responsibility | Required Functions | Existing System Functionality | Future Functional Needs |
|---|---|---|---|---|
| Year-Round Operations | Weather and Pavement Sensors<br><br>Implementation Responsibility: ADOT&PF<br>Operations Responsibility: ADOT&PF | Measure<br>• Ambient air and pavement temperature<br>• Wind Speed and direction<br>• Relative Humidity<br>• Visual Observations | None | Measure<br>• Ambient air and pavement temperature<br>• Wind Speed and direction<br>• Relative Humidity<br>• Visual Observations |
| | Smart Snowplows<br><br>Implementation Responsibility: MOA<br>Operations Responsibility: MOA | • Measure road surface friction<br>• Compile data from roadway sensors<br>• Calibrate appropriate amount of chemical and sand<br>• Track snow and ice operations including use of sand by rate and vehicle<br>• Snowplow guidance | None | • Measure road surface friction<br>• Compile data from roadway sensors<br>• Calibrate appropriate amount of chemical and sand<br>• Track snow and ice operations including use of sand by rate and vehicle<br>• Snowplow guidance |

| ITS Program Area | ITS Strategy and Responsibility | Required Functions | Existing System Functionality | Future Functional Needs |
|---|---|---|---|---|
| | Traffic Signal System<br><br>Implementation Responsibility: MOA<br>Operations Responsibility: MOA | • Integrated and remote signal control | None | • Integrated and remote signal control |
| | Highway Rail Intersection Warning System<br><br>Implementation Responsibility: Alaska Rail<br>Operations Responsibility: MOA | • Advance warning of trains to motorists | None | • Advance warning of trains to motorists |
| Year-Round Operations | Transit Signal Priority (Needs Study)<br>Implementation Responsibility: MOA (Public Transportation & Engineering)<br>Operations Responsibility: MOA Public Transportation & Engineering) | • In-field Signal Control | None | • In-field Signal Control |

| ITS Program Area | ITS Strategy and Responsibility | Required Functions | Existing System Functionality | Future Functional Needs |
|---|---|---|---|---|
| | Smart Fare Box<br><br>Implementation Responsibility:<br>MOA Public Transportation<br>Operations Responsibility:<br>MOA Public Transportation | Collect:<br>• Origin/Destination, and<br>• Passenger characteristics | | Collect:<br>• Origin/Destination, and<br>• Passenger characteristics |
| | Transit Vehicle Management<br><br>Implementation Responsibility:<br>MOA Public Transportation<br>Operations Responsibility:<br>MOA Public Transportation | | | |
| Incident and Emergency Management | Hazardous Materials Tracking and Reporting<br><br>Implementation Responsibility:<br>ADOT&PF<br>Alaska State Troopers<br>Operations Responsibility:<br>Alaska State Troopers | • Monitor movement of vehicles carrying hazardous materials | None | • Monitor movement of vehicles carrying hazardous materials |

| ITS Program Area | ITS Strategy and Responsibility | Required Functions | Existing System Functionality | Future Functional Needs |
|---|---|---|---|---|
| | Closed Circuit Television<br><br>Implementation Responsibility:<br>ADOT&PF<br>MOA<br>Operations Responsibility:<br>MOA (if within MOA Boundary) | • Monitor and confirm, incidents, and roadway surface conditions. | • Monitor and confirm weather conditions | • Monitor and confirm, incidents, and roadway surface conditions. |
| | Vehicle Detection<br><br>Implementation Responsibility:<br>ADOT&PF<br>MOA<br>Operations Responsibility:<br>MOA | • Detect and classify vehicles | None | • Detect and classify vehicles |
| | Dynamic Message Signs<br><br>Implementation Responsibility:<br>MOA<br>ADOT&PF<br>Operations Responsibility:<br>MOA | • Provide en route traveler information | None | • Provide en route traveler information |

| ITS Program Area | ITS Strategy and Responsibility | Required Functions | Existing System Functionality | Future Functional Needs |
|---|---|---|---|---|
| | Highway Advisory Radio<br><br>Implementation Responsibility:<br>MOA<br>ADOT&PF<br>Operations Responsibility:<br>MOA | • Provide en route traveler information | None | • Provide en route traveler information |
| Traveler Information | 5-1-1<br><br>Implementation Responsibility:<br>ADOT&PF<br>Operations Responsibility:<br>ADOT&PF<br>MOA | • Provide en route traveler information | None | • Provide en route traveler information |
| | Internet<br><br>Implementation Responsibility:<br>ADOT&PF<br>MOA<br>Operations Responsibility:<br>ADOT&PF<br>MOA | • Provide Pre-trip traveler information | None | • Provide Pre-trip traveler information |

| ITS Program Area | ITS Strategy and Responsibility | Required Functions | Existing System Functionality | Future Functional Needs |
|---|---|---|---|---|
| | Wireless Web<br><br>Implementation Responsibility:<br>ADOT&PF<br>MOA<br>Operations Responsibility:<br>ADOT&PF<br>MOA | • Provide Pre-Trip traveler information | None | • Provide Pre-Trip traveler information |
| Internal Operations | Mobile Data Terminals<br><br>Implementation Responsibility:<br>MOA (APD, Fire)<br>Operations Responsibility:<br>MOA (APD, Fire) | • In-field communications | None | • In-field communications |
| | Materials Usage Tracking<br><br>Implementation Responsibility:<br>MOA Maintenance<br>Operations Responsibility:<br>MOA Maintenance | • Inventory materials used | None | • Inventory materials used |

| ITS Program Area | ITS Strategy and Responsibility | Required Functions | Existing System Functionality | Future Functional Needs |
|---|---|---|---|---|
| | Asset Management<br><br>Implementation Responsibility:<br>MOA<br>ADOT&PF<br>Operations Responsibility:<br>MOA<br>ADOT&PF | • Inventory and condition of Infrastructure | None | • Inventory and condition of Infrastructure |
| | Automatic Vehicle Location<br><br>Implementation Responsibility:<br>MOA (various departments)<br>Operations Responsibility:<br>MOA (various departments) | • Provide real-time vehicle location data<br>• Monitor vehicle movements | None | • Provide real-time vehicle location data<br>• Monitor vehicle movements |
| | Shared Traveler and Traffic Information Database<br><br>Implementation Responsibility:<br>ADOT&PF<br>MOA<br>Operations Responsibility:<br>ADOT&PF<br>MOA | • Data Storage and retrieval | None | • Data Storage and retrieval |

| ITS Program Area | ITS Strategy and Responsibility | Required Functions | Existing System Functionality | Future Functional Needs |
|---|---|---|---|---|
| | Condition Acquisition and Reporting System<br><br>Implementation Responsibility:<br>ADOT&PF<br>MOA<br>Operations Responsibility:<br>MOA<br>ADOT&PF | • Provide near real-time weather data | None | • Provide near real-time weather data |
| | Common Geographic Information System<br><br>Implementation Responsibility:<br>MOA<br>ADOT&PF<br>Other Participating Organizations, e.g. Air Force Base)<br>Operations Responsibility:<br>MOA<br>ADOT&PF<br>Other Participating Organizations, e.g. Air Force Base) | • Data storage and analysis | • Data storage and analysis | • None |

# 6. LEGACY SYSTEM ANALYSIS

This section provides an analysis of ITS previously deployed throughout the state of Alaska. These systems are defined in terms of:

- Operational functions
- Data sharing functions and infrastructure
- Data requirements
- Geographical location of deployments
- The municipality's role in operating these systems (e.g., determination of regional function or statewide functions)

## 6.1 LEGACY SYSTEM FUNCTIONAL ANALYSIS

The municipality has initiated the process of deploying ITS technologies throughout the region. Analysis of current systems is critical to evaluate whether existing systems have the potential to provide the desired functionality identified in the ITS Vision. In addition, this high-level assessment provides the opportunity to evaluate system integration that will be deployed in the future, which may also help in achieving the ITS vision.

### Roadway Weather Information Systems (RWIS)

In a recent project, the ADOT&PF have installed eight RWIS stations in the Anchorage area. All units are connected to a central server that, initially, only ADOT&PF personnel can access. Available information includes the following:

- Pavement temperature
- Chemical composition on pavement
- Ambient air temperature
- Wind speed and direction
- Relative humidity

### Closed Circuit Television

As part of the RWIS project described above, ADOT&PF has installed CCTV cameras at each of the RWIS sites. Still motion "snapshot" images are available on a website that ADOT&PF personnel can access.

### Dynamic Message Signs

The Anchorage Police Department operates portable DMS for traffic control during construction on arterials and freeways. Fixed DMS are located on Glenn and Seward Highways.

### Highway Advisory Radio

HAR is operational on the Seward Highway. Includes such information as avalanche and weather warnings. Special event HAR is provided for the Whittier/Palmer area during the State Fair.

### Mobile Data Terminals

The MOA has installed mobile data terminals (MDT's) in their police vehicles to enhance operational efficiency. The MDT's to be installed will provide both Computer-Aided Dispatch (CAD) and Automatic Vehicle Location (AVL) functions.

CAD combines computer and communication technologies to better manage communications among vehicles in the field and dispatch centers. CAD will enable the following functions:

- Assisting dispatchers in tracking the status of field units, and dispatching of vehicles based on proximity and available equipment
- Assisting the agencies in accessing multiple databases with information on issues such as Haz-Mat locations, national crime databases, and data from department of licensing and motor vehicles
- Electronic tracking of dispatch "events" in case reconstruction is necessary. A complete history is recorded and available on-line for problem resolution

AVL systems provide the ability to track vehicle movements through time and space. Emergency vehicle management, transit operations, and maintenance operations have applied this technology to maximize operational efficiency of vehicle fleets.

It is also anticipated that several other law enforcement agencies from across the state will implement MDT's on their patrol vehicles. The MOA is among these agencies, and has initiated the process of implementing Mobile Data Terminals (MDT's) on its entire fleet of patrol cars.

**Traffic Signal Systems**

The MOA owns and operates a central signal control system. Traffic detection is based on a system of detectors embedded in the pavement at various locations around the municipality. Vehicle detectors installed on poles are found on Minnesota Drive, but plans call for their removal in 2002.

**Automatic Traffic Recorders (ATR's)**

Forty-five permanent automatic traffic recorders (ATR's) have been deployed throughout the Anchorage Bowl, and approximately 100 count stations have been deployed throughout the state. The ATR's are used to meet the federal HPMS reporting requirements and provide traffic data to the ADOT&PF planning department. Data collected includes:

- Volume
- Speed
- Classification

Twenty-three of the stations located in the Anchorage Bowl are equipped with ground temperature sensors.

**Transit Information**

The municipality maintains a website (http://www.peoplemover.org/) that provides travelers with pre-trip information. Functions provided by the website include:

Dynamic route generator that enables users to determine the optimal route based on user requirements that include:

- Origin and destination
- Departure time
- Arrival time requirements
- Ability to transfer
- Travel time table generator
- System maps

Detailed route information, including:

- Major transfer points
- Major points of interest
- Transit On-board Systems
- GPS-based next stop annunciation and DMS

**Temperature Sensors**

As mentioned in Section 5.1, 23 temperature sensors are deployed in the Anchorage Bowl to obtain sub-grade temperature data. Currently these devices are not used for operations and management functions. Rather they are an element of the highway performance monitoring system.

Table 4-3 provides a summary of legacy systems in the municipality:

- The first column identifies the device or system that has been deployed.
- The second column provides the location where these systems are deployed or operate.
- The third column provides a description of the functionality provided by the system or device (e.g., provide roadway conditions).
- The fourth column identifies operational data provided by the system or device (e.g., roadway temperature and moisture).
- The fifth column identifies the power that is required to operate the device/system (e.g., 110 volts).
- The sixth column identifies the communications that have been deployed to communication with the device system.

**Table 4-3: Legacy Systems**

| Equipment/System | Deployment Locations | Function | Data Provided | Communication |
|---|---|---|---|---|
| RWIS | Eight locations in the Anchorage Bowl area | Weather Information Collection | Humidity Pavement temperature<br>Chemical composition on pavement<br>Ambient air temperature<br>Wind speed and direction<br>Relative humidity | Wireline (leased or dedicated circuits or ADOT physical plant) and wireless (cellular, satellite, spread spectrum, ALMRS) |
| Closed Circuit Television | Anchorage | Part of State RWIS system<br>Provision of video images to determine prevailing weather conditions<br>Can be supportive for other surface transportation functions such as incident management | Video images | Telephone circuits or spread spectrum |
| Automatic Traffic Recorders (ATRs) | 45 ATRs have been deployed throughout the Anchorage Bowl. | Facilitate data reporting requirements of federal Highway Performance Monitoring System.<br>Provide traffic data for ADOT&PF planning department. | Vehicle Volumes, Speed and Classification Data.<br>Ground Temperature data? | Wireline (leased or dedicated circuits or ADOT physical plant) and wireless (cellular, satellite, spread spectrum, ALMRS) |
| Dynamic Message Signs | Temporary Deployment on Arterials and freeways around municipality region during construction.<br>Fixed signs at Glenn and Seward Highways. | Provide traffic information and alternative routing during construction periods.<br>Provide traveler information for Glenn and Seward Highway corridors. | Text message sets | Wireline (leased or dedicated circuits or ADOT physical plant) and wireless (cellular, satellite, spread spectrum, ALMRS) |

| Equipment/System | Deployment Locations | Function | Data Provided | Communication |
|---|---|---|---|---|
| Highway Advisory Radio | Seward Highway corridor<br>Special event HAR provided during State Fair. | Provide traveler information | Message sets | Wireline (leased or dedicated circuits or ADOT physical plant) and wireless (cellular, satellite, spread spectrum, ALMRS) |
| Transit Information | Website with pre-trip traveler information. (www.people mover.org)<br>On-board stop annunciation and dynamic message signs. This system operates within PeopleMover service area. | Provide both pre-trip and real-time traveler information. | TBD | TBD |
| Traffic Counting Stations | Anchorage Bowl | Collect traffic counts | | Wireline (leased or dedicated circuits or ADOT physical plant) and wireless (cellular, satellite, spread spectrum, ALMRS) |
| Transit Information Website | | | | TBD |
| Mobile Data Terminals Municipality of Anchorage | Located in numerous police vehicles | Assist dispatchers in tracking location and status of vehicles. Provide linkages to multiple databases for improved operations | Vehicle location<br>Text message sets<br>Vehicle operating characteristics | Radio (Alaska Land Mobile Radio System – ALRMS) |

| Equipment/System | Deployment Locations | Function | Data Provided | Communication |
|---|---|---|---|---|
| Temperature Sensors | 23 with count stations | | | Wireline (leased or dedicated circuits or ADOT physical plant) and wireless (cellular, satellite, spread spectrum, ALMRS) |

## 6.2 MAPPING TO THE NATIONAL ITS ARCHITECTURE

To assist in the development of an ITS architecture for the state of Alaska, current ITS functions have been mapped to the concepts of the National ITS Architecture in Table 4-4. This analysis also provides the opportunity to identify gaps in the desired User Services identified in the User Services Report.

**Table 4-4: Legacy Systems Mapping to the National ITS Architecture**

| | National ITS Architecture Element | | |
|---|---|---|---|
| **Legacy System** | **User Service** | **Sub-System** | **Equipment Package** |
| Roadway Weather Information System | Pre-trip Traveler Information | Roadway | Roadway Environmental Monitoring |
| Closed Circuit Television | Incident Management | Roadway | Roadway Basic Surveillance |
| Dynamic Message Signs | En route Traveler Information | Roadway | Roadway Traffic Information Dissemination<br>Roadway Freeway Control |
| Highway Advisory Radio | En route Traveler Information | Roadway | Roadway Traffic Information Dissemination |
| Mobile Data Terminals | Emergency Management | Emergency Vehicle | On-board EV Incident Management Communication |
| Traffic Signal System | Traffic Control | Roadway | Roadway Signal Controls |
| Automatic Traffic Recorders | Achieved Data | Roadway | Roadside Data Collection |
| Transit Information Website | Pre-trip Traveler Information | Personal Information Access | Personal Basic Information Reception |
| Temperature Sensors | Incident Management | Roadway | Roadway Environmental Monitoring |

## 6.3 FUTURE SYSTEM NEEDS ANALYSIS

Completing a future needs analysis is a critical step in determining the ITS functions needed in the future to realize the ITS vision.

**Table 4-5: Future Infrastructure Needs**

| Program Area | ITS Strategy | Current Deployment Status |
|---|---|---|
| Year-Round Operations | Weather and Pavement Sensors | Deployed |
| | Smart Snowplows | Deployed |
| | Traffic Signal System | Deployed |
| | Highway Rail Intersection Warning System | Not Deployed |
| | Transit Signal Priority | Not Deployed |
| | Smart Fare Box | Not Deployed |
| | Transit Vehicle Management | Not Deployed |
| Incident and Emergency Management | Hazardous Materials Tracking and Reporting | Not Deployed |
| | Closed Circuit Television | Deployed |
| | Vehicle Detection | Deployed |
| | Dynamic Message Sign | Deployed |
| | Highway Advisory Radio | Deployed |
| Traveler Information | 5-1-1 | Not Deployed |
| | Internet | Deployed |
| | Wireless Web | Not Deployed |
| Internal Operations | Mobile Data Terminals | Deployed |
| | Materials Usage Tracking | Not Deployed |
| | Asset Management | Not Deployed |
| | Automatic Vehicle Location | Not Deployed |
| | Shared traveler and traffic information database | Not Deployed |
| | Condition Acquisition and Reporting System | Not Deployed |
| | Common Geographic Information System | Not Deployed |

# 7. COMMUNICATION SYSTEMS ANALYSIS

This section provides a summary of existing communication systems currently deployed in the MOA. Although these communication systems do not currently support ITS functions, they could potentially support future ITS functions identified in the ITS Vision. In addition, this section also provides an analysis of communication infrastructure needed to realize the ITS vision.

## 7.1 WIRELINE COMMUNICATIONS

Wireline communications are comprised of a physical connection, a wire, between two endpoints. It does not matter whether the wire is made of twisted pair cables, coaxial cables, or optical fiber cables, or whether the connection is provided by a service provider or by MOA — the importance is the physical asset of the wire. Specifically, MOA has two options for wireline connections: namely telephone lines and cable modems.

**Telephone Lines**

Local exchange carriers (LECs) and competitive local exchange carriers (CLECs) provide telephone services in Anchorage. These services can be dial-up or dedicated and can range in throughput rates of 56 Kbps to 45 Mbps. Each telephone line is billed similar to regular telephone service. Dial-up lines can be used for nearly all data applications considered for communicating to field devices. Dial-up lines can be used for transmitting video snapshots; however, full motion video requires higher bandwidth than a standard dial-up line can provide. Dial-up lines can give nearly full-motion video using video compression techniques and DSL, if the carrier offers DSL.

Wireline carriers also offer dedicated telephone lines. Dedicated telephone lines can have the same bandwidth as dial-up telephone lines or they can have substantially more bandwidth. Frequent connections are not necessary – there is always a connection between the two ends of the line. Dedicated phone lines are most applicable for applications that require frequent data transmission (once every minute or two). Additionally, higher bandwidth (e.g. T-1 – 1.544 Mbps) lines make high bandwidth applications, such as full-motion video or center-to-center communications, possible.

**Cable Modems**

Cable television providers offer cable modems. Cable modems have relatively high bandwidth and can transmit data and video images. Cable modems are most applicable for CCTV transmission and for center-to-center communication.

## 7.2 WIRELESS COMMUNICATIONS

Wireless communications differs from wireline communications in that there is no physical connection between endpoints. Instead, an air interface and radio spectrum are used between endpoints. Examples of wireless communication options for the MOA include:

- Municipality of Anchorage Radio
- Spread Spectrum Radio
- Alaska Land Mobile Radio
- Cellular service, satellite service
- Planned Alaska Railroad radio system

**Municipality of Anchorage Radio**

Two-way radios are extensively used throughout the municipality to support public safety, law enforcement, public facilities operation, and emergency management.

Advantages of radio systems include:

- Providing voice (and data where applicable) communications to maintenance vehicles
- The ability to propagate into built-up areas and buildings
- Cost effectiveness, depending on the application

Disadvantages of radio systems include:

- Terrain (can limit range)
- Channel availability (limited in urban areas)
- Radio channels (not multiplexed, because of narrow channel width)
- Antennas (required at each controller site)
- Turnaround time (excessive for some applications)
- Service reliability (may limit some applications)
- FCC regulations

**Spread Spectrum Radio**

Spread spectrum radio can be used within the municipality for short-range data communications, in areas where there is adequate line of sight. Spread spectrum radio can be used to transfer data from field devices, including but limited to RWIS stations, and detector stations to a central location where this information can be compiled and analyzed. Because spread spectrum is a wireless device, installation costs are normally less than wireline telephone circuits.

With spread spectrum radio transmission, the signal occupies a bandwidth greater than the minimum necessary to send information. The band spread is accomplished by means of a code that is independent of data, and for subsequent data recovery, synchronized reception is used with the code at the receiver. With spread spectrum radio, the entire band is available to all users. Advantages include:

- Flexible installation
- No cable installation and maintenance requirements
- No FCC channel requirements
- Works extremely well in high-noise environments
- Uses low transmitter power
- Can be used in a mixed system of wired or radio inter-connected controllers
- No land-line interconnect required
- Relatively low equipment cost
- Faster installation than ordering wireline circuit from telephone company
- Potential for broad range of traffic control-system applications

Disadvantages of spread spectrum radio include:

- Power restrictions limit transmitter output to approximately ten miles
- Higher bandwidth than radio fixed-frequency transceivers
- Unprotected channel space
- Requires line-of-sight

**Alaska Land Mobile Radio System**

The ALMRS project will convert the state wideband radio systems to narrowband radio systems enabling interoperability and efficiency of two-radio resources at the state, local, and federal levels. This will prove very useful in coordinating operational procedures and responses to natural disasters and other major catastrophes. The upgraded ALMRS, when deployed beginning in 2002, will permit voice and data communications from both vehicles and fixed locations.

Under this project, the state of Alaska has been divided into four zones: north, south, southeast, and statewide remote. The North zone will likely have 19 sites, the South zone will likely have 42 sites, the Southeast zone will likely have ten sites, and the statewide remote will likely have over 50 sites.

This LMRS offers a significant opportunity to implement many of the projects described in this report, because of the significant infrastructure being installed at a reasonable cost to MOA.

**Cellular Service**

Cellular systems transmit voice, video, and data through the air where the radio signal is transmitted between a subscriber unit (cell phone) and a base transceiver station (BTS). There are several cellular service providers in the Anchorage area that could provide the necessary communication link between field devices and detectors and a communication hub. They offer relatively small throughput, 9.6 Kbps, at a high recurring cost, up to $0.40/minute; however, they could provide an adequate link for temporary operations. Cellular service may be used to transmit still video images, but not full-motion video.

**Satellite Service**

Satellite systems transmit voice, video, and data through the atmosphere where the radio signal is directed to a satellite transponder in orbit above the Earth, instead of using a terrestrial line-of-site transmission, like microwave.

A low-earth-orbit (LEO) satellite system employs a large fleet of satellites, called birds, each in a circular orbit at a constant altitude of a few hundred miles. The orbits take the satellites over, or nearly over, the geographic poles. Each revolution takes approximately 90 minutes to a few hours. The fleet is arranged in such a way that, from any point on the surface, at any time, at least one satellite is within the line of sight.

A geostationary satellite orbits the earth directly over the equator, approximately 22,000 miles up. At this altitude, one complete trip around the earth (relative to the sun) takes 24 hours. Thus, the satellite remains over the same spot on the earth's surface at all times, and stays fixed in the sky from any point on the surface from which it can be seen. A single geostationary satellite can see approximately 40 percent of the earth's surface. Three such satellites, spaced at equal intervals (120 angular degrees apart), can provide coverage of the entire civilized world. A geostationary satellite can be accessed using a dish antenna aimed at the spot in the sky where the satellite hovers, and in Alaska, that is approximately 11° above the horizon.

There are also several satellite service providers in the Anchorage area that could provide the necessary communication link between field devices and detectors and a communication hub. They offer an even slower throughput, 2.4 Kbps and a moderate to high recurring cost ($70-100/month). Satellite service is not recommended to use for video images (even stills), as the throughput is too slow. It is better suited for data transfers.

**Planned Alaska Railroad Radio Service**

The Alaska Railroad (ARR) has proposed to install a radio system along 500 miles of track between Seward and Fairbanks. The radio system will operate under license to the ARR (and hence available to other governmental agencies) in the 40-50 MHz range with a transmitter power of 100 watts. Transmitting sites will have a range of 50-75 km (kilometers). Up to 15 repeater stations can be linked to one base station transmitter. The system will packetize the data in order to use the bandwidth efficiently, and a typical ARR data transaction will take less than 100 msec (milliseconds, or millionth of a second). Data will transfer at 9,600 bps (bits per second).

Approval of this change is pending due to a slight change from the ARR originally proposed radio system. Assuming approval, construction of this radio network is anticipated to be complete during 2002.

# 8. SUMMARY

The development of the concept of operations identified current functions and future desired functions of the MOA and other local stakeholders. This exercise also identified both ITS and communications systems needed to support the desired function. Each was discussed in the previous sections.

The development of concept of operations also identified issues to consider and address in the planning, development, and deployment of such systems. Issues associated with the deployment, as identified by the MOA and other stakeholders in the MOA, are documented below.

## 8.1 FUNDING

The costs associated with the deployment and operation of ITS are potentially significant. This provides a significant challenge given that budgets are becoming increasingly constrained, as well as the fact that eventually ITS projects will compete for funding with other traditional transportation projects. Costs that must explicitly be considered when developing and implementing ITS include:

- Deployment of Infrastructure
- Routine and emergency maintenance
- Organizational adaptation
- Staff training

The MOA and their stakeholders fully recognize that challenges facing them in terms of deploying, operating, and maintaining ITS infrastructure. As such, they have identified the need to:

- Participate in inter-agency integration
- Increase operational efficiency
- Increase public safety and security

Eventually, ITS initiatives must be shown to offer greater benefits than their costs in order to justify the capital and operating expenses required. As a rural state with urgent basic transportation concerns, ITS must compete in practical terms with projects that provide basis transportation in order for these new costs to warrant local investment.

Further, attracting and retaining skilled staff should be a priority in the planning and development of ITS. The full potential of the system will not be realized without skilled staff. Again, this requires identifying and securing adequate funding.

## 8.2 ORGANIZATIONAL SUPPORT FOR ITS DEPLOYMENTS

An organization is need to support ITS. The full benefits of deploying systems will not be recognized if they cannot be supported within the existing organizational structures of the MOA and their stakeholders. Therefore, the following should be emphasized when developing and deploying ITS in Anchorage:

- Planning of future systems
- Planning of advanced technologies

Other organizational issues as they relate to the successful deployment and operation of ITS in Anchorage, including:

- Deployment must be transparent and not disrupt existing functions
- System deployment must lend itself to making existing operations more efficient
- Deployment must simplify or reduce the current workloads
- ITS deployment that supports current functions must be cost effective

## 8.3 PUBLIC AWARENESS

The traveling public awareness of ITS deployments will ensure success. This is critical mainly because the traveling public is the end user who can potentially benefit from the deployment of ITS in Anchorage.

## 8.4 INTER-JURISDICTIONAL COORDINATION

The MOA and their stakeholders recognize the need to coordinate the planning, design, implementation, and operation of ITS projects across jurisdictional boundaries. This coordination may be partially achieved through a regional traffic operations center which could potentially serve as the focal point of information dissemination to foster coordination and cooperation across jurisdictional boundaries.

# 9. APPENDIX A – REFERENCES

Anchorage 2020 Plan.

Anchorage Metropolitan Area Transportation Study.

http://www.state.ak.us/local/akpages/ADMIN/info/rfpweb/services1.html.

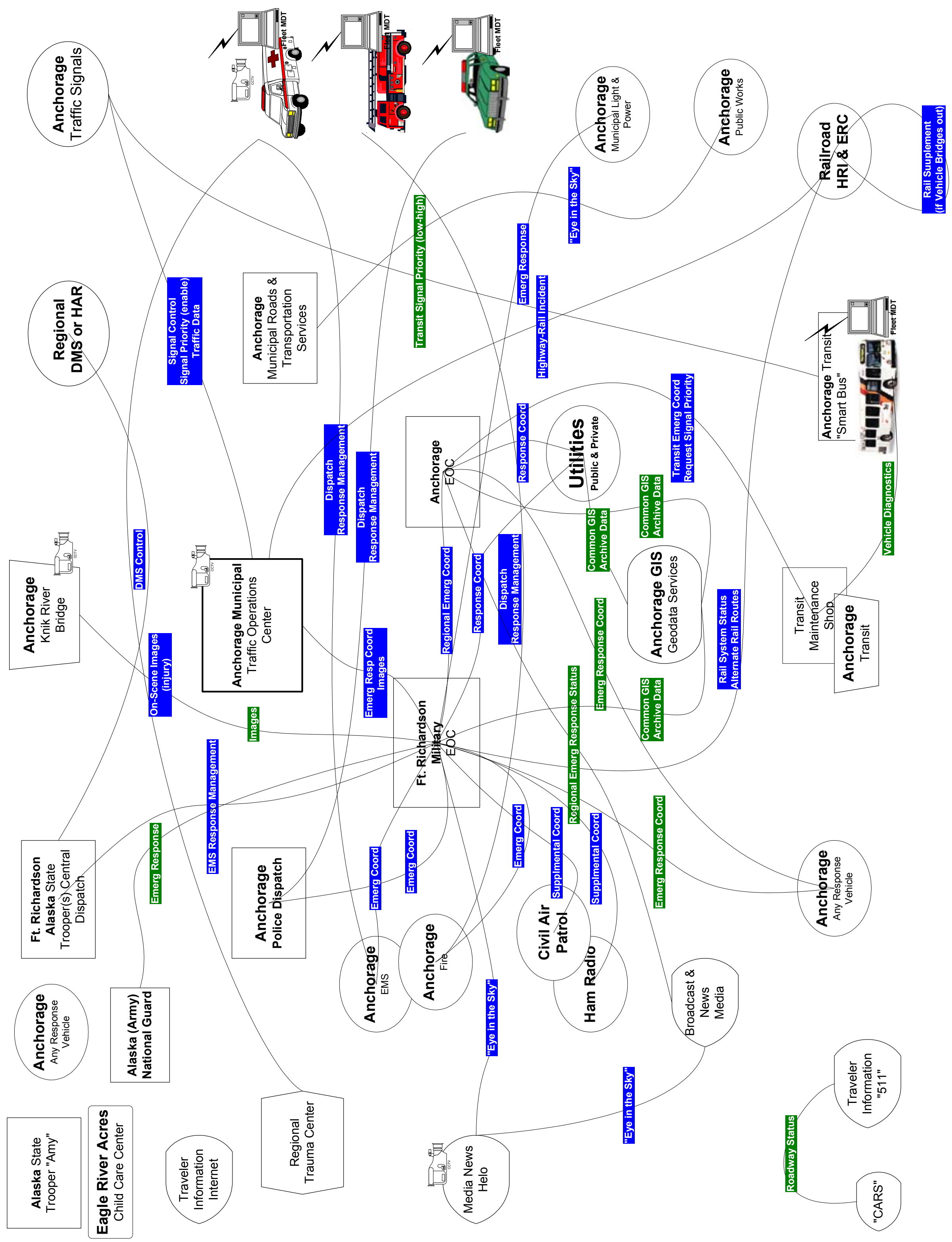
State of Alaska – Statewide Emergency Medical Services Communications Plan. Frank Thatcher Associates, Inc. September 15, 1997.

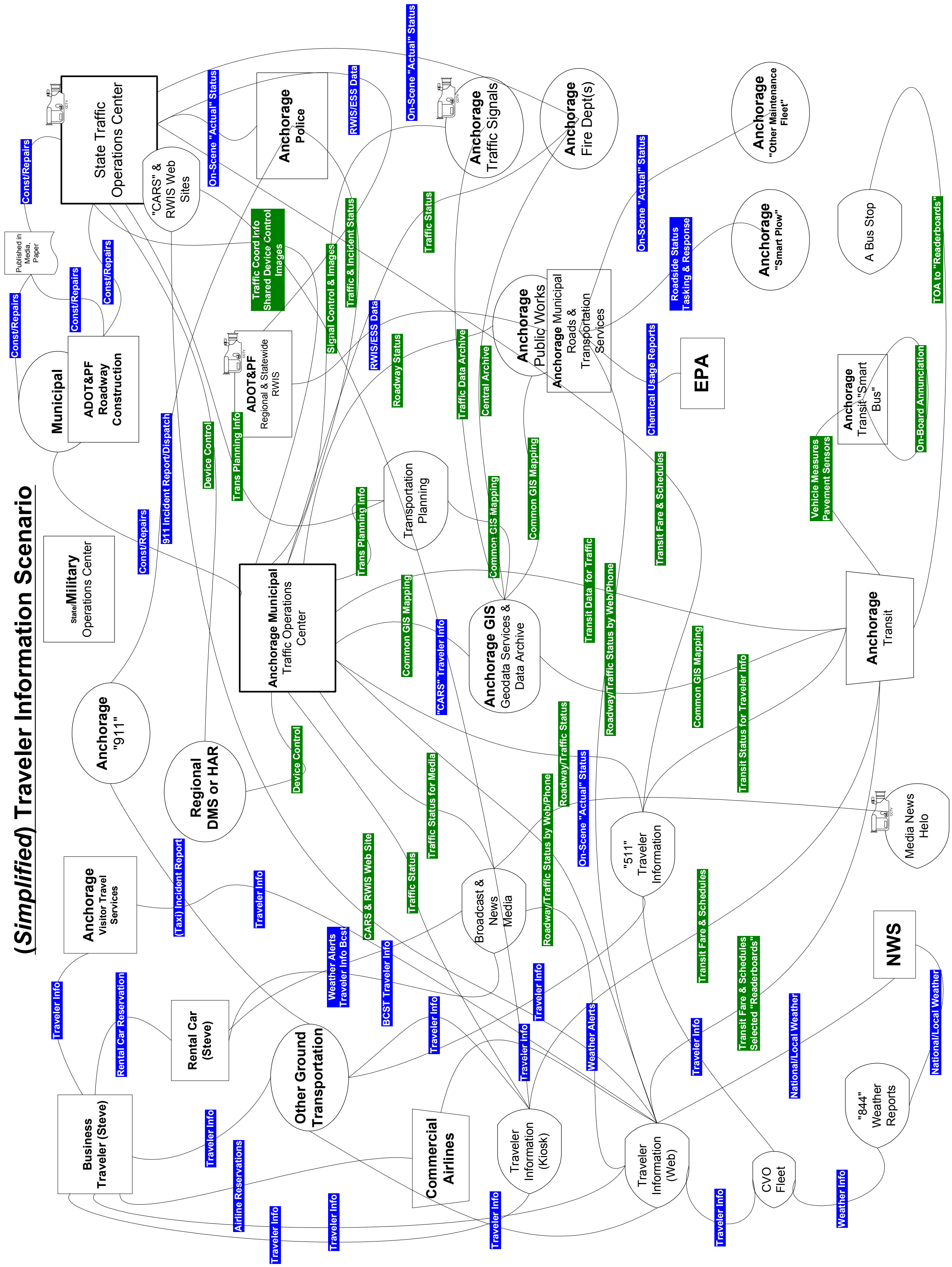
http://www.peoplemover.org/.

http://www.dot.state.ak.us/external/amhs/home.html.

# 10. APPENDIX B - CONCEPT OF OPERATION INFORMATION FLOWS

## (Simplified ) Earthquake Scenario




(Simplified) Traveler Information Scenario
State Traffic Operations Center
"CARS" & RWIS Web Sites
Anchorage Police
Anchorage Traffic Signals
Anchorage Fire Dept(s)
Anchorage "Other Maintenance Fleet"
Anchorage "Smart Plow"
A Bus Stop
Published in Media, Paper
Municipal
ADOT&PF Roadway Construction
ADOT&PF Regional & Statewide RWIS
Anchorage Public Works
Anchorage Municipal Roads & Transportation Services
EPA
Anchorage Transit "Smart Bus"
Transportation Planning
State Military Operations Center
Anchorage Municipal Traffic Operations Center
Anchorage GIS Geodata Services & Data Archive
Anchorage Transit
Anchorage "911"
Regional DMS or HAR
"511" Traveler Information
Media News Helo
Anchorage Visitor Travel Services
Broadcast & News Media
Rental Car (Steve)
Other Ground Transportation
Business Traveler (Steve)
Commercial Airlines
Traveler Information (Kiosk)
Traveler Information (Web)
CVO Fleet
"844" Weather Reports
NWS
Const/Repairs
On-Scene "Actual" Status
RWIS/ESS Data
Traffic Coord Info Shared Device Control Images
Signal Control & Images
Traffic & Incident Status
Traffic Status
Roadside Status Tasking & Response
TOA to "Readerboards"
911 Incident Report/Dispatch
Device Control
Trans Planning Info
Roadway Status
Traffic Data Archive
Central Archive
Chemical Usage Reports
On-Board Annunciation
Vehicle Measures Pavement Sensors
Common GIS Mapping
Transit Fare & Schedules
Transit Data for Traffic
Roadway/Traffic Status by Web/Phone
"CARS" Traveler Info
Transit Status for Traveler Info
Traffic Status for Media
(Taxi) Incident Report
Traveler Info
CARS & RWIS Web Site
Weather Alerts Traveler Info Bcst
BCST Traveler Info
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APPENDIX B – DETAILED PHYSICAL ARCHITECTURE ILLUSTRATIONS, INCLUDING FIGURES 5-7 TO 5-15, AVAILABLE ONLY ELECTRONICALLY. WHEN UPDATED, APPENDIX B WILL BE POSTED SEPARATELY TO WEBSITE:
http://www.muni.org/transplan/ITSLibrary.cfm

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NOTE: FIGURES 5-7 TO 5-15, DETAILED PHYSICAL ARCHITECTURE ILLUSTRATIONS, INCLUDED IN APPENDIX B, AVAILABLE ONLY ELECTRONICALLY. WHEN UPDATED, APPENDIX B WILL BE POSTED SEPARATELY TO WEBSITE:
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# 1. INTRODUCTION

This statement of the regional architecture for the Municipality of Anchorage (MOA) is one in a series of five documents: User Services, Long-Range Vision, Concept of Operations, Regional Architecture [this document], and an Implementation Plan. These documents have been developed for the Municipality concurrent with and as part of an Alaska Department of Transportation and Public Facilities (ADOT&PF) initiative to develop a statewide architecture.

## 1.1 PURPOSE OF DOCUMENT

The purpose of this document is to extend and more fully describe the elements of the physical and logical architecture that are derived from the User Services Report and the Concept of Operations. These two predecessor documents formulate the foundational material for this document's statement of the architectural framework.

### User Services Report

The User Services Report formulates a consensus statement of user needs then traces and maps these needs to an expression of User Services. These User Services are the initial link from the stakeholder's expression of user needs to the logical framework of the national ITS architecture.

### Concept of Operations

The Concept of Operations then continues the formulation of an architectural basis through statement of the municipality stakeholder's vision and goals for regional ITS. The vision and goals are then considered in an analysis of current and future operational needs, legacy systems integration, and communications architectural needs for implementation. A statement of the key program areas for the Municipality and the identification of all operational partners is included in this discussion.

### Statement of Architecture

The purpose of this document is to continue the process to derive the statement of a physical architecture based on the foundations established in the two prior documents. Thus, this document introduces and develops an ITS architecture for the Municipality of Anchorage.

This architecture statement and transition from vision, goals and user needs describes in words and pictures the functional framework for Municipality's operations, and their interactions with other public agency and private sector partners.

## 1.2 THE NATIONAL ITS ARCHITECTURE

There are several viewpoints of the national ITS architecture—selection of one versus another is largely a matter of personal or organizational preference. In this document, two viewpoints are adopted: logical architecture using user services and physical architecture using market packages. These viewpoints and their relevance are discussed in the following.

### User Services and Logical Architecture

ITS user services provide the bridge between a statement of user needs, requirements and the functional processes described in the logical architecture.

The user services contained in the national ITS architecture are statements of the functions and services expected from ITS—these are statements of what ITS should do for the user, from the perspective of that user. A broad range of users is considered, including the constituent traveling public as well as the system owner/operators. The concept of user services allows system or project definition to begin by establishing the high level services that will be provided to address identified transportation problems and user needs.

The logical architecture defines what has to be done to support and implement the ITS user services. It defines the processes that perform the ITS functions and the information or data flows that are shared between these processes. The logical architecture is not technology specific, nor does it dictate a particular implementation. This implementation independence makes the logical architecture accommodating to innovation and relatively seamless scalability from municipal implementations to larger regional or statewide systems.

**Market Packages and Physical Architecture**

The national ITS architecture market packages provide an accessible, deployment and service-oriented perspective to the National ITS Architecture. They are focused collections of components, subsystems, interfaces and terminators that are tailored to fit, separately or in combination, real world transportation operational problems and needs. A market package collects together one or more equipment packages that must work together to deliver a given transportation service and the data/information exchange architecture flows that connect them and other important external systems. In other words, the market packages identify the pieces of the physical architecture that are required to implement a particular transportation service. The architecture flows are implemented to enable the exchange of data and information.

Equipment packages are the building blocks of the physical architecture subsystems contained within the market packages. These equipment packages group similar processes of a particular subsystem together into an “implementable” package. This grouping also takes into account the user services and the need to accommodate various levels of functionality. Since equipment packages are both the most detailed elements of the physical architecture view of the National ITS Architecture and tied to specific market packages, they provide the common link between the interface-oriented architecture definition and the deployment-oriented market packages.

The physical architecture provides the Municipality of Anchorage with a physical representation (though not a detailed design) of the important ITS interfaces and major system components. It provides a high-level structure around the processes and data flows defined in the more process-oriented logical architecture. The principal elements in the physical architecture are the subsystems and terminators, and architecture flows that interconnect these subsystems and terminators into an overall structure—an operational framework. A physical architecture takes the processes identified in the logical architecture and assigns their functions to subsystems. Additionally, data exchanges are grouped together into architecture flows.

**Cross-Reference Mapping User Services to Market Packages**

The market packages and user services are cross-referenced to each other later in this document. This cross-referencing will show that each user need and service relates to a market package; and how the deployment of each market package enables from one to several user services. Accordingly, this cross-reference will also illustrate which market packages provide the most “bang for the buck” in terms of breadth of user services enabled, and it therefore provides useful information for implementation strategy, project planning and scheduling.

**Relationships: Physical/Market Packages to Logical/User Services**

The purpose of mapping user needs and program areas to both user services and market packages is to adopt a viewpoint and define the national ITS architecture components of interest. As illustrated by Figure 5-1, the mapping of user needs and program areas to user services (gray-shaded area on the left) provides the linkage to the national ITS logical architecture (the components shown in green). Likewise, the mapping of user needs and program areas to market packages (lower right) provides the linkage to the subsystems/terminators and architecture flows of the national ITS physical architecture (the components shown in blue).

This document includes these mappings and resulting diagrams to the level of detail shown by the shaded areas in Figure 5-1:

- Logical architecture (gray) – user services
- Physical architecture (blue) – market packages, subsystems/terminators, and architecture flows

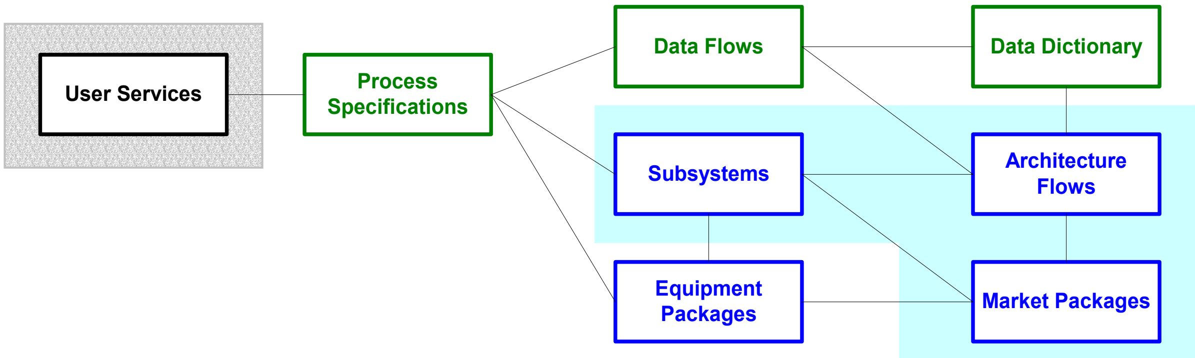


**Figure 5-1: Relationships Between Components of the National ITS Architecture**

The definition and linkage to other components of the national ITS architecture (i.e., for logical: process specifications, data flows, and data dictionary elements; for physical: equipment packages) is not included in this document. It is suggested that these components of the national ITS architecture should be selected and refined as part of a specific ITS deployment project.

## 1.3 ORGANIZATION OF THIS DOCUMENT

This document is organized as outlined in the following.

### Establish Foundations

Beginning in Section 2, this document first restates and expands upon the goals of Municipality of Anchorage as developed in the Concept of Operations. The expansion of these goals is to clarify them where needed, and to establish traceability from user needs to market packages and user services.

### Mapping Program Areas to Market Packages and User Services

Section 3 contains the mapping of the four program areas, and the several individual goals within each to the national ITS architecture market packages1 and user services2. The four program areas are: year-round operations, incident/emergency management, traveler information and internal operations.

Section 3.1 maps these goals to the one or more national ITS architecture market packages illustrative of the packaged functionality required to implement and achieve the goal. The selected market packages are tailored to expand, include or exclude functionality specific to meet Municipality of Anchorage needs.

Section 3.2 maps these goals to the one or more national ITS architecture user services illustrative of the user functions needed to implement and achieve the goal. The selected user services are consistent with those derived in the mapping of user needs in the Users Services Report and have

[1] **Market Packages** - provide an accessible, deployment oriented perspective to the national architecture that identifies the pieces of the Physical Architecture that are required to implement a particular transportation service.
[2] **User services** - document what ITS "should do" from the user's perspective by establishing the high level services that will be provided to address identified problems and needs.

been tailored to expand, include or exclude functionality and services specific to meet Municipality of Anchorage user needs.

At the conclusion of both Sections 3.1 and 3.2, the mapped market packages or user services are summarized and duplicates are eliminated. Then in Section 3.3 these summarized market packages and user services are cross-referenced to each other. This cross-referencing indicates how the deployment of each market package enables from one to several user services. Accordingly, this cross-reference also illustrates which market packages provide the most "bang for the buck" in terms of breath of user services enabled, and is useful information for implementation strategy, planning and scheduling.

**Program Areas Revisited**

Section 4 revisits the four program areas to illustrate and describe in words and figures a high-level viewpoint of the resulting ITS architecture. This section concludes the presentation of the resulting architecture for the casual reader.

**Detailed Physical Architecture**

Appendix A includes descriptions of the several market packages that were selected and tailored for the Anchorage architecture.

Appendix B contains detailed physical architecture illustrations. These illustrations are derived from an analysis and synthesis of the physical architecture components (e.g., subsystems, terminators and architecture flows)3 as identified in the mapping of market packages. In essence, these illustrations represent the non-duplicative overlays of from one to several market packages.

[3] Definitions: subsystem, terminator and architecture flow.

# 2. ESTABLISH FOUNDATIONS

This section establishes the link between the process steps of collecting user needs, mapping them to user services, and developing a concept of operations. This section first restates and expands upon the goals of Municipality of Anchorage as developed in the Concept of Operations. The expansion of these goals is to clarify them where needed, and to establish traceability from user needs to market packages and user services.

The Concept of Operations defines the ITS Vision for the Municipality of Anchorage. This Vision is written from the perspective of how future ITS deployment will affect transportation system users, Municipality of Anchorage, and various other stakeholders throughout the State in the future. The ITS Vision is inclusive of proposed concepts for ITS operations, data exchange, and integration opportunities with respect to:

- Current Municipality of Anchorage operations, and
- Interfaces and joint operational strategies of Municipality of Anchorage and other stakeholders in the state.

## 2.1 GOALS

The goals of the Municipality of Anchorage's ITS Deployment Strategy are based on the key transportation needs of the region, and consistent with and supplemental to those of the State (ADOT&PF). Each of these local goals is described below.

**Ensuring Public Safety**

One of the most important of all government services is that of ensuring the safety of the public at large. In the context of the ITS Plan, this goal relates to ensuring safe travel on all modes. To achieve this goal, transportation system risks to public safety are reduced by:

- Reducing the presence of snow and ice on the roadway,
- Informing the public of hazards so they may avoid them; and,
- Clearing crashes from the roadway as quickly as possible to reduce the potential for secondary crashes.

**Supporting Public Security**

Public security in the context of this ITS plan relates to monitoring, managing and mitigating potential and actual major planned events, and unplanned incidents and emergencies to ensure that they have the least impact on public safety. Ideally, the goal is to eliminate all man-made security hazards, and to reduce the impact of any natural disasters.

**Supporting the Community Vision**

The Anchorage 2020 Plan outlined a clear Community Vision, and this ITS plan goal is to support that vision. Providing services via ITS that contribute more directly to an enhanced quality of life in the AMATS region is included in the ITS vision.

**Delivering Services Effectively**

The Municipality of Anchorage has demonstrated its commitment to the effective delivery of public services by implementing a set of performance measures for every department within the Municipality. The Municipality is also emphasizing enhanced delivery through e-commerce. This goal relates to implementing ITS that is:

- Able to make existing service delivery more efficient;
- Providing a new, important service that we could not provide before without today's technology;
- Cost effective; and,
- Focused on customer service.

## 2.2 RESTATEMENT OF FOUR PROGRAM AREAS

The first stage in the development of this architecture is to restate the expressed needs and wants of the Municipality as illustrated in an earlier document. The ITS strategy consists of four key program areas as illustrated in Figure 5-2, and described below.

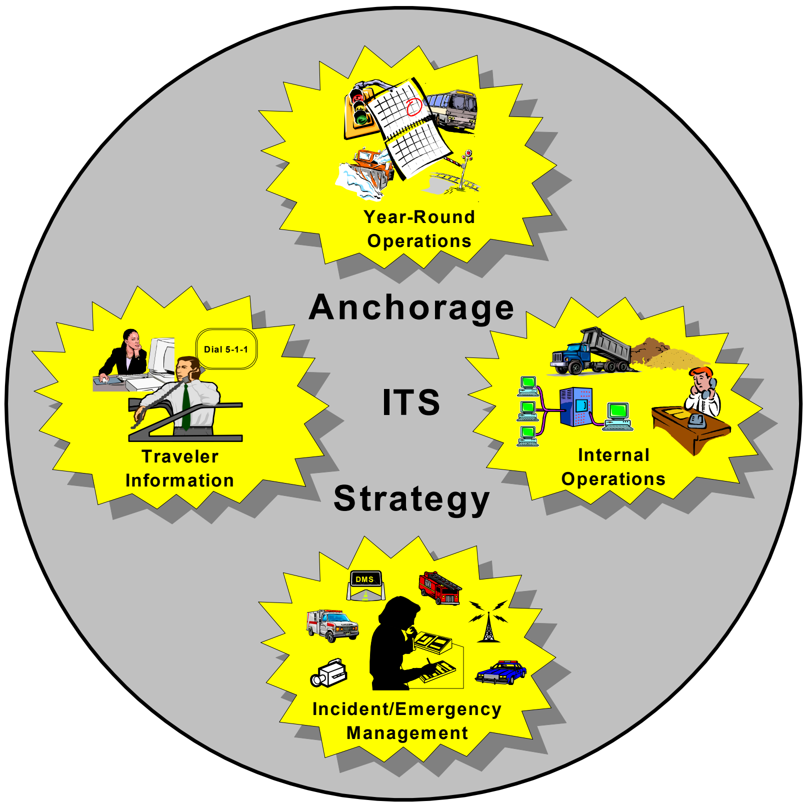


**Figure 5-2: Municipality of Anchorage - Key ITS Program Areas**

This following discussion begins the mapping and transition of those stated goals and program areas to the corresponding user services and market packages stated in terms derived from the national ITS architecture.

### Year Round Operations

There are several ITS elements that will be used year round to help improve transportation system operations within the MOA. These ITS systems will provide information that will improve mobility and traveler safety in and around Anchorage.

*Weather and Pavement Sensors*

The ADOT&PF installed Roadway Weather Information Systems (RWIS) along the roadside measure ambient air temperature, type and amount of precipitation, wind speed and direction, and relative humidity. Additionally, weather sensors installed in the pavement measure pavement temperature, and help monitor the amount of ice-fighting chemical remaining on the road surface. Further, pavement temperature sensors mounted on vehicles such as snowplows and transit buses can also provide a valuable source of weather information.

_Smart Snow Plows_
The MOA will deploy and operate smart snow plows equipped with several systems that enhance roadway safety, and enhance the efficiency and effectiveness of snow and ice control operations. First, smart snowplows are equipped with Automatic Vehicle Location (AVL) sensors and GPS that are used to locate and track snowplow locations in real-time. Second, snowplows are equipped with sensors that detect the presence of magnets along the edge of the roadway. This provides the snowplow operators with an image of the roadway that can be used to safely steer the snowplow in the most extreme “white-out conditions”. Lastly, there will be sensors on the snowplow that can detect and record pavement temperatures, thus allowing the plow operator to apply the right amount of treatment to the roadway as needed. This will significantly reduce the amount of chemicals used commensurate with the calculated need, and the amount of particulates released into the air is greatly reduced thus having a very positive effect on reducing environmental impacts from such treatments. This benefits watershed management as well through acquired data and knowledge about the type, amount and location of chemical treatments that could potentially migrate into the water table.

Smart snowplows as well as other maintenance fleet vehicles may be equipped with systems to monitor vehicle performance. These sensors will collect vehicle systems diagnostic information, such as engine temperature and oil pressure, and transmit it to the fleet vehicle maintenance facility. This enhances fleet availability, improves roadway safety, and limits significant maintenance issues in the future through diagnostics before operational failure.

_Traffic Signal System_
The ITS in Anchorage already includes an advanced traffic control system to allow the MOA to control their traffic signals remotely from a Municipal traffic operations center. Traffic System Operators are able to monitor, verify and change signal-timing patterns from a central fixed facility. This will improve the municipality’s traffic signal operations since operators are not required to travel to the intersection site to make these timing changes. In addition, software installed locally at traffic signals enables traffic signal priority for transit, and signal pre-emption to give first responders “green time” when responding to an emergency. Additionally, MOA signal timing patterns can also be adopted to fit the short-term travel patterns of traffic arriving and/or departing sports stadiums or other large pre-planned event venues.

_Highway-Rail Intersection (HRI) Warning and Preemption Systems_
HRI Warning and Preemption Systems are used to increase safety and reduce potential train/vehicle conflicts. HRI Warning Systems determine the probability of a collision at an equipped intersection--either highway-highway near a rail crossing or at an actual highway-rail intersection—and, provide timely warnings to drivers and train operators. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection congestion and traffic patterns. Sensors in the roadway infrastructure assess vehicle locations, queues and speeds near a highway-rail intersection. Using this information, a warning is determined and communicated to the approaching vehicle using a dedicated short-range ITS telecommunications system. Lastly, rail to traffic signal preemption systems improve transportation safety by automatically changing a traffic signal indication to red when a train approaches the HRI. From the perspective of the Alaska Railroad (AKRR) these same HRI systems and access to a common GIS will provide operational data collection and train schedule validation that is useable for more positive train control leading to more accurate train arrival times.

_Needs Study for Transit Signal Priority_
The MOA transit signal priority systems interact with traffic signals to extend the “green time” or accelerate the transition to green for transit vehicles equipped with the necessary equipment. Signal priority sensors are connected to the traffic signal to detect a signal emitted by equipment on the transit vehicle. The extended or accelerated “green-time” enables transit vehicles to pass through the intersection where they would normally have to stop. This reduces transit schedule delay time and

helps achieve better schedule adherence and overall system performance. Transit customers then perceive that their trip is either quicker and/or more reliable thereby enhancing their transit experience. This attracts new ridership while retaining the existing riders. Transit vehicles are also used during disaster response for evacuations, triage and other emergency response functions.

*Smart Fare Box*
Anchorage People Mover's smart fare box systems, including electronic ticketing, are installed on transit vehicles and are used to collect ridership, fare and origin-destination data. These data collection systems streamline transit operations, and enable better route assignment, equipment usage, and route planning.

*Transit Vehicle Management*
Anchorage People Mover's on-board vehicle management systems use sensors and subsystems to examine vehicle performance measures, automatically detect vehicle mechanical problems and report them to the transit agency's maintenance department in near real time. This significantly enhances transit operations, equipment availability and roadway safety. Prior to the implementation of these systems, vehicle problems often remain undiscovered until the vehicle becomes damaged or inoperable during operations. A transit vehicle diagnostic and data/information management system, however, reports these problems earlier, giving maintenance personnel time to fix the vehicle and dispatch it when maintenance services are completed.

*Emissions Monitoring, Management and Vehicle Electronic Tags*
The Anchorage Bowl is a non-attainment area for CO (carbon monoxide) and under certain conditions may institute vehicle roadside inspections to determine that vehicles entering the municipality are in compliance with emissions standards. Currently MOA residents are required to have their vehicles inspected for emissions; MOA may in the future elect to issue electronic tags to those residents whose vehicles are in compliance with the vehicle inspection regulations and that meet emissions standards. MOA non-residents are not required to have these same vehicle inspections but can do so voluntarily and if in compliance, their vehicle may in the future be awarded the same MOA electronic tag. When municipal or regional emissions reduction management policies are in effect, traffic entering or in the non-attainment area may be subject to roadside inspection by staff from the Alaska Department of Environmental Conservation (ADEC) and/or en-route monitoring by environmental sensors and traffic surveillance devices placed at roadside. Emissions violations determined by manual roadside inspection or environmental and traffic surveillance could then be processed in accordance with ADEC enforcement policies and procedures.

### Incident and Emergency Management Systems

Rapid detection, verification and reporting of incidents as soon as possible after they occur can decrease response time, improve safety, and minimize delays and other traffic related secondary incident effects in the MOA. The impact of incidents on travel safety and roadway efficiency can be minimized through the application of several ITS technologies. These technologies are designed to enhance incident identification, verification, notification and response coordination and resource management. Thus, MOA will use these ITS systems to enable emergency management operators to dispatch appropriate personnel and equipment quickly and effectively, get to the scene to treat any injured victims, perform traffic control as needed, and in general, respond and clear the incident in an efficient and timely manner.

*Hazardous Materials Tracking and Reporting*
ADOT&PF operated regional weigh stations are equipped with systems that enable operators to process electronic HAZMAT manifests and weigh these vehicles without stopping. It is also possible that on-board GPS will be used to supplement the tracking of HAZMAT cargo with accurate location and integrity of the shipment. This weigh-in-motion HAZMAT tracking and reporting capability will enable staff at the weigh station to identify commercial vehicles carrying hazardous materials, and if necessary, divert them to alternate routes based on downstream transportation system status, weather, or other criteria. Likewise, similar GPS, HRI data collection and positive train control capabilities will be leveraged by AKRR to track HAZMAT shipments within their rail system.

_Closed Circuit Television (CCTV)_
MOA will use CCTV as a surveillance tool to monitor normal and exceptional traffic flows, confirm congestion or incidents, and remotely monitor and assess weather and roadway surface conditions. Remotely controlled CCTV cameras will greatly enhance incident management operations through quick identification and verification of incidents. This then enables quick dispatch of appropriate equipment needed to the clear the incident, treat injured persons, and clear or treat the roadway to restore it to service.

_Vehicle Detection_
Vehicle detection using ITS sensor technologies enables MOA traffic operators to monitor traffic flows, volumes and congestion from a remote location. Traffic data so acquired is used in real-time to enhance MOA transportation operations, and also can be archived in a database and used to enhance transportation maintenance, construction and for MOA, regional and statewide transportation planning processes.

_Dynamic Message Signs (DMS)_
MOA will use fixed and portable DMS along freeways and major arterials to report incident information to motorists and for short-term traffic controls measures to guide motorists through or around affected areas. These DMS also provide alternative routing directions or other pertinent transportation system en-route messages.

_Highway Advisory Radio (HAR)_
MOA will use HAR to provide broadcast radio information, cautions and warnings to drivers en-route. These broadcasts will reach the drivers well in advance of them reaching an impacted area.

**Traveler Information Systems**

In the future, travelers will utilize fixed infrastructure as well as wireless communications for obtaining travel related information. The freedom of using wireless communications will provide access to traveler information at all times, and in most locations in the MOA and the Anchorage Bowl region. New technologies will include Interactive Voice Responsive Information, Transit Center Signage, Kiosks, and Web Enabled Trip Planning.

The information baseline for regional multi-modal traffic, transit and rail traveler information benefits from the broader scope of data collection and information synthesis for all modes by the MOA, Anchorage People Mover and the AKRR. This operational data and schedule performance data acquired through operations in other program areas enhances the richness of the traveler information and the accuracy of the traffic situation, and the on-time performance and arrival times for transit and AKRR services.

_Regional Traveler Information at "5-1-1"_
Recently launched in the Cincinnati/Northern Kentucky and Central Puget Sound metropolitan areas, the 5-1-1 Telephone Traveler Information Service is gaining popularity within other states, and is expected to be widely implemented in the future through a national mandate. This will greatly benefit all drivers in that they will be able to call the "5-1-1" number on their mobile communication device (e.g., cell phones) wherever that service is available to obtain near real-time traveler information. Currently, each region within the State of Alaska uses a different travel advisory number—using "5-1-1" will tie each region together and will offer one easy to remember number that could be used anywhere in the State.

_Internet_
The Internet is a vital medium for distribution of pre-trip traveler information for all modes. Whether at home, work or other fixed location (e.g., a public kiosk), pre-trip travel information on the Internet can be easily accessed. This provides the information needed to more effectively plan a trip and avoid problem areas if they exist.

*Wireless Web*
In the near future, travelers using all modes will likely be able to obtain pre-trip and en-route traveler information via a personal digital assistant or other device that supports wireless web browsing. It is likely that vehicle on-board devices will be fully equipped with voice-actuated (for safety) web-based Traveler Information Systems. This will allow drivers to obtain route guidance directions to their destination, including but not limited to the nearest gas station, restaurant, hospital or lodging.

### Internal Operations

ITS can help facilitate better internal operations by providing the capability for agencies to minimize the use of scarce financial and physical resources. The following technologies will help streamline operations, reduce costs, and improve the safety and efficiency of the roadway network.

*Mobile Data Terminals (MDTs)*
The use of MDTs in Anchorage PD and other fleet vehicles can greatly enhance internal and inter-agency communication and cooperation in the MOA and the region. These systems will provide law enforcement, incident response and emergency management, and MOA personnel in the field with greater flexibility to interactively collect, report and share information. This will enhance in-field operations through more relevant up to date information, and will alleviate much of the status collection and reporting burden traditionally placed on dispatchers at a fixed central facility. MDTs also provide easier means to disseminate collected information from the operations center to the field.

The incident management and emergency response technologies described above can and will have a beneficial impact in several areas of transportation system usage. These benefits are not limited to daily commute travelers in and around the city, but extend to and include commercial vehicle operations, emergency response and management, and tourism. Incident management technologies make it easier to inform commercial vehicle operators of incidents in a timely fashion, so an adequate amount of time is given to divert the vehicle around the incident. Likewise, emergency management dispatchers can use or benefit from incident management technologies by using CCTV to visually confirm and determine the extent of an incident. Dispatchers can relay this information and traffic conditions to emergency responders in the field so an appropriate and unimpeded “best” route can be selected to the scene, and necessary preparation made before arriving at the scene. All of this awareness of the status of the transportation system, traffic flows, congestion and incidents becomes the basis for traveler information of use to commuters, tourists and drivers of all vehicles using the MOA’s roadways.

*Material Usage Tracking*
The MOA will better track the amount of ice and snow fighting chemicals, fuel, and other resources consumed by various maintenance activities to significantly enhance operations efficiency and reduce costs in Anchorage. Tracking the use of resources year after year will achieve economies through more realistic planning for resources to be ordered, thus reducing over-spending, waste and storage space requirements.

*Asset Management*
An Asset Management System stores pavement and infrastructure condition information so it can be used more effectively. This asset information can and should be integrated into a geographic information system (GIS), and used to easily and unambiguously identify the condition of infrastructure at desired locations. This allows funding to be prioritized and allocated among roadways and/or structures most in need of repair.

*Automatic Vehicle Location (AVL)*
Anchorage People Mover and the MOA will use AVL sensors and GPS installed on public transportation and maintenance vehicles to communicate real-time vehicle locations and movements to transit service and MOA maintenance fleet dispatchers. In addition to the fixed route operations, GPS and AVL are also used for demand responsive dispatch in the new Community Circulator routes in Eagle River. This AVL and GPS information can enable dispatchers to assign vehicles more effectively to a location (e.g., avalanche site, transit stop) based on the current location of an

appropriate and available vehicle, and the information is used to provide in-vehicle annunciators and for LED stop announcement signs. Additionally, maintenance vehicles can use this precise position location information to locate streets that have/have not been cleaned or plowed, reducing costs and the time needed to complete these activities. This technology can also be used to quickly locate a stalled or disabled vehicle, and to enable real-time bus arrival information to transit users via the Internet, kiosks or message reader boards at selected transit stops.

*Shared Traveler and Traffic information Database*

Individual public agency data is a valued asset not only to the agency itself but to other partner agencies as well. A shared traveler and traffic information database archive will enable agencies to share their electronic data (e.g., infrastructure assets GIS, crash data) in exchange for other agency data. This will enhance operations of each participating agency by reducing their data collection costs, increasing data usefulness, and increasing the value-added of agency unique data through regional information synthesis.

*Condition Acquisition and Reporting System (CARS)*

The CARS is a web-based software tool that allows authorized public agency or contract staff (i.e., police, city or county officials, DOT personnel, or other pre-authorized users) to input accident, construction, restrictions, closure, delay, and other roadway and weather information into statewide databases. Authorized data entry users of the system can store information on active incidents (e.g., hazardous material spills, crashes, or natural disasters) or planned incidents (e.g., pubic attendance events, construction activities, road closures or restrictions) in the database quickly using pull down menus, or manually using text entries. This information is then plotted and illustrated graphically for quick reference. This CARS information should then be filtered to mask or remove agency-private data/information before being passed along to the traveler information users via the Internet, HAR, DMS, or other public broadcast or interactive access channel.

*Common Geographic Information System*

A GIS enhances data storage, processing and analysis by displaying text and numerical information in a spatial format. This enables quick and easy identification of patterns in the data as it pertains to specific areas of responsibility for the Municipality and surrounding areas. In addition, a common GIS foundation also offers advanced functionalities including common tools and queries that help users access and analyze a data set.

Many agencies in Anchorage own a geographic information system, but GIS information is not exchanged. Different GIS programs, data incompatibility, and a lack of inter-agency cooperation contribute to these difficulties in information exchange. A common GIS System can resolve two of the three issues, thus enabling exchange of usable map and infrastructure spatial data, and operational data files between agencies resulting in enhanced regional information exchange. Thus, the MOA is working to formulate a project that will create an integrated GIS Transportation Network—this is currently called “Roadnet.” The integrated transportation network will serve as the roads network element for MOA’s Land Information System (LIS) project also currently under development. The LIS is designed to centralize land information and GIS databases so as to be usable by all MOA departments and then in cooperation with other agencies.

A common GIS will benefit stakeholders within the Municipality of Anchorage to include the following Departments: Public Transportation, Traffic, Fire, Police, Street Maintenance, Office of Planning, Development and Public Works Technical Services Section, Information Technology, and the Emergency Operations Center.

# 3. MAPPING PROGRAM AREAS

This section contains the mapping of the four program areas, and the several individual goals within each to the national ITS architecture market packages and user services. The four program areas are: year round operations, incident and emergency management systems, traveler information systems, and internal operations.

The market packages and user services are cross-referenced to each other at the conclusion of this section,. This cross-referencing indicates how the deployment of each market package enables from one to several user services. Accordingly, this cross-reference also illustrates which market packages provide the most "bang for the buck" in terms of breadth of user services enabled, and is useful information for implementation strategy, planning and scheduling.

Each program area mapping, i.e., to market packages and to user services, is color-coded for ease in tracing them through the tables and figures that follow. The legend to the right associates these colors with the program area.

| |
|---|
| **Year Round Operations** |
| **Incident and Emergency Management Systems** |
| **Traveler Information Systems** |
| **Internal Operations** |

## 3.1 MAPPING PROGRAM GOALS TO MARKET PACKAGES

This section maps these four program goals to the one or more national ITS architecture market packages best illustrative of the packaged functionality required to implement and achieve the goal. The selected market packages are tailored to expand, include or exclude functionality specific to meet MOA needs.

It is important to map user needs to market packages to establish a thoughtful linkage to the physical architecture. The national ITS architecture market packages identify the pieces of the physical architecture that are required to implement a particular operational transportation service. The market packages provide a deployment-oriented functional perspective for the national architecture. They are tailored to fit operational transportation problems and needs such as have been stated by the users and stakeholders as their needs.

The mapping illustrated by Table 5-1 includes columns that state the key program area as a goal, identify the market package(s) that best represent the functional solutions for that program area, and lastly, present a brief discussion and/or rationale for why these particular market packages are relevant. The full-text descriptions of the MOA tailored market packages are found in Appendix A.

At the conclusion of this section, the mapped market packages are summarized, and duplicates are eliminated.

**Table 5-1: Mapping of Program Areas to Market Packages**

| Stated Goal/Focus Area | Market Package(s) | Discussion/Rationale |
|---|---|---|
| Year Round Operations | | |
| Weather & pavement sensors | Road Weather Data Collection (MC03), and<br>Weather Information Processing and Distribution (MC04). | Rationale: These two market packages provide the functionality needed to collect weather and roadway environmental conditions using fixed (e.g., RWIS) roadside devices as well as mobile sensors integrated with the on-board systems of the MOA maintenance fleet (including snowplows) as well as the buses operated by Anchorage Transit. |
| Smart Snow Plows | Maintenance and Construction Vehicle Tracking (MC01),<br>Maintenance and Construction Vehicle Maintenance (MC02),<br>Roadway Automated Treatment (MC05), and<br>Winter Maintenance (MC06). | Rationale: These four market packages provide the capabilities needed to deploy and operate “smart snowplows.” These smart plows use the AVL capabilities provided by MC01 as supplemented by the local requirement to track off the magnets embedded in the roadway. The on-board diagnostics and vehicle performance capabilities derived from MC02 assist in the notification, scheduling and management of vehicle maintenance. This notification and scheduling capability enhances both routine and corrective maintenance activities on vehicles and other maintenance and construction equipment. The remaining two packages provide the capabilities to manage treatment of roadways in the winter, and to monitor, control and manage the usage of treatment materials (e.g., chemicals). |
| Traffic Signal System | Surface Street Control (ATMS03),<br>Incident Management System (ATMS08), and<br>Emergency Routing (EM2). | Rationale: These three market packages provide the capabilities to control and manage the MOA signal systems during normal operations, and during times when incident or emergency response coordination requires signal timing changes and/or signal preemption rules to be in effect. This granting of signal preemption when needed ensures that emergency response vehicles can expedite their movement to the scene thus clearing the incident sooner, and reducing the risk of secondary effects or major negative impacts on traffic flows in the region. |
| HRI Warning & Preemption | Standard Rail Grade Crossing (ATMS13),<br>Advanced Rail Grade Crossing (ATMS14), and<br>Intersection Collision Avoidance (AVSS10). | Rationale: These three packages combine the features of detection and warning of approaching low and high-speed trains at the at-grade crossings. The combined capability includes early warning of the arrival of the train, collision avoidance deconfliction between the traffic and the train, and the coordinated management of adjacent signalized intersections to reduce delays and avoid gridlock in and around the rail crossing. |

| Stated Goal/Focus Area | Market Package(s) | Discussion/Rationale |
|---|---|---|
| Transit Signal Priority | Transit Vehicle Tracking (APTS1),<br>Transit Fixed-Route Operations (APTS2), and<br>Multi-Modal Coordination (APTS7).<br>Emergency Routing (EM2) | Rationale: These packages collect the AVL data for the fixed route buses as they operate thus enabling the determination of schedule performance and (if late) a subsequent need for signal priority to get them back on schedule. The MOA traffic operations and transit agencies will determine the policy for requesting and/or granting of transit signal priority based on degree of lateness, route of travel, and potential effect on prevailing traffic conditions. It may also be the case that signal priority may be enabled at AM/PM peaks, and that "smart buses" determine the need in cooperation with their fixed-route management facility. Emergency Routing is including in the event transit vehicles are used for evacuation, triage units, etc., during a disaster/emergency. |
| Smart Fare Box | Transit Passenger and Fare Management (APTS4). | Rationale: This market package includes the capability to monitor passenger loading using smart fare boxes, track passenger embark/debark loading locations for origin-destination analysis, and collect and store data aboard the vehicle and/or transmit it to the central facility on demand or as required. |
| Transit Vehicle Management | Transit Vehicle Tracking (APTS1),<br>Transit Fixed-Route Operations (APTS2), and<br>Demand Response Transit Operations (APTS3)<br>Transit Security (APTS5)<br>Transit Maintenance (APTS6) | Rationale: These five packages provide the basis for management of a complete fixed-route and on-demand (paratransit) operation. This capability includes AVL tracking of the transit vehicles and determination of schedule adherence and on time performance as they service their routes and/or on-demand riders. |

| Stated Goal/Focus Area | Market Package(s) | Discussion/Rationale |
|---|---|---|
| Emissions Monitoring, Management and Vehicle Pre-Pass | Emissions Monitoring and Management (ATMS11) | Rationale: This market package provides the capability to monitor individual vehicle emissions, and for MOA and regional general air quality monitoring using data collected from distributed sensors. The collected data and information is then shared with ADEC and the MOA TOC for their use. Both area wide air quality monitoring and point emissions monitoring are supported: for area wide monitoring, the market package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports the supporting data; for point emissions monitoring, the market package measures tail pipe emissions to identify vehicles that exceed emissions standards. The information can then be used to implement environmentally sensitive compliance programs, policies, and regulations, and for enforcement. |
| Incident and Emergency Management Systems | | |
| Hazardous materials tracking & reporting | Electronic Clearance (CVO03),<br>CV Administrative Processes (CVO04),<br>Weigh-In-Motion (CVO06), and<br>HAZMAT Management (CVO10).<br>Emergency Response (EM1) | Rationale: These five market packages provide the capability to pre-credential commercial vehicles and their cargos (e.g., Hazmat or other), and then use those electronic credentials, AVL and WIM check points to track and expedite the CV through the instrumented roadway/freeway system. Additional safety benefits accrue from monitoring the cargo for its safety and integrity—with an explicit incident notification report and current AVL data delivered to emergency response agencies at any sign of abnormal conditions or incident. |
| Video surveillance | Network Surveillance (ATMS01), and<br>Road Weather Data Collection (MC03).<br>Emergency Response (EM1) | Rationale: These three packages enable the capability to collect roadside and roadway environmental condition data, and to observe the roadways with electronic devices (e.g., loops, radar, etc.) or CCTV to collect traffic flow data, verify roadway conditions and detect incidents. |

| Stated Goal/Focus Area | Market Package(s) | Discussion/Rationale |
|---|---|---|
| Vehicle detection | Network Surveillance (ATMS01), and<br>ITS Data Mart (AD1).<br>Emergency Response (EM1) | Rationale: As above, the surveillance package collects data from roadside devices. This data includes (typically) vehicle detection for determination of traffic flows, and CCTV imagery. The traffic counts, or subsequently derived congestion, volume, speed information, can then be used for real-time traffic operations, including emergency response, shared with partner agencies, and archived for future use as traveler information, or for regional traffic analysis and planning. |
| Dynamic message signs | Traffic Information Dissemination (ATMS06)<br>Emergency Response (EM1) | Rationale: These market packages provides the capability for the MOA traffic operations center and MOA incident management function to disseminate en-route driver information using roadside variable message signs and wide-area highway advisory radio. |
| Highway advisory radio | Traffic Information Dissemination (ATMS06)<br>Emergency Response (EM1) | (Same as above) |
| Traveler Information Systems | | |
| 5-1-1 | Interactive Traveler Information (ATIS2) | Rationale: This market package provides the essence of the capability to implement the "5-1-1" traveler information service. The package enables interactive specification and retrieval of traveler information using (in this case) the touch pad of a telephone (fixed or mobile). |
| Internet | Broadcast Traveler Information (ATIS1), and<br>Interactive Traveler Information (ATIS2). | Rationale: These two market packages provide the functionality of the delivery mechanisms for Internet access to traveler information in a broadcast or interactive fashion. Using the Internet is most often interactive (e.g., go to a URL site, click a few buttons, get your information), but can also be broadcast in the sense of a one-time subscription and then recurring notification delivery service. |
| Wireless Web | Broadcast Traveler Information (ATIS1),<br>Interactive Traveler Information (ATIS2), and<br>Yellow Pages and Reservation (ATIS7). | Rationale: This capability is delivered using the same packages from above, with the added capability provided by the ATIS7 yellow pages services. As earlier, the ATIS1 and 2 packages provide the access and delivery mechanisms for the travelers. It is then clear that yellow pages information can be accessed interactively; an example of broadcast yellow pages information might be based on a subscription/profile of the user, or might be based on intentionally short-range wireless advertisement for a special event or location (e.g., Eat at Joe's – one mile ahead). |

| Stated Goal/Focus Area | Market Package(s) | Discussion/Rationale |
|---|---|---|
| Internal Operations | | |
| Mobile data terminals | ITS Data Mart (AD1),<br>ITS Data Warehouse (AD2)<br>Demand Responsive Transit Operations (APTS3)<br>Roadway Maintenance and Construction (MC07).<br>Emergency Response (EM1) | Rationale: These packages provide the desired capability for the MOA fleet to have mobile data terminals (MDT) installed in a variety of vehicles, and for their use in field data collection, dispatch and status reporting as they conduct their business of roadway maintenance and construction, asset management, and emergency/incident response. The archive data mart and warehousing capabilities enable the storage and regional use of the collected data by public agencies and trusted partners. |
| Material usage tracking | Maintenance and Construction Vehicle Maintenance (MC02), and<br>Roadway Automated Treatment (MC05). | Rationale: The packages provide the central facility and the on-board fleet vehicle capabilities to manage automated treatment of roadways, tracking of those applicants and treatments, and monitoring of vehicle performance and diagnostics to assist in fleet vehicle maintenance. |
| Asset management | ITS Data Mart (AD1), and<br>Roadway Maintenance and Construction (MC07). | Rationale: These two market packages enable the collection of roadside infrastructure (and other) asset inventory by MOA fleet operators, and the archiving of that data for asset management and planning uses. |
| Automatic vehicle location | Maintenance and Construction Vehicle Maintenance (MC01),<br>Transit Vehicle Tracking (APTS1), and<br>Transit Traveler Information (APTS8). | Rationale: These packages deliver the central and vehicle on-board capability to instrument fleet vehicles and transit vehicles for automatic vehicle location (AVL) and reporting. In the maintenance vehicle fleet, this data is used to more effectively dispatch and manage the fleet operation. In the transit operations, this data is used to determine schedule adherence and performance, and as a basis for real-time transit traveler information. |
| Shared traveler and traffic information database | ITS Data Warehouse (AD2) | Rationale: This package provides basic data collection and management capabilities with the added functionality and interface definitions that allow collection of data from multiple diverse operating agencies and data sources spanning across modal and jurisdictional boundaries. Then this shared and remotely accessible archive can also function as the regional MOA traveler information source. |

| Stated Goal/Focus Area | Market Package(s) | Discussion/Rationale |
|---|---|---|
| Condition acquisition & reporting system (CARS) | Maintenance and Construction Activity Coordination (MC10),<br>Work Zone Management (MC08), and<br>Incident Management System (ATMS08). | Rationale: These market packages provide the data generation and collection capabilities, which approved agencies then use to enter data into the CARS. This data includes the planning, conduct and coordination of maintenance and construction activity; and the existence, response and clearance estimate details about current planned or unplanned incidents. Once the public agencies enter the data into CARS, it can be filtered and made available for use as traveler information. |
| Common GIS | ITS Data Mart (AD1), and<br>ITS Data Warehouse (AD2). | Rationale: These two market packages provide the focused regional data repository of real-time, near real-time for operational use as well as a more traditional archive of long term performance and planning data. In addition to the capabilities to collect and store the data, the warehouse provides a common regional interface and common spatial reference (e.g., a GIS) for the data thus facilitating more effective information sharing across modal and institutional boundaries. |

**Market Packages – Duplicates Removed**

Thus, with duplicates removed, the list of ITS market packages of interest to the Municipality of Anchorage includes those shown in the following table.

| Code | Title |
|---|---|
| AD1 | ITS Data Mart |
| AD2 | ITS Data Warehouse |
| APTS1 | Transit Vehicle Tracking |
| APTS2 | Transit Fixed-Route Operations |
| APTS3 | Demand Response Transit Operations |
| APTS4 | Transit Passenger and Fare Management |
| APTS5 | Transit Security |
| APTS6 | Transit Maintenance |
| APTS7 | Multi-modal Coordination |
| APTS8 | Transit Traveler Information |
| ATIS1 | Broadcast Traveler Information |
| ATIS2 | Interactive Traveler Information |
| ATIS7 | Yellow Pages and Reservation |
| ATMS01 | Network Surveillance |
| ATMS03 | Surface Street Control |
| ATMS06 | Traffic Information Dissemination |
| ATMS08 | Incident Management System |
| ATMS11 | Emissions Monitoring and Management |
| ATMS13 | Standard Railroad Grade Crossing |

| Coded | Title |
|---|---|
| ATMS14 | Advanced Railroad Grade Crossing |
| AVSS10 | Intersection Collision Avoidance |
| CVO03 | Electronic Clearance |
| CVO04 | CV Administrative Processes |
| CVO06 | Weigh-In-Motion |
| CVO10 | HAZMAT Management |
| EM1 | Emergency Response |
| EM2 | Emergency Routing |
| MC01 | Maintenance and Construction Vehicle Tracking |
| MC02 | Maintenance and Construction Vehicle Maintenance |
| MC03 | Road Weather Data Collection |
| MC04 | Weather Information Processing and Distribution |
| MC05 | Roadway Automated Treatment |
| MC06 | Winter Maintenance |
| MC07 | Roadway Maintenance and Construction |
| MC08 | Work Zone Management |
| MC10 | Maintenance and Construction Activity Coordination |

## 3.2 MAPPING PROGRAM GOALS TO USER SERVICES

This section maps the four program goals to the one or more national ITS architecture user services illustrative of the user functions needed to implement and achieve the goal. The selected user services are derived from and consistent with those developed and stated as the initial mapping of user needs in the Users Services Report and have been tailored to expand, include or exclude functionality and services specific to meet MOA user needs.

It is important to map the stated users needs to the ITS user services as this provides the basis for subsequent selection of the functional processes described in the logical architecture. The user services document what should ITS do from the perspective of the user having expressed the need. Thus, the concept of mapping to user services allows system or project definition to begin by establishing the high level services that will be provided to address both identified transportation problems and the stated user needs.

The mapping illustrated by Table 5-2 includes columns that state the key program area as a goal, identify the top-level user services(s) and lastly, present a brief discussion of the tailored user services(s). The same color-coding scheme is used for ease in locating or tracking a program area.

At the conclusion of this section, the mapped user services are summarized, and duplicates are eliminated.

**Table 5-2: Mapping of Program Areas to User Services**

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| Year Round Operations | | |
| Weather & pavement sensors | Maintenance and Construction Operations (8.1)<br>Roadway Management (8.1.2) | The delivery of user capabilities for sensing or observation of roadways for snow and ice, or other pavement conditions are found within the new roadway management user service within the higher-level collection of maintenance and construction operations.<br>8.1 MAINTENANCE AND CONSTRUCTION OPERATIONS (8.1.0) The MOA ITS shall provide municipal Maintenance and Construction Operations (MCO) functions to support monitoring, operating, maintaining, improving and managing the physical condition of roadways, the associated infrastructure equipment, and the required resources. MCO shall focus on four major functions: 1) the Maintenance Vehicle Fleet Management (MVFM) function, to monitor and track locations and conditions of fleets of maintenance, construction, and specialized service vehicles; 2) the Roadway Management (RWM) function, to monitor and forecast conditions and manage treatment of roadways during various travel conditions; 3) the Work Zone Management and Safety (WZMS) function, to support effective and efficient roadway operations during work zone activities; and 4) the Roadway Maintenance Conditions and Work Plan Dissemination (RMCWPD) function, to coordinate work plans and to communicate conditions.<br>(8.1.2) The MOA MCO ITS shall provide a RWM function using statewide RWIS and/or vehicle on-board sensors to monitor road surface, and environmental conditions and forecast traffic and road surface conditions to support management of routine and hazardous road condition remediation and to communicate changes in conditions. This function includes interactions among Traffic Managers, Supervisors, Dispatchers, Field Crews, Construction Crews, Asset Managers, Planning Agencies, and Weather Services Organizations. |
| Smart Snow Plows | Maintenance and Construction Operations (8.1)<br>Maintenance Vehicle Fleet Management (8.1.1) | Likewise, the delivery of users services in support of "smart snow plows" falls within the new maintenance vehicle (e.g., a snow plow) fleet management user service within the higher-level collection of maintenance and construction operations.<br>8.1 MAINTENANCE AND CONSTRUCTION OPERATIONS (8.1.0) |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | The MOA ITS shall provide municipal Maintenance and Construction Operations (MCO) functions to support monitoring, operating, maintaining, improving and managing the physical condition of roadways, the associated infrastructure equipment, and the required resources. MCO shall focus on four major functions: 1) the Maintenance Vehicle Fleet Management (MVFM) function, to monitor and track locations and conditions of fleets of maintenance, construction, and specialized service vehicles; 2) the Roadway Management (RM) function, to monitor and forecast conditions and manage treatment of roadways during various travel conditions; 3) the Work Zone Management and Safety (WZMS) function, to support effective and efficient roadway operations during work zone activities; and 4) the Roadway Maintenance Conditions and Work Plan Dissemination (RMCWPD) function, to coordinate work plans and to communicate conditions.<br>(8.1.1) MVFM shall be capable of monitoring and tracking the locations of MOA fleet vehicles and/or contracted fleets of maintenance, construction, and specialized service vehicles to provide current location and status information. |
| Traffic Signal System | Traffic Control (1.6) | All aspects of municipal traffic signal control and operations fall under the traffic control family of users services. This includes the capability to enable and deliver centralized or decentralized (i.e., roadside) signal preemption to emergency vehicles, or signal priority to transit vehicles.<br>1.6 TRAFFIC CONTROL (1.6.0) The MOA ITS shall provide a Traffic Control capability. This Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. Four functions are provided which are (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information. |
| HRI Warning & Preemption | Highway-Rail Intersection (1.10)<br>Standard Speed Rail (1.10.4)<br>High-Speed Rail (1.10.5) | The users services covering at grade rail and roadway intersections are delivered by the HRI family; specific services covering standards and advanced HRI are delivered by sub-services for operations at <79MPH, and those 80MPH or greater. These services include centralized or roadside (local) coordination of control for local intersection and roadway traffic signals with the municipal traffic agency.<br>1.10 HIGHWAY-RAIL INTERSECTION (1.10.0) The MOA ITS shall include a Highway-Rail Intersection (HRI) function to control highway and |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | rail traffic in at-grade HRIs. Two sub-services are supported: Standard Speed Rail service which is applicable to light rail transit, commuter rail and heavy rail trains with operational speeds up to 79 miles per hour (MPH); and High Speed Rail service which is applicable to all passenger and freight trains with operational speeds from 80 to 125 MPH.<br>(1.10.4) MOA HRI shall include a Standard Speed Rail (SSR) service to manage highway and rail traffic at HRIs for rail lines with operational speeds less than 80 MPH; and<br>(1.10.5) High Speed Rail (HSR) on rail lines with operational speeds between 80 and 125 MPH. |
| Transit Signal Priority | Traffic Control (1.6)<br>Emergency Vehicle Management (5.2)<br>Emergency Vehicle Signal Preemption/Priority (5.2.3)<br>Public Transportation Management (2.1)<br>Transit Signal Priority (2.1.1.2.3) | The user services that deliver municipal or regional "transit signal priority" cross-cut the areas of traffic control, emergency vehicle management and transit fixed-route (i.e., scheduled service) management. The enabling of transit signal priority is by operational agreement or on request between transit and traffic operations; competing priority/preemption de-confliction of emergency vehicle signal preemption vs. transit signal priority is most likely a decision made at roadside (local control).<br>1.6 TRAFFIC CONTROL (1.6.0) The MOA ITS shall provide a Traffic Control capability. This Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. Four functions are provided which are (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information.<br>5.2 EMERGENCY VEHICLE MANAGEMENT (5.2.0) The MOA ITS shall include an Incident Response Vehicle Management service.<br>(5.2.3) EVM Service shall include a Signal Preemption/Priority System for emergency response vehicles.<br>2.1 PUBLIC TRANSPORTATION MANAGEMENT (2.1.0) The Anchorage People Mover ITS shall include a Public Transportation Management (PTM) function.<br>(2.1.1.2.3) Anchorage People Mover fixed-route operations management shall include an integrated (or shared with the MOA) traffic control capability that provides invocation of traffic signal priority when required for schedule adjustment to Anchorage People Mover vehicles at traffic signals. |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| Smart Fare Box | Public Transportation Management (2.1)<br>Planning and Scheduling Services (2.1.2)<br>Electronic Payment Services (3.1)<br>Electronic Payment Capability<br>(3.1.0)<br>Electronic Fare Collection (EFC) Capability (3.1.2)<br>EFC - Compatible Fare Medium (3.1.2.1)<br>EFC – Data Collection Capability (3.1.2.7)<br>Electronic Payment Services Integration (ESPI) (3.1.4)<br>EPSI for Various Modes (3.1.4.1)<br>EPSI Deployed Across Multiple Agency Political Boundaries (3.1.4.4) | The services to collect fare, ridership boarding, and rider origin-destination information are delivered by sub-services that support data collection for planning and scheduling within public transportation management.<br>2.1 PUBLIC TRANSPORTATION MANAGEMENT (2.1.0) The Anchorage People Mover ITS shall include a Public Transportation Management (PTM) function.<br>2.1.2 Anchorage PTM shall include a Planning and Scheduling Services (PSS) function to automate the planning and scheduling of public transit operations based on data (e.g., passenger loading at stops, origin-destination, etc.) collected through the use of smart fare boxes.<br>3.1 ELECTRONIC PAYMENT SERVICES Anchorage People Mover ITS shall include an Electronic Payment Services (EPS) function.<br>(3.1.0) Anchorage People Mover ITS shall include an Electronic Payment capability. EPS allows travelers to pay for transportation services by electronic means. Four functions are provided: 1) Electronic Toll Collection 2) Electronic Fare Collection, 3) Electronic Parking Payment and 4) Electronic Payment Services Integration.<br>(3.1.2) Anchorage EPS shall include an Electronic Fare Collection (EFC) capability.<br>(3.1.2.1) Anchorage EFC shall be implemented in a manner that the traveler is able to use a compatible fare medium for all applicable surface transportation services.<br>(3.1.2.7) Anchorage EFC shall include the capability to collect the data<br>Required to determine accurate ridership levels.<br>(3.1.4) Anchorage People Mover ITS shall include an Electronic Payment Services Integration (EPSI) feature.<br>(3.1.4.1) Anchorage EPSI shall provide the capability to combine electronic payments made for use of various transportation modes into a single integrated system.<br>(3.1.4.4) Anchorage EPSI shall be implemented in a manner that ensures that it may be deployed across multiple agency political boundaries without degrading the services it provides. |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| Transit Vehicle Management | Public Transportation Management (2.1)<br>Operation of Vehicles and Facilities (2.1.1)<br>Maintenance Personnel Management On-Board Function (2.1.3.1)<br>Personalized Public Transit<br>(2.3) | The MOA and Anchorage People Mover will provide on-board and centralized user services to monitor the real-time operational health and performance parameters of transit vehicles to enhance maintenance diagnostics, improve transit operational performance and transit roadside safety.<br>2.1 PUBLIC TRANSPORTATION MANAGEMENT (2.1.0)<br>The MOA and Anchorage People Mover ITS shall include Public Transportation Management (PTM) functions.<br>(2.1.1) PTM shall include an Operation of Vehicles and Facilities (OVF) on-board function that monitors driveline-operating condition; mileage accumulated by individual buses, and provides real-time vehicle location reports. PTM shall also include a maintenance personnel management (2.1.3.1) on-board function that tracks vehicle measures and diagnostics on each bus in real-time, uses bus mileage or diagnostic/prognostic data to automatically generate preventative maintenance schedules for each specific bus; and the use of these data (centrally) assists/supports in that proper service personnel are provided information for their bus maintenance activities.<br>(2.3) The Personalized Public Transit user service supports flexibly routed transit vehicles. Small, publicly or privately operated vehicles provide on-demand routing to pick up passengers who have requested service and deliver them to their destinations. Route deviation schemes, where vehicles would leave a fixed route for a short distance to pick up or discharge passengers, is another approach employed to improve service. Vehicles providing this service can include small buses, taxicabs, or other small, shared-ride vehicles. Several P-Specs may apply. |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| Emissions Monitoring, Management and Vehicle Pre-Pass | Emissions Testing and Mitigation (1.9)<br>Wide Area Pollution Monitoring (WAPM) capability (1.9.1)<br>Roadside Pollution Assessment (RPA) capabilities (1.9.2)<br>En-Route Driver Information (1.2) | The user services that enable the monitoring, management and enforcement of MOA and/or regional emissions management policies and procedures are contained within and result from the Emission Testing and Mitigation (ETAM) Functions.<br>1.9 EMISSIONS TESTING AND MITIGAITON (1.9.0) The MOA ITS shall include functions that provide local government with the capability to enhance their air quality control strategies using both wide area and roadside emissions monitoring capabilities. Information gleaned from ETAM will be used by the Traffic Management Center (TMC) to mitigate pollution and may be provided to enforcement agencies to compel offenders to comply with standards.<br>(1.9.1) ETAM shall include a Wide Area Pollution Monitoring (WAPM) capability to support air quality control strategies by assessing the level of emission precursors in all sectors of the area, providing air quality data to the MOA TOC, and capable of determining those sectors, within its monitored area, whose emissions exceed the emission standard. WAPM shall be capable of manual or automatic self-calibration, and of collecting the necessary data on emission standards violators for enforcement of air quality standards.<br>(1.9.2) ETAM shall include roadside pollution assessment (RPA) capabilities capable of detecting the level of emissions, and capable of detecting moving vehicles, within its monitored area, whose emissions violate the defined emission standard. RPA shall also be capable of reading a suitably equipped vehicle's diagnostic data or Pre-Pass tag to determine that vehicle's operational status, also determine a suspect vehicle's registration data either by license plate or via automatic vehicle identification, and determine which suspect vehicles are not in compliance with emission standards for that vehicle from the vehicle's registration or Pre-Pass tag data. RPA shall be capable of providing the necessary data to alert en-route non-complaint vehicle drivers of their violation via roadside message signs or in-vehicle devices. |
| Incident and Emergency Management Systems | | |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| Hazardous materials tracking & reporting | Commercial Vehicle Electronic Clearance (4.1)<br>On-Board Safety Monitoring (4.3)<br>Hazardous Material Incident Response (4.5)<br>Incident Management (1.7)<br>Emergency Vehicle Management (5.2)<br>Emergency Vehicle Management Service Determination and Dispatch (5.2.1.2) | The tracking of HAZMAT movement in MOA and the region is enabled by the delivery of several supporting and complimentary user services. These include electronic clearance, vehicle identification and safety monitoring, and notification when something isn't right (e.g., incident, disabled, etc.) with a HAZMAT shipment. Regional HAZMAT and incident response, and emergency vehicle management capabilities are also pre-conditioned to the particular HAZMAT situation as they respond.<br>4.1 COMMERCIAL VEHICLE ELECTRONIC CLEARANCE (4.1.0) The MOA ITS shall include a Commercial Vehicle Electronic Clearance (CVEC) capability to include both fixed facilities (e.g., structures and equipment located at Ports Of Entry, Inspection Stations, Weigh Stations, etc.) and supporting information systems to enable tracking of HAZMAT in the region.<br>4.3 ON-BOARD SAFETY MONITORING (4.3.0) The MOA ITS shall encourage or require an On-Board Safety Monitoring (OBSM) function that provides monitoring and warnings of vehicle or cargo safety problems for all transport of HAZMAT in the municipality and the region. Of primary importance is to inform the driver, as soon as possible, of any problem that has been detected. Of secondary importance is notifying the carrier and (HIR) first response agencies of detected safety problems with the vehicle or the HAZMAT cargo.<br>4.5 HAZARDOUS MATERIAL INCIDENT RESPONSE (4.5.0) The MOA ITS shall include a Hazardous Materials (HAZMAT) Incident Response (HIR) service to include the capability (4.5.1.1) to provide enforcement and HAZMAT first response teams with timely and accurate information on cargo contents when the HAZMAT vehicle is disabled or involved in an incident.<br>1.7 INCIDENT MANAGEMENT (1.7.0) The MOA ITS shall include an Incident Management (IM) function. This Incident Management capability will identify traffic, environmental or weather incidents; formulate response actions, and support initiation and ongoing coordination of HAZMAT or normal traffic incident response actions. Six major functions are provided which are (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions.<br>5.2 EMERGENCY VEHICLE MANAGEMENT (5.2.0) The MOA ITS |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | shall include an Emergency Vehicle Management (EVM) Service to include (5.2.1.2) determination and dispatch of the emergency response vehicles best suited to respond to a HAZMAT incident. |
| Video surveillance | Traffic Control (1.6)<br>Traffic Surveillance (1.6.2)<br>Incident Management (1.7) | Traffic network surveillance using CCTV (and several other means) is included in the traffic control user services, and is used to detect incidents and monitor incident status.<br>1.6 TRAFFIC CONTROL (1.6.0) The MOA ITS shall provide a Traffic Control capability. This Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. Four functions are provided which are (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information.<br>(1.6.2) MOA ITS shall include a Traffic Surveillance capability to include the use of closed-circuit TV to observe and capture full-motion or snapshot images of traffic.<br>1.7 INCIDENT MANAGEMENT (1.7.0) The MOA ITS shall include an Incident Management (IM) function. This Incident Management capability will identify traffic, environmental or weather incidents; formulate response actions, and support initiation and ongoing coordination of HAZMAT or normal traffic incident response actions. Six major functions are provided which are (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions. |
| Vehicle detection | Traffic Control (1.6)<br>Traffic Surveillance (1.6.2)<br>Incident Management (1.7)<br>Archived Data Function (7.1) | Traffic network surveillance using CCTV (and several other means) is included in the traffic control users services, and is used to detect incidents and monitor incident status.<br>1.6 TRAFFIC CONTROL (1.6.0) The MOA ITS shall provide a Traffic Control capability. This Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. Four functions are provided which are (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information.<br>(1.6.2) MOA ITS shall include a Traffic Surveillance capability to include the use of vehicle detection (e.g., using loops, radar, imagery processing, etc.) and data collection. |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | 1.7 INCIDENT MANAGEMENT (1.7.0) The MOA ITS shall include an Incident Management (IM) function. This Incident Management capability will identify traffic, environmental or weather incidents; formulate response actions, and support initiation and ongoing coordination of those response actions. Six major functions are provided which are (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions.<br>7.1 ARCHIVED DATA FUNCTION (7.1.0) The MOA ITS shall provide a municipal Archived Data Function to control the archiving and distribution of ITS data. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data with five major functions: (1) the Operational Data Control function to manage operations data integrity; (2) the Data Import and Verification function to acquire historical data from the Operational Data Control function; (3) the Automatic Data Historical Archive function for permanently archiving the data; (4) the Data Warehouse Distribution function, which integrates the planning, safety, operations, and research communities into ITS and processes data products for these communities; and (5) the ITS Community Interface which provides the ITS common interface, common GIS, and access tools used by all ITS users for data products specification and retrieval. ADUS and common regional databases and GIS help achieve the ITS information goal of unambiguous interchange and reuse of data and information throughout all program areas. |
| Dynamic message signs | En-Route Driver Information (1.2)<br>Traffic Control (1.6)<br>Incident Management (1.7) | The use of DMS for en-route driver information and traffic management under normal or unusual conditions is based on the availability of that information as produced by routine traffic control operations, or under exceptional conditions as part of incident management and response activities.<br>1.2 EN-ROUTE DRIVER INFORMATION (1.2.0) The MOA ITS shall include an En-Route Driver Information (DI) function. Driver Information provides vehicle drivers with advisory and status information, while en-route, which will allow alternative routes or modes to be chosen for their destination.<br>1.6 TRAFFIC CONTROL (1.6.0) The MOA ITS shall provide a Traffic Control capability. This Traffic Control provides the capability to |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | efficiently manage the movement of traffic on streets and highways. Four functions are provided which are (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information.<br>1.7 INCIDENT MANAGEMENT (1.7.0) The MOA ITS shall include an Incident Management (IM) function. This Incident Management capability will identify traffic, environmental or weather incidents; formulate response actions, and support initiation and ongoing coordination of those response actions. Six major functions are provided which are (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions. |
| Highway advisory radio | En-Route Driver Information (1.2)<br>Traffic Control (1.6)<br>Incident Management (1.7) | Likewise, as with DMS, the use of HAR for en-route driver information and traffic management under normal or unusual conditions is based on the availability of that information as produced by routine traffic control operations, or under exceptional conditions as part of incident management and response activities.<br>1.2 EN-ROUTE DRIVER INFORMATION (1.2.0) The MOA ITS shall include an En-Route Driver Information (DI) function. Driver Information provides vehicle drivers with advisory and status information, while en-route, which will allow alternative routes or modes to be chosen for their destination.<br>1.6 TRAFFIC CONTROL (1.6.0) The MOA ITS shall provide a Traffic Control capability. This Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. Four functions are provided which are (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information.<br>1.7 INCIDENT MANAGEMENT (1.7.0) The MOA ITS shall include an Incident Management (IM) function. This Incident Management capability will identify traffic, environmental or weather incidents; formulate response actions, and support initiation and ongoing coordination of those response actions. Six major functions are provided which are (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions. |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| Traveler Information Systems | | |
| 5-1-1 | Pre-Trip Travel Information (1.1)<br>En-Route Driver Information (1.2)<br>En-Route Transit Information<br>(2.2) | The use of MOA, regional or statewide "5-1-1" to provide traveler information delivers a capability for both pre-trip planning, and en-route access to information about any changes in travel conditions.<br>1.1 PRE-TRIP TRAVEL INFORMATION (1.1.0) The MOA ITS shall provide a Pre-Trip Travel Information (PTTI) capability to assist all type travelers in making modal choices, travel time estimates, and route decisions prior to their trip departure. This PTTI will consist of four major functions, which are, (1) Available Services Information, (2) Current Situation Information, (3) Trip Planning Service, and (4) User Access.<br>1.2 EN-ROUTE DRIVER INFORMATION (1.2.0) The MOA ITS shall include an En-Route Driver Information (DI) function. Driver Information provides vehicle drivers with advisory and status information, while en-route, which will allow alternative routes or modes to be chosen for their destination.<br>2.2 EN-ROUTE TRANSIT INFORMATION (2.2.0) The MOA ITS shall include an En-Route Transit Information (TI) function. En-Route Transit Information provides travelers with real-time transit and high-ocupancy vehicle information allowing travel alternatives to be chosen once the traveler is en-route. It consists of three major functions, which are 1) Information Distribution, 2) Information Receipt and 3) Information Processing. This capability integrates information from different transit modes and presents it to travelers for decision making. |
| Internet | Pre-Trip Travel Information (1.1)<br>En-Route Driver Information (1.2)<br>En-Route Transit Information<br>(2.2) | Likewise, the use of the Internet to provide access to traveler information delivers a capability for both pre-trip planning, and en-route access to information about any changes in travel conditions. The en-route access capability can be delivered through hands-free in-vehicle systems, at road-side locations (e.g., rest stop kiosk), etc.<br>1.1 PRE-TRIP TRAVEL INFORMATION (1.1.0) The MOA ITS shall provide a Pre-Trip Travel Information (PTTI) capability to assist all type travelers in making modal choices, travel time estimates, and route decisions prior to their trip departure. This PTTI will consist of four major functions, which are, (1) Available Services Information, (2) Current Situation Information, (3) Trip Planning Service, and (4) User Access. |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | 1.2 EN-ROUTE DRIVER INFORMATION (1.2.0) The MOA ITS shall include an En-Route Driver Information (DI) function. Driver Information provides vehicle drivers with advisory and status information, while en-route, which will allow alternative routes or modes to be chosen for their destination.<br>2.2 EN-ROUTE TRANSIT INFORMATION (2.2.0) The MOA ITS shall include an En-Route Transit Information (TI) function. En-Route Transit Information provides travelers with real-time transit and high-ocupancy vehicle information allowing travel alternatives to be chosen once the traveler is en-route. It consists of three major functions, which are 1) Information Distribution, 2) Information Receipt and 3) Information Processing. This capability integrates information from different transit modes and presents it to travelers for decision making. |
| Wireless Web | Pre-Trip Travel Information (1.1)<br>En-Route Driver Information (1.2)<br>Traveler Services Information (1.5)<br>En-Route Transit Information (2.2) | Likewise, the use of the "wireless web" capabilities to provide access to traveler information delivers a capability for both pre-trip planning, en-route access to information about any changes in travel conditions, and regional traveler services information (e.g., limited yellow pages). The en-route access capability can be delivered through hands-free in-vehicle systems, at road-side locations (e.g., rest stop kiosk), etc.<br>1.1 PRE-TRIP TRAVEL INFORMATION (1.1.0) The MOA ITS shall provide a Pre-Trip Travel Information (PTTI) capability to assist all type travelers in making modal choices, travel time estimates, and route decisions prior to their trip departure. This PTTI will consist of four major functions, which are, (1) Available Services Information, (2) Current Situation Information, (3) Trip Planning Service, and (4) User Access.<br>1.2 EN-ROUTE DRIVER INFORMATION (1.2.0) The MOA ITS shall include an En-Route Driver Information (DI) function. Driver Information provides vehicle drivers with advisory and status information, while en-route, which will allow alternative routes or modes to be chosen for their destination.<br>1.5 TRAVELER SERVICES INFORMATION (1.5.0) The MOA ITS shall include a Traveler Services Information (TSI) function. Traveler Services Information will provide all type travelers with service and facility status data and information for the purpose of assisting them prior to embarking on a |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | trip or after the traveler is underway. The functions that are included in this capability are (1) Information Receipt and (2) Information Access. In many cases this will also emphasize tourism information and provide the traveler with a "yellow pages" information capability.<br>2.2 EN-ROUTE TRANSIT INFORMATION (2.2.0) The MOA ITS shall include an En-Route Transit Information (TI) function. En-Route Transit Information provides travelers with real-time transit and high-ocupancy vehicle information allowing travel alternatives to be chosen once the traveler is en-route. It consists of three major functions, which are 1) Information Distribution, 2) Information Receipt and 3) Information Processing. This capability integrates information from different transit modes and presents it to travelers for decision making. |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | |
| Internal Operations | | |
| Mobile data terminals | Incident Response (1.7)<br>Archived Data Function (7.1)<br>Maintenance and Construction Operations (8.1)<br>Maintenance Vehicle Fleet Management (8.1.1)<br>Public Transportation<br>Management (2.1)<br>Personalized Public<br>Transportation (2.3) | MDT's are used in incident response, as well as by other fleets, and for data collection. The use of mobile data terminals is enabled through the MVFM user service within MCO. This user service delivers the capability for field data entry, two-way communications, and more effective, efficient fleet and fixed asset management.<br>1.7 INCIDENT MANAGEMENT (1.7.0) The MOA ITS shall include an Incident Management (IM) function. This Incident Management capability will identify traffic, environmental or weather incidents; formulate response actions, and support initiation and ongoing coordination of those response actions. Six major functions are provided which are (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions.<br>7.1 ARCHIVED DATA FUNCTION (7.1.0) The MOA ITS shall provide a municipal Archived Data Function to control the archiving and distribution of ITS data. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data with five major functions: (1) the Operational Data Control function to manage operations data integrity; (2) the Data Import and Verification function to acquire historical data from the Operational Data Control function; (3) the Automatic Data Historical Archive function for permanently archiving the data; (4) the Data Warehouse Distribution function, which integrates the planning, safety, operations, and research communities into ITS and processes data products for these communities; and (5) the ITS Community Interface which provides the ITS common interface, common GIS, and access tools used by all ITS users for data products specification and retrieval. ADUS and common regional databases and GIS help achieve the ITS information goal of unambiguous interchange and reuse of data and information throughout all program areas.<br>8.1 MAINTENANCE AND CONSTRUCTION OPERATIONS (8.1.0) The MOA ITS shall provide municipal Maintenance and Construction Operations (MCO) functions to support monitoring, operating, maintaining, improving and managing the physical condition of roadways, the associated infrastructure equipment, and the required resources. MCO |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | shall focus on four major functions: 1) the Maintenance Vehicle Fleet Management (MVFM) function, to monitor and track locations and conditions of fleets of maintenance, construction, and specialized service vehicles; 2) the Roadway Management (RM) function, to monitor and forecast conditions and manage treatment of roadways during various travel conditions; 3) the Work Zone Management and Safety (WZMS) function, to support effective and efficient roadway operations during work zone activities; and 4) the Roadway Maintenance Conditions and Work Plan Dissemination (RMCWPD) function, to coordinate work plans and to communicate conditions.<br>(8.1.1) MVFM shall be capable of monitoring and tracking the locations of MOA fleet vehicles and/or contracted fleets of maintenance, construction, and specialized service vehicles to provide current location, and to exchange dispatch and status information using vehicle on-board mobile data terminals (MDT).<br>(2.1) PUBLIC TRANSPORTATION MANAGEMENT 92.1.0) The Anchorage People Mover ITS shall include a Public Transportation Mangement (PTM) Function.<br>(2.3) The Personalized Public Transit user service supports flexibly routed transit vehicles. Small, publicly or privately operated vehicles provide on-demand routing to pick up passengers who have requested service and deliver them to their destinations. Route deviation schemes, where vehicles would leave a fixed route for a short distance to pick up or discharge passengers, is another approach employed to improve service. Vehicles providing this service can include small buses, taxicabs, or other small, shared-ride vehicles. |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | |
| Material usage tracking | Maintenance and Construction Operations (8.1)<br>Roadway Management (8.1.2) | The comprehensive capability to monitor on-board vehicle and roadway management systems, the needs for treatment, and to monitor and manage the consumption of (treatment) materials is included in the sub-services of the roadway management user service.<br>8.1 MAINTENANCE AND CONSTRUCTION OPERATIONS (8.1.0) The MOA ITS shall provide municipal Maintenance and Construction Operations (MCO) functions to support monitoring, operating, maintaining, improving and managing the physical condition of roadways, the associated infrastructure equipment, and the required resources. MCO shall focus on four major functions: 1) the Maintenance Vehicle Fleet Management (MVFM) function, to monitor and track locations and conditions of fleets of maintenance, construction, and specialized service vehicles; 2) the Roadway Management (RM) function, to monitor and forecast conditions and manage treatment of roadways during various travel conditions; 3) the Work Zone Management and Safety (WZMS) function, to support effective and efficient roadway operations during work zone activities; and 4) the Roadway Maintenance Conditions and Work Plan Dissemination (RMCWPD) function, to coordinate work plans and to communicate conditions.<br>(8.1.2) The MOA MCO ITS shall provide a RWM function using vehicle on-board sensors to monitor road surface, and environmental conditions and forecast traffic and road surface conditions to support management of routine and hazardous road condition remediation and to communicate changes in conditions; to determine the need for forecasted and scheduled roadway treatment (8.1.2.4) and make use of information on usage of treatments and materials (8.1.2.4.4). This function includes interactions among Traffic Managers, Supervisors, Dispatchers, Field Crews, Construction Crews, Asset Managers, Planning Agencies, and Weather Services Organizations. |
| Asset management | Archived Data Function (7.1)<br>Maintenance and Construction Operations (8.1) | The use of a MOA or regional asset management archive, and roadway fleet operations to collect and monitor the status of such assets using contact crews or mobile data terminals is enabled through the RWM user service within MCO. This user service delivers the capability for initial or |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | Roadway Management (8.1.2) | follow-up field data entry, two-way communications, and achieves more effective, efficient fixed asset management.<br><br>7.1 ARCHIVED DATA FUNCTION (7.1.0) The MOA ITS shall provide a municipal Archived Data Function to control the archiving and distribution of ITS data. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data with five major functions: (1) the Operational Data Control function to manage operations data integrity; (2) the Data Import and Verification function to acquire historical data from the Operational Data Control function; (3) the Automatic Data Historical Archive function for permanently archiving the data; (4) the Data Warehouse Distribution function, which integrates the planning, safety, operations, and research communities into ITS and processes data products for these communities; and (5) the ITS Community Interface which provides the ITS common interface, common GIS, and access tools used by all ITS users for data products specification and retrieval. ADUS and common regional databases and GIS help achieve the ITS information goal of unambiguous interchange and reuse of data and information throughout all program areas.<br><br>8.1 MAINTENANCE AND CONSTRUCTION OPERATIONS (8.1.0) The MOA ITS shall provide municipal Maintenance and Construction Operations (MCO) functions to support monitoring, operating, maintaining, improving and managing the physical condition of roadways, the associated infrastructure equipment, and the required resources. MCO shall focus on four major functions: 1) the Maintenance Vehicle Fleet Management (MVFM) function, to monitor and track locations and conditions of fleets of maintenance, construction, and specialized service vehicles; 2) the Roadway Management (RM) function, to monitor and forecast conditions and manage treatment of roadways during various travel conditions; 3) the Work Zone Management and Safety (WZMS) function, to support effective and efficient roadway operations during work zone activities; and 4) the Roadway Maintenance Conditions and Work Plan Dissemination (RMCWPD) function, to coordinate work plans and to communicate conditions.<br><br>(8.1.2) The MOA MCO ITS shall provide a RWM function using vehicle on-board sensors and/or MDTs to support the identification of pavement and infrastructure assets, and the management and status tracking for these |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | same assets. This function includes interactions among Traffic Managers, Supervisors, Field Crews, Construction Crews, Asset Managers, and Planning Agencies. |
| Automatic vehicle location | Maintenance and Construction Operations (8.1)<br>Maintenance Vehicle Fleet Management (8.1.1)<br>Public Transportation Management (2.1)<br>Real-Time Vehicle Locations Reports (2.1.1.1(f)) | The automatic tracking of MOA fleet and Anchorage Transit vehicles is enabled by the MVFM services within MCO, and by the PTM functions within Anchorage Transit vehicles and collected at their transit management facility. These collectively enable better dispatch of the MOA fleet, and better performance of the Anchorage transit fleet—including better information then provided to transit riders as traveler information.<br>8.1 MAINTENANCE AND CONSTRUCTION OPERATIONS (8.1.0) The MOA ITS shall provide municipal Maintenance and Construction Operations (MCO) functions to support monitoring, operating, maintaining, improving and managing the physical condition of roadways, the associated infrastructure equipment, and the required resources. MCO shall focus on four major functions: 1) the Maintenance Vehicle Fleet Management (MVFM) function, to monitor and track locations and conditions of fleets of maintenance, construction, and specialized service vehicles; 2) the Roadway Management (RM) function, to monitor and forecast conditions and manage treatment of roadways during various travel conditions; 3) the Work Zone Management and Safety (WZMS) function, to support effective and efficient roadway operations during work zone activities; and 4) the Roadway Maintenance Conditions and Work Plan Dissemination (RMCWPD) function, to coordinate work plans and to communicate conditions.<br>(8.1.1) MVFM shall be capable of monitoring and tracking the locations of MOA fleet vehicles and/or contracted fleets of maintenance, construction, and specialized service vehicles to provide current location and status information.<br>2.1 PUBLIC TRANSPORTATION MANAGEMENT (2.1.0) The Anchorage Transit ITS shall include a Public Transportation Management (PTM) function including the capability to track the location of transit vehicles in real-time (2.1.1.1(f)). |
| Shared traveler and traffic info database | Archived Data Function (7.1)<br>Archived Data-ITS Community Interface (7.1.6) | The essence of a successful shared regional traveler information database is found in the archive data user service—in particular, that covering a common, well-understood "ITS community" interfaces to access the real- |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | time and non-real time historical data resident in the archive.<br>7.1 ARCHIVED DATA FUNCTION (7.1.0) The MOA ITS shall provide a municipal Archived Data Function to control the archiving and distribution of ITS data. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data with five major functions: (1) the Operational Data Control function to manage operations data integrity; (2) the Data Import and Verification function to acquire historical data from the Operational Data Control function; (3) the Automatic Data Historical Archive function for permanently archiving the data; (4) the Data Warehouse Distribution function, which integrates the planning, safety, operations, and research communities into ITS and processes data products for these communities; and (5) the ITS Community Interface which provides the ITS common interface, common GIS, and access tools used by all ITS users for data products specification and retrieval. ADUS and common regional databases and GIS help achieve the ITS information goal of unambiguous interchange and reuse of data and information throughout all program areas.<br>(7.1.6) The MOA Archived Data Function shall provide users with an ITS Community Interface (ICI) including all common database access tools, common municipal and regional GIS, etc., that MOA, regional and statewide ITS users need for the specification and retrieval of archived data products. |
| Condition acquisition & reporting system (CARS) | Maintenance and Construction Operations (8.1)<br>Roadway Management (8.1.2)<br>Roadway Maintenance Conditions and Work plan Dissemination (8.1.4)<br>Incident Management (1.7) | The use of CARS provides the underlying capability for better collection and management of internal maintenance and construction operations data, incident notification and coordinated incident response, and it also provides a primary source for filtered (e.g., less detailed, sanitized) regional traveler information. The use of CARS itself is covered by these two users services (below); the benefits provided to traveler information dissemination are realized in the "5-1-1", Internet and wireless web delivery services mentioned above.<br>8.1 MAINTENANCE AND CONSTRUCTION OPERATIONS (8.1.0) The MOA ITS shall provide municipal Maintenance and Construction Operations (MCO) functions to support monitoring, operating, maintaining, improving and managing the physical condition of roadways, the associated infrastructure equipment, and the required resources. MCO shall focus on four major functions: 1) the Maintenance Vehicle Fleet Management (MVFM) function, to monitor and track locations and |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
|---|---|---|
| | | conditions of fleets of maintenance, construction, and specialized service vehicles; 2) the Roadway Management (RWM) function, to monitor and forecast conditions and manage treatment of roadways during various travel conditions; 3) the Work Zone Management and Safety (WZMS) function, to support effective and efficient roadway operations during work zone activities; and 4) the Roadway Maintenance Conditions and Work Plan Dissemination (RMCWPD) function, to coordinate work plans and to communicate conditions. These functions include various interactions among Traffic Managers, Supervisors, Dispatchers, Field Crews, Construction Crews, Asset Managers, Planning Agencies, Weather Services Organizations, Planning Agencies, Public Safety Organizations, and Information Service Providers.<br>(8.1.2) The MOA MCO ITS shall provide a RWM function using statewide CARS record the results of monitoring roadway surface, and environmental conditions and forecast traffic and road surface conditions to support management of routine and hazardous road condition remediation and to communicate changes in conditions.<br>(8.1.4) The MOA MCO ITS shall provide a Roadway Maintenance Conditions and Work Plan Dissemination (RMCWPD) function using CARS to provide Intra- and Inter-agency coordination of work plans, and as a source for basic traveler information dissemination by the agencies or by ISPs.<br>1.7 INCIDENT MANAGEMENT (1.7.0) The MOA ITS shall include an Incident Management (IM) function. This Incident Management capability will identify traffic, environmental or weather incidents; formulate response actions, and support initiation and ongoing coordination of those response actions. Six major functions are provided which are (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions |
| Common GIS | Archived Data Function (7.1)<br>Archived Data-ITS Community Interface (7.1.6) | Likewise, the essence of a successful shared regional transportation information database is found in the archive data user service—in particular, that covering standardization and commonality of spatial references in well-understood "ITS community" interfaces to access the real-time and non-real time historical data resident in the archive. The use of a common GIS provides the consistency needed to more effectively share information |

| Stated Goal/Focus Area | User Service(s) | Description/Rationale |
| --- | --- | --- |
| | | across institutional boundaries—in effect, eliminating those boundaries as far as use of the archived data is concerned.<br>7.1 ARCHIVED DATA FUNCTION (7.1.0) The MOA ITS shall provide a municipal Archived Data Function to control the archiving and distribution of ITS data. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data with five major functions: (1) the Operational Data Control function to manage operations data integrity; (2) the Data Import and Verification function to acquire historical data from the Operational Data Control function; (3) the Automatic Data Historical Archive function for permanently archiving the data; (4) the Data Warehouse Distribution function, which integrates the planning, safety, operations, and research communities into ITS and processes data products for these communities; and (5) the ITS Community Interface which provides the ITS common interface, common GIS, and access tools used by all ITS users for data products specification and retrieval. ADUS and common regional databases and GIS help achieve the ITS information goal of unambiguous interchange and reuse of data and information throughout all program areas.<br>(7.1.6) The MOA Archived Data Function shall provide users with an ITS Community Interface (ICI) including all common database access tools, common municipal and regional GIS, etc., that authorized MOA, regional and statewide ITS users need for the collection and insertion of data into the archive, and for the specification and retrieval of archived data products. |

**User Services – Duplicates Removed**

Thus, with duplicates removed, the list of ITS user services of interest to the Municipality of Anchorage includes those shown in the following table.

| Number | Title |
|---|---|
| 1.1 | Pre-Trip Traveler Information |
| 1.2 | En-Route Driver Information |
| 1.5 | Traveler Services Information |
| 1.6 | Traffic Control |
| 1.6.2 | Traffic Surveillance |
| 1.7 | Incident Management |
| 1.9 | Emissions Testing and Mitigation |
| 1.9.1 | Wide Area Pollution Monitoring |
| 1.9.2 | Roadside Pollution Assessment |
| 1.10 | Highway-Rail Intersection |
| 1.10.4 | Standard Speed Rail |
| 1.10.5 | High-Speed Rail |
| 2.1 | Public Transportation Management |
| 2.1.1 | Operation of Vehicles and Facilities |
| 2.1.1.1(f) | Real-Time Vehicle Location Reports |
| 2.1.1.2.3 | Transit Signal Priority |
| 2.1.2 | Planning and Scheduling Services |
| 2.1.3.1 | Maintenance Personnel On-Board Function |
| 2.2 | En-Route Transit Information |
| 2.3 | Personalized Public Transit |
| 3.1 | Electronic Payment Services |
| 3.1.0 | Electronic Payment Capability |

| Number | Title |
|---|---|
| 3.1.2 | Electronic Fare Collection (EFC) |
| 3.1.2.1 | Compatible Fare Medium |
| 3.1.2.7 | Ridership Data Collection |
| 3.1.4 | Electronic Payment Services Integration |
| 3.1.4.1 | EPS – Single Integrated System |
| 3.1.4.4 | EPS Deployment Across Boundaries |
| 4.1 | Commercial Vehicle Electronic Clearance |
| 4.3 | On-Board Safety Monitoring |
| 4.5 | Hazardous Material Incident Response |
| 5.2 | Emergency Vehicle Management |
| 5.2.1.2 | Emergency Vehicle Management Service Determination and Dispatch |
| 5.2.3 | Emergency Vehicle Signal Preemption/Priority |
| 7.1 | Archived Data Function |
| 7.1.6 | Archived Data-ITS Community Interface |
| 8.1 | Maintenance and Construction Operations |
| 8.1.1 | Maintenance Vehicle Fleet Management |
| 8.1.2 | Roadway Management |
| 8.1.4 | Roadway Maintenance Conditions and Work |

## 3.3 MARKET PACKAGE TO USER SERVICES CROSS-REFERENCE

This section presents the summarized market packages and user services cross-referenced to each other. This cross-referencing indicates how the deployment of each market package enables from one to several user services. Accordingly, this cross-reference also illustrates which market packages provide the most “bang for the buck” in terms of breath of user services enabled, and is useful information for subsequent implementation strategy, planning and scheduling.

Table 5-3: Market Package to User Service Cross-Reference eliminates all duplication of market packages and user services, and illustrates how the user services (the rows) are related to the market packages (the columns). This information is interpreted as follows--when a market package is deployed, it enables the functionality required to deliver a user service to the target user audience. This enabling effect is illustrated in the table by the indication of a "●" in each location where a user service (row) is enabled by the corresponding market package (column) functionality. This relationship is seldom if ever one-to-one and is not always obvious. It is often the case that a single user service will require multiple market packages for full capability as envisioned in the national architecture, or as tailored for specific implementation in Alaska. Likewise, it is often the case that a single market package provides functionality that will enable more than one user service.

## Table 5-3: Market Package to User Service Cross-Reference

| User Services \ Market Packages | AD1 | AD2 | APTS1 | APTS2 | APTS3 | APTS4 | APTS5 | APTS6 | APTS7 | APTS8 | ATIS1 | ATIS2 | ATIS7 | ATMS01 | ATMS03 | ATMS06 | ATMS08 | ATMS11 | ATMS13 | ATMS14 | AVSS10 | CVO03 | CVO04 | CVO06 | CVO10 | EM1 | EM2 | MC01 | MC02 | MC03 | MC04 | MC05 | MC06 | MC07 | MC08 | MC10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | ● | ● | | ● | ● | | ● | | | ● | ● | ● | ● | | | | | | | | | | | | | | | | | | | | | | | |
| 1.2 | | | | | | | | | | ● | ● | ● | ● | | | ● | | ● | ● | ● | | | | | | | | | | | | | | | | |
| 1.5 | ● | ● | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | |
| 1.6 | | | | | | | | | | | | | | ● | ● | ● | ● | | ● | ● | | | | | | | ● | | | | | | | | | |
| 1.6.2 | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | |
| 1.7 | | | | | | | ● | | | | | | | ● | | ● | ● | | | | | | | | ● | ● | | | | | | | | | | |
| 1.9 | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | |
| 1.9.1 | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | |
| 1.9.2 | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | |
| 1.10 | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | |
| 1.10.4 | | | | | | | | | | | | | | | | | | | ● | ● | ● | | | | | | | | | | | | | | | |
| 1.10.5 | | | | | | | | | | | | | | | | | | | ● | ● | ● | | | | | | | | | | | | | | | |
| 2.1 | ● | ● | ● | ● | ● | ● | | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.1.1 | ● | ● | ● | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.1.1.1(f) | | | ● | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.1.1.2.3 | | | | | | | | | ● | | | | | | ● | | | | | | | | | | | | | | | | | | | | | |
| 2.1.2 | | | | ● | ● | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.1.3.1 | | | ● | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 | | | ● | ● | ● | ● | | ● | ● | ● | | ● | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.3 | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1 | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1.0 | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1.2 | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1.2.1. | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1.2.7 | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1.4 | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1.4.1 | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1.4.4 | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Market Packages**

| | AD1 | AD2 | APTS1 | APTS2 | APTS3 | APTS4 | APTS5 | APTS6 | APTS7 | APTS8 | ATIS1 | ATIS2 | ATIS7 | ATMS01 | ATMS03 | ATMS06 | ATMS08 | ATMS11 | ATMS13 | ATMS14 | AVSS10 | CVO03 | CVO04 | CVO06 | CVO10 | EM1 | EM2 | MC01 | MC02 | MC03 | MC04 | MC05 | MC06 | MC07 | MC08 | MC10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.1 | ● | ● | | | | | | | | | | | | | | | | ● | | | | ● | ● | ● | | | | | | | | | | | | |
| 4.3 | | | | | | | | | | | | | | | | | ● | | | | | | | | ● | | | | | | | | | | | |
| 4.5 | | | | | | | | | | | | | | | | | ● | | | | | | | | ● | ● | | | | | | | | | | |
| 5.2 | | | | | | | | | | | | | | | ● | | ● | | | | | | | | | ● | ● | | | | | | | | | |
| 5.2.1.2 | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | |
| 5.2.3 | | | | | | | | | | | | | | | ● | | | | | | | | | | | ● | ● | | | | | | | | | |
| 7.1 | ● | ● | | ● | | | | | | | | | | ● | ● | | ● | ● | | | | | | | | | | | | ● | ● | | | | | ● |
| 7.1.6 | ● | ● | | | | | | | | | ● | ● | | | | | | ● | | | | | | | | | | | | | | | | | | |
| 8.1 | ● | ● | | | | | | | | | | | | | | ● | | | | | | | | | | | | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 8.1.1 | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | ● | ● | | | |
| 8.1.2 | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | ● | ● | ● | | |
| 8.1.4 | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | ● |

# 4. PROGRAM AREAS REVISITED

Now that the proposed market packages and user services are identified, this section presents a synthesis of that information as a next stage—represented as a top-level graphical illustration of each of the four key program areas.

The four figures that follow illustrate the integration of the one or more market packages to meet the stated needs for: year round operations, incident and emergency management systems, traveler information systems or internal operations. For continuity, the user services that will be enabled are listed beside each figure.

## 4.1 YEAR ROUND OPERATIONS

Figure 5-3 illustrates the Municipality of Anchorage Year Round Operations capability. In general, the left of Figure 5-3 shows the sensors and mechanisms for roadway and other environmental data collection, visual surveillance of the roadway for detection and verification of weather conditions, and vehicle emissions monitoring. Likewise, it illustrates that MOA snow plows and maintenance fleet vehicles, and Anchorage transit vehicles will serve as sources of roadway environmental conditions using on-board sensor systems. Lastly, MOA will acquire rail-roadway intersection data for standard and high-speed rail crossings.

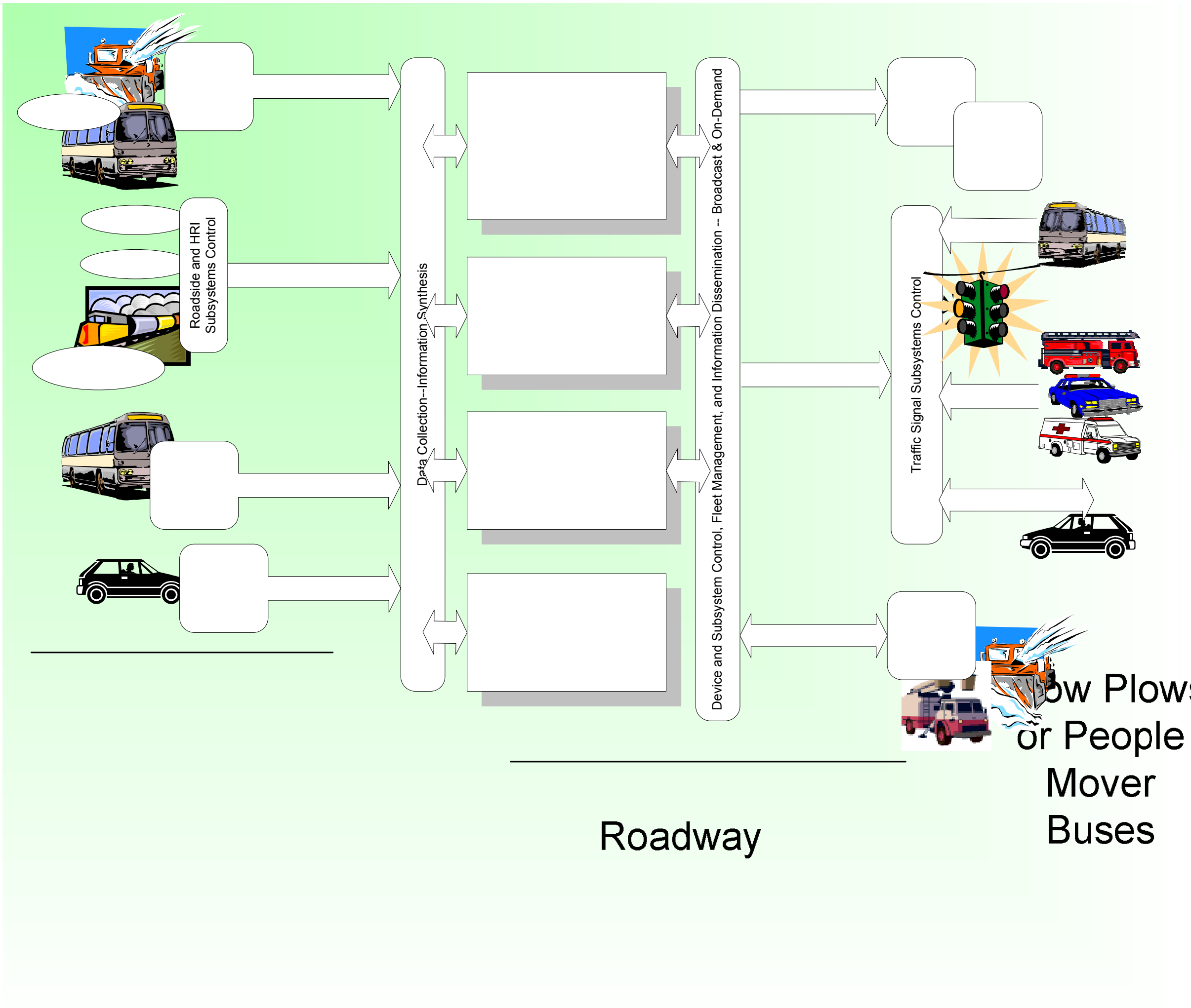


**Figure 5-3: Year Round Operations -- High-Level Viewpoint**

The integration, processing and synthesis of the varied all-source roadway conditions, weather situation, emissions data and rail crossing data begins with the use of standardized formats from the sources, then is further processed into useable form for operational uses by traffic, maintenance and construction, transit management, and ADEC facilities so equipped with their own information processing systems. These facilities may be quite simple (e.g., a single terminal where operations staff may observe MOA intersections, query statewide RWIS, M&C Ops status, etc.), or they may be quite complex, depending on the need. The transit management facility will also interact with the traffic facility for requesting transit signal priority when needed.

On the right of the figure are the several mechanisms for dissemination of roadway conditions, advisories, and weather, control of signal and other roadside systems, and MOA maintenance fleet management. The MOA can disseminate directly to drivers en-route using dial-in service access to pre-recorded messages or through information sharing with the commercial broadcast media. The MOA also controls the signal systems throughout the municipality—granting signal priority to transit when needed and appropriate, and granting signal preemption to emergency and incident response vehicles when appropriate. Lastly, the figure illustrates the MOA's mechanism for snowplow and fleet vehicle management.

## 4.2 INCIDENT AND EMERGENCY MANAGEMENT SYSTEMS

Figure 5-4 illustrates the MOA viewpoint for Incident and Emergency Management. In general, the left of Figure 5-4 shows the sensors that produce the data used to automatically detect traffic anomalies—potential incidents. It also illustrates that drivers and travelers report incidents, and that commercial vehicles operating as Hazmat carriers will be instrumented for cargo safety and pre-credentialed—able to report a Hazmat safety incident should one occur. Lastly, the Anchorage PD (or any law enforcement agency) and the MOA maintenance fleet operators can discover and report incidents or emergency situations by radio or using their mobile data terminals (MDTs).

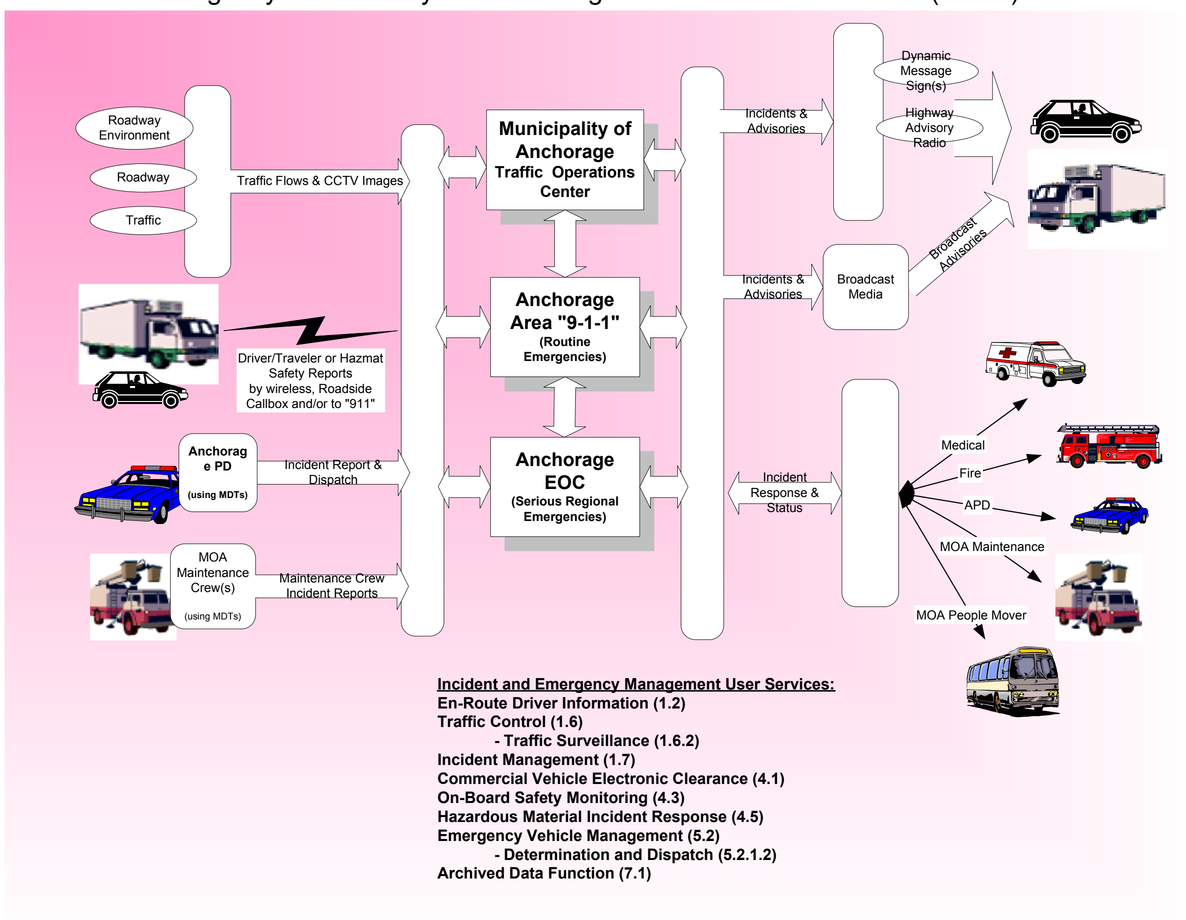


**Figure 5-4: Incident and Emergency Management Systems -- High-Level Viewpoint**

The integration of the collected roadway and traffic status data begins with the use of standardized formats from the roadside to the traffic facility. Further processing and synthesis of the network status data into useable operational data and information happens in the middle at the MOA traffic operations center or through a computer-aided dispatch (CAD) system used by the 911 Operator. The incident reports from travelers will go to the “9-1-1” center where the response will be initiated then handed-off to first responder management for all “normal” incidents and emergency situations (e.g., fire, police, medical, crash, etc.). For events that are regional, or long term (e.g., earthquake, flood, etc.), the Anchorage EOC will turn on and assume responsibility for incident and emergency response and coordination. This EOC is not normally a 24/7 function.

On the right of the figure are the several mechanisms for delivery of the incident or emergency status information that affects regional travel, and the initiation and coordination of incident or emergency response actions by first responders or MOA maintenance crews. The MOA can disseminate directly to the traveling public and commercial fleet operators en-route using public agency-owned roadway signs and advisory radio, or more broadly through the commercial broadcast media. The EOC, 911 or the first responder agencies use the incident report, regional status data, and then on-scene reports to manage and tailor their coordinated incident or emergency response resources as needed.

## 4.3 TRAVELER INFORMATION SYSTEMS

Figure 5-5 illustrates the MOA plan for Traveler Information Services. These services include pre-trip and en-route information delivery to travelers and drivers to include provisions for their safe and efficient use of the transportation system. In general, the left of the figure shows the specific sources of information about the situation including real-time or archived (near real time) traffic, weather, accidents and roadway conditions that could affect safe, efficient travel. It includes provisions for use of data and information stored in the common regional archive or direct interaction between a traveler and Anchorage People Mover. The information resident in the regional archive is produced by the Internal Operations capability (see next figure and discussion).

The integration of regional traveler information begins with the use of standardized formats for data storage and data exchange, and the use of a common regional GIS. The further processing, spatial and temporal synthesis of the traffic, weather, incident and transit data into the regional archive occurs through standardized formats, and pre-processing of the raw data by the agencies that collect. The (Other) ISP illustrates that the public agencies will share roadway and weather information relevant to the safe, efficient use of the roadways and regional travel—the ISP can further redistribute this information as is, and/or add value to it in some way.

On the right of the figure are the several mechanisms for delivery of the collected or archived travel, weather and roadway conditions information to the traveler. The MOA can disseminate directly to drivers en-route using public agency-owned roadway signs , in-vehicle systems and advisory radio, or through the broadcast media. Additionally the information can be disseminated via the Internet to fixed or mobile users, by pre-recorded or interactive telephone systems (e.g., 511), or to remote fixed facilities (e.g., an airport or rest stop kiosk).

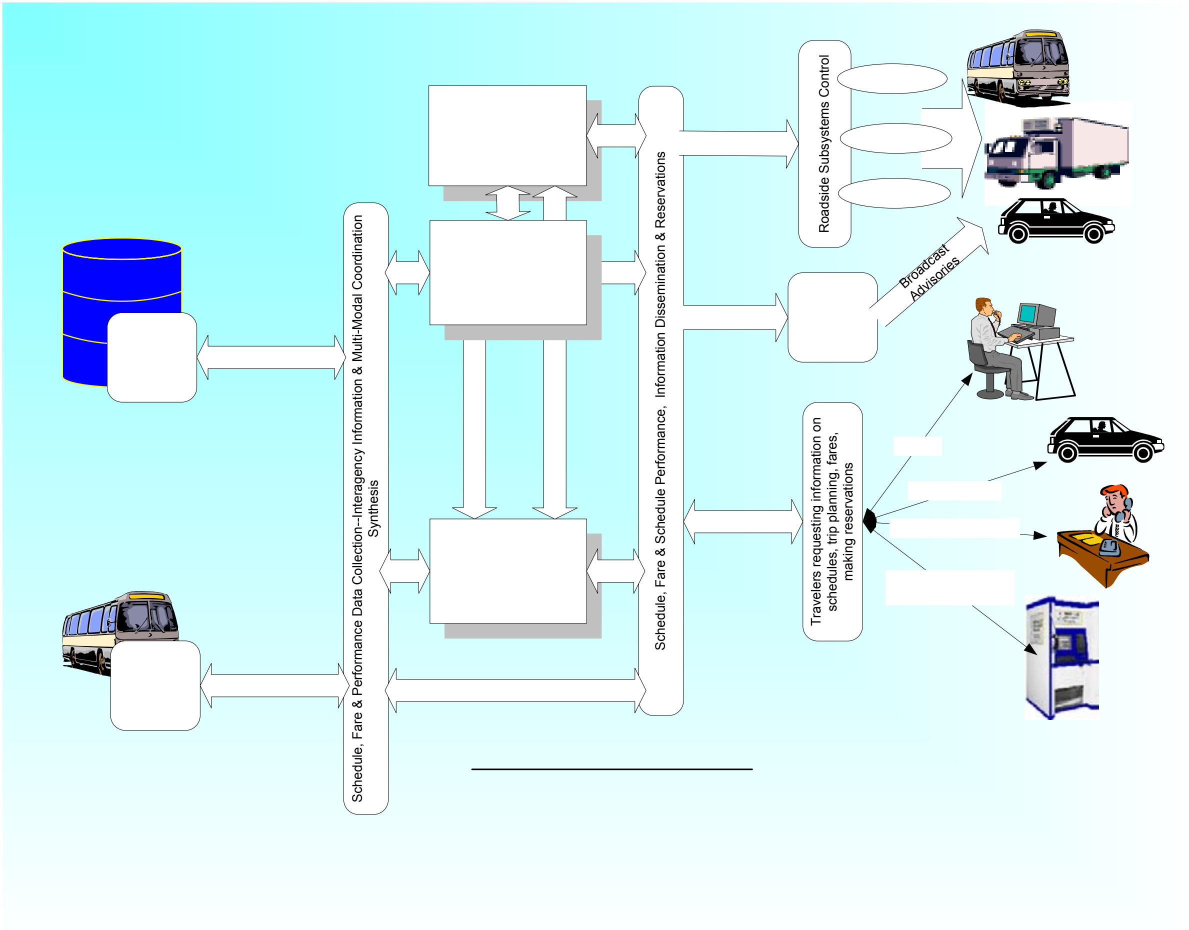


**Figure 5-5: Traveler Information Systems -- High-Level Viewpoint**

## 4.4 INTERNAL OPERATIONS

Figure 5-6 illustrates the Municipality's architecture for Internal Operations including monitoring and/or examination of the roadways, infrastructure and surrounding environments (e.g., bridges)—this asset identification, status and management data then goes into the regional data archive (on the right of the illustration). In general, the left of the figure shows the several sources for this data and information drawn from roadway surveillance, condition and status reports from MOA maintenance and snowplow crews as they do their work and consume their materials, the status of road construction and maintenance obtained through the Condition Acquisition and Reporting System (CARS), and reports from Anchorage transit's AVL instrumented buses.

The integration of the asset management, status and bus AVL data begins with the regional use of standardized data formats. Further processing, synthesis and spatial and temporal fusion of the data into useable formats for the regional archive happens in the middle at a public agency such as the MOA Traffic Operations Center, or at Anchorage People Mover. Concurrently with the collection and synthesis of information, this process builds and updates the Anchorage municipal data archive about traffic, transit, roadway conditions, construction and maintenance, etc.

Anchorage GIS and Regional Archive

Regional Transportation Systems Status Archived Dat

The right of the figure illustrates the Anchorage regional data archive and repository. The data and information stored in this archive is contributed by the operating agencies, and made available for regional use in unfiltered (e.g., between public agencies) or filtered (e.g., to an external ISP) form. It is intended that this process be aided by decision support tools to deploy resources and track use of materials (e.g., treatments) most effectively and efficiently in response to a roadway situation. These decision support tools are perhaps supported by the response models and empirical data that have and will accumulate in the DOT&PF archive.

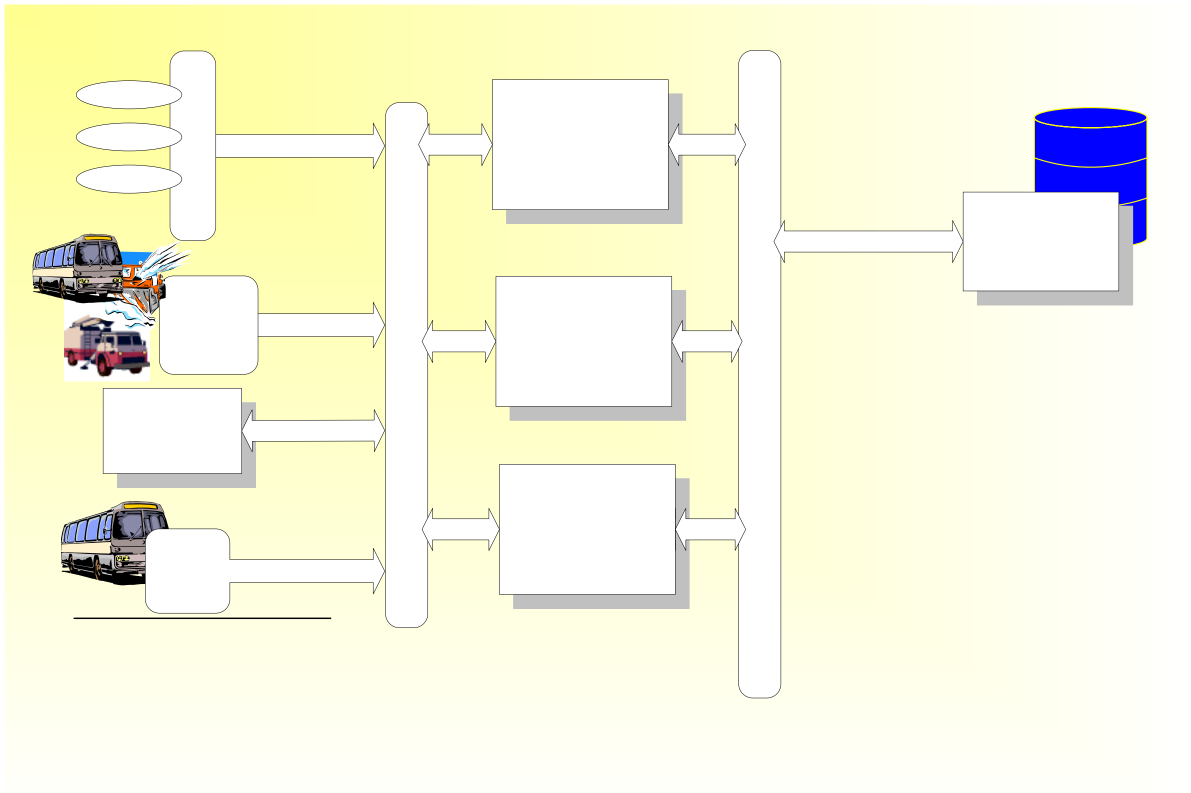

**Figure 5-6: Internal Operations – High-Level Viewpoint**

Roadway

Signals

Other Assets

Roadside Subsystems

Infrastructure and Assets

Infrastructure L
Condi

# APPENDIX A – MARKET PACKAGE DESCRIPTIONS – TAILORED FOR MUNICIPALITY OF ANCHORAGE PROGRAM AREAS

| | | |
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| AD1 | ITS Data Mart | This market package provides a focused archive that houses operational, planning and asset management data collected and owned by a single agency (e.g., the MOA). This focused archive would typically include the data covering a single transportation mode or agency function that is collected from an operational source automatically or through operator data entry (e.g., workstation, MDT, etc.), and archived for near real time operational and future uses. The collecting source agency provides for input data quality, controls data privacy and access, and defines the meta data management common to all defined ITS archives. The source agency can (1) contribute these data to a regional archive (AD2), or (2) provide a general query and report access to regional archive data users. In either case, it is critical that a common spatial referencing system (GIS) be used to ensure common understanding and usability of the data mart capabilities. Note that this approach requires the data user to know that the data resides at the collection source, and to direct their query specifically to that agency. |
| AD2 | ITS Data Warehouse | This market package provides basic data collection and management capabilities as provided by AD1, and adds the functionality and interface definitions that allow collection of data from multiple diverse operating agencies and data sources spanning across modal and jurisdictional boundaries. It can then enable, and perform, additional spatial (geographic) and temporal (date, time) transformations and data fusion, and provide 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 integrated data suggests that additional on-line analysis and data mining features are also included in this market package; this in addition to the basic local or remote (e.g., MDT) queries, and reporting user access features. This shared and remotely accessible archive can also function as the regional MOA traveler information source. |
| APTS1 | Transit Vehicle Tracking | This market package monitors current Anchorage Transit vehicle location using an AVL System. The location data is then used to determine real time schedule adherence and update the transit system's schedule performance in real-time. Vehicle position may be determined either by the vehicle and relayed to the infrastructure, or may be determined directly by the communications infrastructure. A two-way DSRC or wide-area wireless communication link with transit central operations is used for relaying vehicle position and control measures. The central transit management facility processes this location and schedule performance information, updates the transit schedule, and makes real-time schedule information available within the transit operation and/or to one or more external ISPs. |

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| APTS2 | Transit Fixed-Route Operations | This market package performs transit vehicle routing and scheduling, as well as system monitoring for fixed-route transit services. This service determines current schedule adherence and performance using AVL data collect4ed by another package (APTS1), and provides information displays to Anchorage Transit operators at the central facility. Static and real time transit data is exchanged with Information Service Providers where it is integrated with that from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic public transportation schedules. |
| APTS3 | Demand Response Transit Operations | This market package performs vehicle routing and scheduling as well as automatic driver assignment and monitoring for MOA demand responsive transit services. This package monitors the current status of the Anchorage transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. The transit central dispatch provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. This service includes the capability for a traveler request for personalized transit services to be made through the transit agency, or an external Information Service Provider (ISP) Subsystem. |
| APTS4 | Transit Passenger and Fare Management | This market package manages passenger loading and fare payments on-board Anchorage Transit vehicles using smart (electronic) fare boxes. Sensors mounted on the fare box and vehicle permit the driver and central transit operations to determine vehicle loads, collect fare payment data, and identify and collect rider origin and destination data. These data are processed, stored, and displayed on the transit vehicle, and communicated as needed to the central transit management faculty in real-time or as needed. |

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| APTS5 | Transit Security | This market package provides for the physical security of Anchorage People Mover passengers and People Mover vehicle operators. On-board equipment is deployed to perform surveillance and sensor monitoring in order to warn of potentially hazardous situations. The surveillance equipment may include video (e.g., CCTV cameras), audio systems and/or event recorder systems. The sensor equipment may include threat sensors (e.g., chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g., metal detectors). People Mover passenger or transit vehicle operator activated alarms are provided on-board. Public areas (e.g., transit stops, park and ride lots, stations) are also monitored with similar surveillance and sensor equipment and provided with transit user activated alarms. In addition this market package provides surveillance and sensor monitoring of non-public areas of transit facilities (e.g., transit yards) and transit infrastructure such as bridges, tunnels, and transit railways or bus rapid transit (BRT) guideways. The surveillance equipment includes video and/or audio systems. The sensor equipment includes threat sensors and object detection sensors as described above as well as, intrusion or motion detection sensors and infrastructure integrity monitoring (e.g., rail track continuity checking or bridge structural integrity monitoring).<br><br>The surveillance and sensor information is transmitted to the Anchorage 911 (Emergency Management Subsystem) as are transit user activated alarms in public secure areas. On-board alarms, activated by transit users or transit vehicle operators are transmitted to both 911 (Emergency Management Subsystem) and the Transit Management Subsystem, indicating two possible approaches to implementing this market package.<br><br>In addition the market package supports remote transit vehicle disabling by the Transit Management Subsystem and transit vehicle operator authentication. |
| APTS6 | Transit Maintenance | This market package supports automatic transit maintenance scheduling and monitoring. On-board condition sensors monitor system status and transmit critical status information to the People Mover Management Subsystem. Hardware and software in the People Mover Management Subsystem processes this data and schedules preventative and corrective maintenance. |

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| APTS7 | Multi-Modal Coordination | This market package establishes two-way communications between multiple public transportation (transit) and/or traffic agencies to improve MOA service coordination, and schedule adherence and performance. This regional coordination between MOA traffic and transit management is intended to improve on-time performance of the Anchorage transit system using traffic signal priority to the extent that this can be accommodated without degrading overall performance of the regional traffic network. Regional-wide as well as limited local coordination between the transit vehicle and the individual intersection for signal priority is supported by this package. |
| APTS8 | Transit Traveler Information | This market package uses Anchorage transit performance and schedule adherence data from other sources to provide transit users at transit stops and en-route aboard transit vehicles with ready access to transit arrival, departure, and connection information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general and specific interest to regional MOA transit users. Systems that provide custom transit and multi-modal trip itineraries, and other tailored transit information services are also represented and enabled by this market package. |
| ATIS1 | Broadcast Traveler Information | This market package ATIS1 provides a basic set of traveler information services. Collected information about traffic and roadway conditions, advisories, general public transportation, incident information, air quality and weather information, is broadcast to the traveling public through a wide area system using existing commercial infrastructures and low cost user equipment (e.g., AM/FM broadcast radio, local TV broadcast, FM sub-carrier, cellular data broadcast, Land Mobile Communications, etc.). The information can also be conveyed as data, as pre-recorded status reports or as a spoken report on the radio. Different from the market package ATMS06, which provides localized en-route HAR and DMS information capabilities, ATIS1 provides a wide area digital or analog broadcast service. |

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| ATIS2 | Interactive Traveler Information<br>(Traveler Information Systems—"5-1-1") | Beyond continuous or periodic broadcast of information, the ATIS2 package can provide general MOA regional or tailored information in response to a "5-1-1" call for specific travel routes or locations. This regional status information can be used for pre-trip planning or en-route updates. Both real-time interactive request/response systems and information systems that "push" a stream of pre-recorded or voice synthesized information to the traveler are supported based on a simple connection or interactive menus with keyed-in response. The traveler can obtain a variety of current information regarding traffic and roadway conditions, weather, coordinated multi-modal services, etc. A selection of two-way wide-area wireless and fixed infrastructure (wired) telephone systems may be used to support the required communications between traveler and the public agency or information service provider. |
| ATIS2 | Interactive Traveler Information<br>(Traveler Information Systems—Internet & Wireless Web) | In addition to the broadcast capabilities provided by ATIS1, this market package provides tailored information in response to a traveler's more specific interactive request. It supports both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a pre-determined or on-the-fly profile. The traveler can obtain current information regarding traffic conditions, weather, roadway status (e.g., construction, closures, restriction, etc.), transit services, ride share/ride match, parking management, and pricing information. A range of two-way wide-area wireless or wire line communications systems may be used to support the required data communications between the traveler and Information Service Provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including: phone, kiosk, personal digital assistant, personal computer at home or work, and a variety of in-vehicle devices. Successful deployment of this market package relies on availability of real-time transportation data from roadway instrumentation, probe vehicles or other means. A traveler may also input personal preferences and identification information via a "traveler card" that can convey information to the system about the traveler as well as receive updates from the system so the card can be updated over time. |
| ATIS7 | Yellow Pages and Reservations | This market package enhances the ATIS2 Interactive Traveler Information package by making infrastructure provided yellow pages, reservation and payment services available to the traveler/user. This market package provides multiple ways for accessing information either while en-route in a vehicle using wide-area wireless communications or pre-trip via wireless or wire line connections. |

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| ATMS01 | Network Surveillance<br>(Incident and Emergency Management Systems—Video Surveillance) | This market package includes CCTV surveillance equipment located roadside or (optionally) mounted on roadside weather stations to enable visual verification of the sampled conditions. It includes the supporting field equipment, and wire line or wide area wireless communications to transmit the collected images back to the MOA traffic management center for integration, analysis and appropriate response action. The derived full-motion or snapshot images can be used locally, or shared on a regional or statewide basis. These images enable MOA traffic agency managers/operators to monitor roadway traffic congestion, weather conditions, identify and verify events and incidents of interest |
| ATMS01 | Network Surveillance<br>(Incident and Emergency Management Systems—Vehicle Detection) | This market package includes exactly the detectors and decision support functional features, and the appropriate sensor technology, surveillance equipment, supporting field equipment, and wire line or wide area wireless communications to transmit the collected data back to the appropriate MOA agency for integration, analysis and appropriate response action. The derived data and information can be used locally, or shared on a regional or statewide basis. The data generated by this market package enables key public agency managers to monitor traffic conditions, and collect traffic archive data for transportation operations and long range planning. |
| ATMS03 | Surface Street Control | This market package provides the central MOA traffic management control and traffic monitoring equipment, communication links, and the signal control equipment that support MOA's surface street control and/or arterial traffic management. A range of closed-loop or centrally managed traffic signal control systems are represented by this market package; ranging from static pre-timed control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and signal priority requests from emergency or transit vehicles. This market package is consistent with typical urban traffic signal control systems. |

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| ATMS06 | Traffic Information Dissemination | Unlike the ATIS traveler information packages, the ATMS06 package addresses traffic and traveler information to be disseminated en-route to drivers and vehicles using publicly owned and operated roadway equipment assets such as dynamic message signs or highway advisory radio. This market package provides specific capability to disseminate information to notify drivers of incidents, roadway conditions and closures. The careful placement of this permanent or temporary/portable roadside equipment provides the information at points where the en-route drivers have choices and can tailor their routes in response. This package also covers the equipment and interfaces that provide for the distribution of traffic and roadway information from a traffic management center to the public through telephone, broadcast radio and TV media; and for use by other users such as a transit management center, emergency management center, and public or private regional information service providers. A link to the MOA public works allows real time information on road/bridge closures due to maintenance and construction activities to be included. |

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| ATMS08 | Incident Management System | This market package supports the management of both unexpected incidents and planned events so that the impact to the MOA surface street transportation network and traveler safety is minimized. The market package includes unplanned incident detection capabilities through roadside surveillance devices (e.g. ATMS01 using CCTV) and through regional coordination with other south central traffic management, maintenance and construction management and emergency management centers; planned incidents can be derived as well through regional coordination of weather service entities and special event promoters. Information from these diverse sources are collected and correlated by this market package to plan for or detect and verify incidents, and implement an appropriate response. This market package supports MOA traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between center subsystems. MOA incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination (ATMS06) market package and dissemination of incident information to travelers through the Broadcast Traveler Information (ATIS1) or Interactive Traveler Information (ATIS) market packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency service field personnel. The coordination can also extend to courtesy patrols, tow trucks and other allied response agencies and field service personnel. |

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| ATMS08 | Incident Management System<br><br>(Traveler Information System—CARS) | This CARS capability of this market package supports the management of both unexpected incidents and planned events so that the impact to the MOA surface street transportation network and traveler safety is minimized. The market package includes unplanned and planned incident data entry based on roadside surveillance devices (e.g. ATMS01 using CCTV) and collected through regional coordination with other south central traffic management, maintenance and construction management and emergency management centers; also as derived through regional coordination of weather service entities and special event promoters. Information from these diverse sources are collected, entered into CARS and correlated primarily to share information about maintenance, construction, planned closures nternally—but is equally useful as an agency, and publicly assessable source for filtered planned and unplanned incident information. All response activities are included in the broader interpretation of this market package (see above). |
| ATMS11 | Emissions Monitoring and Management | This market package monitors individual vehicle emissions, and provides MOA and regional general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the ADEC emissions management subsystem for processing, and to the MOA TOC for their use. Both area wide air quality monitoring and point emissions monitoring are supported by this market package. For area wide monitoring, this market package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports supporting statistical data. For point emissions monitoring, this market package measures tail pipe emissions and identifies vehicles that exceed emissions standards. The gathered information can be used to implement environmentally sensitive compliance programs, policies, and regulations, and for enforcement. |

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| ATMS13 | Standard Railroad Grade Crossing | This market package manages traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 MPH). Both passive (e.g., a cross buck sign) and active warning systems (e.g., flashing lights and gates) are supported. The MOA will enhance these traditional HRI warning systems with other standard traffic management devices that are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI will be interconnected with adjacent MOA signalized intersections so that local control can be adapted to traffic volume and congestion at the highway-rail intersection. This will reduce the risk of collisions between vehicles on the roadways approaching the HRI as well as alerting drivers to the approaching train at the HRI. |
| ATMS14 | Advanced Railroad Grade Crossing | This market package manages traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 MPH). This market package includes all capabilities from the Standard Railroad Grade Crossing Market Package (ATMS13) and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems supported by this market package include positive barrier systems that preclude entrance into the intersection when the barriers are activated. Like the MOA Standard Package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with the approaching train. In this market package, the wayside equipment provides additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This market package also includes additional detection capabilities that enable it to detect an entrapped or otherwise immobilized vehicle within the HRI controlled space or exclusion area and to provide an immediate notification to highway and railroad officials. |

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| AVSS10 | Intersection Collision Avoidance | This market package will determine the probability of an intersection collision and provide timely warnings to opposing vehicle-vehicle or train-vehicle so that avoidance actions can be taken. This market package builds on the HRI infrastructure and in-vehicle equipment. The package includes the sensors in the roadway infrastructure that are needed to assess opposing vehicle locations and speeds near an HRI or adjacent intersection. This information is determined and communicated to the approaching vehicle using a short-range communications system (e.g., HAR AM/FM broadcast, in-vehicle device, etc.). |
| CVO03 | Electronic Clearance | This market package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the state (DOT&PF) or local CVO Administration system archive to retrieve database snapshots of critical carrier, vehicle, and driver credentials and safety data to be used to sort passing vehicles into pass/no-pass status. This capability allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using on-board vehicle transponders and dedicated short-range communications to the roadside. The regional roadside facility will be equipped with appropriate vehicle identification, weigh-in-motion, transponder read/write devices, computer workstation processing hardware, software, and database technologies appropriate to the need. |
| CVO04 | CV Administrative Processes | This market package provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, the carriers, drivers, and vehicles may choose to be enrolled in the electronic clearance and weigh-in-motion programs provided by separate market packages (CVO03, CVO06). This enrollment allows commercial vehicles to be screened at mainline speeds at commercial vehicle checkpoints, and speeds up both the safety inspection and the border crossing processes. Current profile databases are created and then maintained in the DOT&PF or local CVO Administration System; with snapshots of this database made available to the commercial vehicle check facilities at the roadside to support the weigh-in-motion and electronic clearance processes. |
| CVO06 | Weigh-In-Motion | This market package provides for highway speed weigh-in-motion with or without vehicle on-board electronic systems. This package provides the regional MOA and/or DOT&PF roadside station with additional equipment, either fixed or removable. If the equipment is fixed, then it is considered as an addition to the electronic clearance and would work in conjunction with the vehicle electronic identification and clearance equipment. |

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| CVO10 | HAZMAT Management | This market package integrates incident management capabilities with commercial vehicle tracking to assure effective handling, monitoring and treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management equivalent facility operated by the DOT&PF (i.e., the Dept. MS/CVE). The Emergency Management subsystem is notified by the Commercial Vehicle if an incident occurs and coordinates the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Subsystem. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation. |
| EM1 | Emergency Response | This market package provides basic public safety call-taking and dispatch services for Anchorage 911. 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 (911, Emergency Operations Center, state, and military emergency management and incident response) supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Subsystems and an Emergency Vehicle supports dispatch and provision of information to responding personnel. |
| EM2 | Emergency Routing | This market package supports automated emergency vehicle location and dynamic routing of emergency vehicles. The service also supports coordination with the Traffic Management Subsystem, collecting detailed road network conditions and requesting special signal priority/preemption or other specific emergency traffic control strategies on the selected route(s). The MOA emergency response center provides the routing for the emergency fleet based on real-time traffic conditions. The Emergency Vehicle may also be equipped with dedicated short-range communications for local signal preemption. The service provides for information exchange between care facilities and both the MOA emergency response center and emergency vehicles. |

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| MC01 | Maintenance and Construction Vehicle Tracking | This market package addresses real-time tracking the location of maintenance and construction vehicles and other MOA fleet equipment to ascertain the progress of their activities. This capability is supplemented by interaction between the roadway (tracking embedded magnets) and the snowplow to ensure operator safety and proper tracking of the roadway surface during maintenance or treatment operations conducted in extreme weather or whiteout conditions. These location and progress tracking activities can include ensuring the correct roads are being plowed, and that work activity is being performed at the correct locations. |
| MC02 | Maintenance and Construction Vehicle Maintenance | This market package includes vehicle on-board sensors capable of performing diagnostics for maintenance and construction vehicles, and the systems that collect this diagnostic information and use it to notify, schedule and manage vehicle maintenance. This notification and scheduling capability enhances both routine and corrective maintenance activities on vehicles and other maintenance and construction equipment. |
| MC03 | Road Weather Data Collection | This market package addresses the need for collection of current road surface and weather conditions using data collected from environmental sensors deployed on and about the roadway. In addition to the state's ADOT&PF fixed RWIS sensor stations at the roadside, on-scene real-time sensing of the roadway environment will also occur from on-board sensor systems located on Maintenance and Construction Vehicles, smart snow plows and on-board Anchorage Transit buses. This collected roadway surface and environmental data is used by the Weather Information Processing and Distribution Market Package (MC04) to process and disseminate the information, and provide decision tools for MOA year round operations. |
| MC04 | Weather Information Processing and Distribution | This market package processes and distributes the environmental information collected from the Road Weather Data Collection (MC03) market package. This market package uses the environmental data to detect and alert MOA operations staff to environmental hazards such as icy road conditions, high winds, dense fog, etc., so MOA operators can use their decision support tools and systems to decide on corrective actions to take, and/or what roadway treatments are needed. The continuing updates of road condition information and current temperatures can also be used by MOA system operators to more effectively deploy road maintenance and treatment resources, issue general traveler information advisories, issue location specific warnings to drivers using the Traffic Information Dissemination market package (ATMS06), and aid MOA operators in scheduling their work activity. |

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| MC05 | Roadway Automated Treatment | This market package assists the MOA operator in the automatic treatment of a roadway section based on existing roadway environmental or atmospheric conditions as determined by another capability (e.g., MC03 or MC06). These treatments include fog dispersion, anti-icing chemicals, etc. This market package includes the sensors needed for monitoring and controlling the automated treatment system itself. It may also include the driver on-board information systems that alert drivers when the treatment system is activated, and its status. |
| MC06 | Winter Maintenance | This market package supplements Roadway Automated Treatment (MC05) specifically for winter road maintenance including snowplow operations, roadway treatments, and other snow and ice control activities. This package shares capability with other packages (e.g., MC03) to monitor 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. |
| MC07 | Roadway Maintenance and Construction | This market package supports numerous MOA services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services would include courtesy patrols, landscape maintenance, hazard removal (e.g., roadway debris, dead animals), routine maintenance activities (e.g., striping, grass cutting), and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, CCTV, etc.). This maintenance and constructions activity would also include initial data entry, and periodic checks on status of agency-owned infrastructure and assets. Environmental conditions information is also received from other sources to aid in scheduling maintenance and construction activities. |
| MC08 | Work Zone Management | This market package aids in the management of activity in work zones, controlling traffic through portable dynamic message signs (DMS) and informing other agencies or users of work activity (e.g., DOT&PF, traffic management, other maintenance and construction centers, ISPs, etc.) for better coordination and management. Work zone speeds and delays are provided to the motorist as en-route information prior to the work zones. |
| MC10 | Maintenance and Construction Activity Coordination | This market package supports the recording and dissemination of maintenance and construction activity internally and to other centers, which can utilize it as part of their operations. It also enables (e.g., using CARS), dissemination of filtered information to travelers or to ISPs. |

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# 1. 1. INTRODUCTION

The Anchorage Intelligent Transportation Systems (ITS) Implementation Plan is one of six documents that have been/ will be developed for the Municipality of Anchorage (MOA). The other five documents are:

- User Needs Report
- User Services Report
- ITS Concept of Operations
- Regional ITS Architecture
- ITS Architecture Final Report

Over the next several years the MOA may have difficulty implementing all the systems outlined in the Anchorage ITS Concept of Operations. ITS projects must compete for funding with other more traditional transportation, construction, and improvement projects. With this in mind, phased ITS implementation will prove effective and help the Plan's recommended ITS technologies meet both Anchorage's and its travelers' diverse and unique needs.

This report focuses on implementing ITS strategies that enhance travel safety and efficiency in the MOA. The report fully considers the resources available to implement technologies, and the existing and planned systems that enhance the transportation system's operations and management.

## 1.1 1.1 NATIONAL ITS ARCHITECTURE CONFORMITY: FINAL FHWA RULE AND FTA POLICY

On January 8, 2001, the United States Department of Transportation (USDOT) released the final Federal Highway Administration (FHWA) rule and Federal Transit Administration (FTA) Policy for applying the National ITS Architecture at the regional level. The rule/policy became effective on April 8th, 2001 and requires regions that have yet to deploy ITS to have a regional ITS Architecture in place four years after the first ITS deployment if the deployment is using National Highway Funds. Regions that currently have ITS in place such as the MOA, are required to have a regional ITS architecture in place by four years after the rule policy became effective (April 8th, 2005).

The rule/policy requires regions (i.e., area in which an ITS Plan is developed and is relevant) including the MOA to develop ITS projects using a systems engineering approach. A systems engineering approach is simply defined as an approach that considers total life cycle costs and value of a project compared to other alternatives. At minimum the systems engineering approach consider the following:

- Portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of the National ITS Architecture).
- Participating agencies' roles and responsibilities.
- Requirements definitions.
- Analysis of alternative system configurations and technology options to meet requirements.
- Procurement options.
- Applicable ITS standards and testing procedures.
- Procedures and resources necessary for operations and management of the system.

In addition to the above system engineering requirements, the regional ITS architecture must also include the following:

- A description of the region.
- Participating agencies and other stakeholders.
- An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the systems included in the regional ITS architecture.
- Any agreements (existing or new) required for operations including, at a minimum, those affecting ITS project interoperability, ITS related standards, and the operation of the projects identified in the regional ITS architecture.
- System functional requirements.
- Interface requirements and information exchanges with planned and existing systems and subsystems (for example, subsystems and architecture flows as defined in the National ITS Architecture).
- ITS standards supporting regional and national interoperability.
- The sequence of projects required for implementation.

The federal ITS requirements identified above apply only to projects using funds from the National Highway Trust Fund including the mass transit account. These include funds from such sources as the National Highway System (NHS) Program, Surface Transportation Program (STP), Congestion Management and Air Quality (CMAQ) Program, and Federal Transit Administration (FTA) program.

## 1.2 1.2 WHAT IS THE PURPOSE OF THE IMPLEMENTATION PLAN?

The purpose of the Implementation Plan is to define a set of projects that are proposed for the MOA over the next ten years and the criteria that has been developed to prioritize the projects. It also provides a project selection methodology, funding opportunities, procurement options, and integration strategies. Integration, as it pertains to implementing ITS, refers to deploying ITS elements into a system where it will support multiple user needs. There are varying levels of integration, ranging from data exchange between stakeholders to the intra-agency control of one stakeholder's infrastructure.

This plan in conjunction with the five others being developed for the MOA fully conforms to federal ITS requirements and as such ensures that the MOA can continue to use National Highway Funds to support implementation and integration of ITS.

## 1.3 1.3 HOW IS THE PLAN ORGANIZED?

This plan is broken into the following sections:

Section 2: **BACKGROUND:** Describes the need for ITS in the MOA, previous ITS initiatives and current ITS focus areas, and descriptions of other relevant ITS projects.

Section 3: **PROJECT SELECTION CRITERIA:** Defines the criteria used to select and prioritize projects for deployment in the MOA.

Section 4: **PROJECT DESCRIPTIONS:** Provides descriptions of potential ITS projects in the MOA. Includes projects approved by the ITS Policy Committee to receive earmark funding for deployment, and other potential projects. Evaluates projects based on the selection and prioritization criteria identified in Section 3.

Section 5: **INTEGRATION STRATEGY:** Provides a strategy for integrating the previously identified and implemented systems in the MOA. This section also identifies policies that may foster the development, implementation, and operation of an integrated ITS.

Section 6: **FUNDING NEEDS AND OPPORTUNITIES:** Identifies funding needs, and the existing and potential opportunities for funding projects identified in Section 3.

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| Section 7: | **PROCUREMENT STRATEGIES:** Identifies potential procurement strategies for projects identified in Section 3. |
| Section 8: | **SUMMARY:** Provides a summary and conclusions of the Implementation Plan. |
| Appendix A: | **REFERENCES:** Identifies the resources used in developing the Implementation Plan. |

# 2. 2. BACKGROUND

This section identifies the need for ITS in the MOA, explains the federal ITS requirements for National ITS architecture conformity, and reviews previous ITS initiatives and the current focus of ITS initiatives for the area.

## 2.1 2.1 THE NEED FOR ITS

Stakeholders in Anchorage have identified several areas where ITS can be used to improve or enhance the existing transportation infrastructure. These areas were closely examined and classified according to the National ITS Architecture User Services. These User Services, or high level areas where ITS can be used to enhance the existing transportation infrastructure, were then bundled into four key programs areas. Each of the four program areas are summarized below..

**Year Round Operations**

Year Round Operations includes ITS elements that will be used year round to help improve operations within the Municipality of Anchorage. These systems will provide information that will improve mobility and traveler safety in and around Anchorage. Year-round ITS elements include:

- Weather and Pavement Sensors
- Smart Snow Plows
- Traffic Signal System
- Highway-Rail Intersection (HRI) Warning System
- Needs Study for Transit Signal Priority
- Smart Fare Box
- Transit Vehicle Management Systems

**Incident and Emergency Management Systems**

Incident and Emergency Management Systems includes ITS elements that are used to quickly identify, verify, report and respond to incidents affecting travel. These systems enable operators to dispatch appropriate personnel and equipment quickly, clearing incidents and treating victims in an efficient and timely manner. Incident and Emergency ITS elements include:

- Hazardous Materials Tracking and Reporting System
- Closed Circuit Television
- Vehicle Detection
- Dynamic Message Signs
- Highway Advisory Radio

**Traveler Information Systems**

Traveler Information Systems includes ITS elements that provide access to readily available traveler information. These systems employ wireless and land line communications in an effort to provide relevant information to travelers from most locations and at all times. ITS elements classified as Traveler Information systems include:

- 5-1-1
- Internet
- Wireless Web

**Systems for Internal Operations**

Systems for Internal Operations includes ITS elements that enhance internal operations through efficient use of financial and physical resources. The following technologies will help streamline operations, reduce costs, and improve the safety and efficiency of the roadway network.

- Mobile Data Terminals
- Material Usage Tracking System
- Asset Management System
- Automatic Vehicle Location
- Shared Traveler and Traffic Information Database
- Condition Acquisition and Reporting System (CARS)
- Common Geographic Information System

Although the ITS elements discussed above are desired to improve transportation operations and safety in the MOA, only a portion of these systems are planned for implementation over the next ten years. As such only the ITS elements planned for implementation are discussed further in this Plan.

## 2.2 2.2 CURRENT ITS FOCUS AREAS

This section describes the current focus of ITS development and implementation efforts in Anchorage, and the effects these efforts have on the travelers and operators that maintain transportation systems. These efforts include systems that:

- Assure Public Safety
- Support Public Security
- Support the Community Vision
- Develop Services Effectively

**Public Safety Assurance**

One of the most important of all government services is assuring public safety. In the context of the ITS Plan, this goal relates to ensuring safe travel on all modes. To achieve this goal, risks to public safety are decreased by:

- Reducing the presence of snow and ice on the roadway
- Informing the public of hazards so they may avoid them
- Clearing crashes from the roadway as quickly as possible to reduce the potential for secondary crashes

**Public Security Support**

Projects and actions included in the Anchorage ITS Plan will support Public Security by monitoring, managing and mitigating potential and actual major incidents and emergencies to ensure that they have the least impact on public safety. Ideally, the goal is to eliminate all man-made security hazards and to reduce the impact of any natural disasters.

**Community Vision Support**

One of the more significant goals of this ITS plan is to support the Anchorage Community Vision. According to the Anchorage 2020 Plan, the Community Vision states that Anchorage should ideally be…

- A diverse, compassionate community where each individual is valued, and children, families and friendships flourish
- A northern community built in harmony with our natural resources and majestic setting
- A thriving, sustainable, broad-based economy supported by an efficient urban infrastructure
- A safe and healthy place to live where daily life is enriched by a wealth of year-round recreational and educational opportunities

**Effective Delivery of Services**

The MOA has demonstrated its commitment to the effective delivery of public services by implementing a set of performance measures for every department within the MOA. The MOA is also emphasizing e-commerce. This goal relates to implementing ITS that:

- Allows more efficient service delivery
- Provides a new, important service that could not be provided without today's technology
- Improves cost effectiveness
- Focuses on customer service

## 2.3 2.3 RELEVANT STATEWIDE ITS INITIATIVES

The State of Alaska, through the Alaska Department of Transportation and Public Facilities (ADOT&PF), completed the Alaska Statewide Intelligent Transportation Systems Implementation Plan guiding the implementation of ITS in the State. The MOA ITS plan is developed to mesh with the Statewide ITS plan, while at the same time focusing on the needs of the MOA. Over the next several years it will be important that the MOA coordinate with the State, so that a common understanding as it relates to ITS deployments is achieved.

# 3. 3. PROJECT DESCRIPTIONS

This section describes approved and potential ITS projects for the MOA. The first section provides a detailed description of projects that the MOA has already selected for deployment. The following section describes other potential projects that have been evaluated and prioritized for deployment, based on the criteria defined in Section 3. As such projects described in the first section (section 4.1) are described in greater detail.

## 3.1 APPROVED ITS PROJECTS

The projects already approved for funding through the AMATS process are described below. They directly relate to needs that various stakeholders identified through an extensive outreach process.

**DMV&I/M Program Data Link (now complete)**

Project to allow for real-time transmission of a passing inspection to DMV, thus allowing for a “paperless” certificate of inspection.

**I/M Enhancement Program (now complete)**

The EPA mandated On Board Diagnostic (OBD) test for 1996 and newer vehicles. In the OBD test, a vehicle’s computer determines an I/M pass/fail. OBD test modifications are anticipated to insure local concerns are addressed through slight software changes & IM technician training. Emissions benefit determination and public awareness are needed for the transition.

**Automated Operating System**

People Mover: Project automates the operation of the fixed route buses including vehicle location, operating characteristics, customer real-time information, passenger counting equipment & improved management reporting capability.

AnchorRIDES: The project improves the system by collecting real-time vehicle location information and further automating the scheduling/dispatch functions that will substantially improve the system.

**Fleet Improvement**

This project funds improvements to existing transit and para-transit fleets. Typical projects include a ticket reader and issue attachment, which issues passenger passes on the bus; security systems; transit/signal improvements for headway enhancements; mobile display terminals; and vehicle communications and locations systems.

**Management Information Systems**

This project funds information systems necessary for efficient management of the public transportation system. Typical projects include: Geographic Information Systems {GIS} capabilities; upgrades to the automated maintenance system, refueling, and inventory system; a new computerized dispatch system; and upgrades to the scheduling/run-cutting process, customer information and telephone communications system; and desktop computers.

**Area-wide Study for Emergency Response Preemption (now complete)**

While emergency response preemption is installed at select locations within the Municipality and projects have been identified to provide additional installations, an area-wide study will allow for a planned, phased implementation of a complete emergency response preemption system.

**Downtown Traffic Signal System Project**

First-year design money has been allocated for the rehabilitation of the traffic signal system in downtown Anchorage. The project will include repair of existing electrical deficiencies, mast arm and foundation replacement where necessary, and installation of emergency response preemption.

## 3.2 POTENTIAL ITS PROJECTS

ITS projects yet to be included in the Anchorage Transportation Improvement Plan, which may be added in the future are summarized in this section. These projects were identified through an extensive outreach process.

**Municipality of Anchorage Traffic Operations Center**

The Municipality of Anchorage Traffic Operations Center will enhance traffic operations, and interagency data sharing/ communication. This will enable agencies such as the Municipality of Anchorage's traffic department to communication more effectively with the Emergency Operations Center and other regionally significant agencies. Field devices will be connected with the Traffic Operations center for remote monitoring and control. For example, operators at the traffic operations center may monitor and analyze loop detector data to determine if equipment is functioning properly, and if a change in traffic signal time is needed.

**Highway-Rail Intersection (HRI) Warning and Preemption Systems**

HRI Warning and Preemption Systems may be used to increase motorist safety by reducing the number of train/vehicle conflicts. HRI Warning Systems determine the probability of a collision at an equipped intersection (highway-rail) and provide timely warnings to drivers and train operators. Preemption Systems, on the other hand, improve safety by automatically changing a traffic signal indication in the HRI to red when a train approaches.

**Needs Study for Transit Signal Priority**

The use of transit versus personal vehicle may be greatly strengthened through the deployment of Transit Signal Priority Systems. These systems extend traffic signal "green time" to transit vehicles in an effort to reduce delay, and maintain schedule adherence. From the passenger's perspective, transit may become a more reliable form of transportation, resulting in retaining existing passengers while attracting new ones. In terms of the environment, less delay and a reduction in the use of passenger cars equates to less emissions being released into the environment. Transit Signal Priority can also assist with emergency response during disasters for evacuation, triage, etc.

Project to be tie-in with the statewide transit signal priority project.

**Smart Fare Box**

Smart Fare Box Systems may be installed on transit vehicles to collect ridership, fare and origin-destination information. The collection of this information will streamline transit operations by enabling better route assignment, equipment usage, and route planning.

Project to be tie-in with the statewide smart fare box project.

**Transit Vehicle Management**

If implemented in the future, Transit On-board Vehicle Management Systems may significantly enhance transit operations and roadway safety. These systems automatically detect vehicle mechanical problems and transmit the relevant data to the transit agency's maintenance department.

With this information in hand, problems can be fixed before they become more severe. This in turn reduces the cost of maintenance, and the potential for problems to occur while the vehicle is in use.

Project to be tie-in with the statewide transit vehicle management project.

**Hazardous Materials Tracking and Reporting Systems**

Since September 11th, 2001 the importance of hazardous materials tracking has taken on a new meaning. Now more than ever, it is important to verify when hazardous materials are being transported by whom. Tracking systems are usually deployed at weigh stations and enable drivers to process manifests and weigh their vehicles without stopping. This will enable staff at the weigh station to identify commercial vehicles carrying hazardous materials and if necessary divert them to alternate routes.

Project to be tie-in with the statewide hazardous materials tracking and reporting project.

**5-1-1 for Traveler Information**

The 5-1-1 telephone number has been recently approved for the dissemination of traveler information. The MOA will tie-into the State 5-1-1 project. Drivers can call the 5-1-1 number on their mobile communication device (e.g., cell phones) to obtain near real-time traveler information (e.g., weather information, road closures, event information). Many regions within the State of Alaska use different travel advisory numbers and as such travelers may have difficulty remembering numbers as they travel from one region to another. Implementation of the simple to remember 511 number in the MOA, along with similar implementations across the state, will ensure that travlers can receive information from any location within the State.

**Integration with ADOT&PF Condition Acquisition and Reporting System (CARS)**

CARS is a web based software tool that allows authorized staff (i.e., police, city officials, DOT personnel, or other user) to input accident, construction, delay, and other roadway and weather information into a statewide database. Users of the system can store information on active incidents (e.g., hazardous material spills, crashes, or natural disasters) or planned incidents (e.g., events, construction activities, road closures) in the database quickly using pull down menus, or manually using text entries. This information is then graphically overlaid on a map of the roadway network so users are able to view the locations of, and obtain information on incidents on a regional level. Information from the CARS system will then be disseminated to the public through the 5-1-1 telephone system and online through regional web sites.

**Mobile Data Terminals (MDTs)**

MDTs can greatly enhance internal agency communication in the MOA. These systems provide personnel in the field with greater flexibility to collect and report information. This enhances in-field operations and alleviates the burden traditionally placed on dispatchers at a fixed facility. MDTs also provide easier means to disseminate information from the field to the operation center. Currently MDT's are installed in Anchorage Police Vehicles, however, it is expected that deployments will be expanded to include the Anchorage Fire Department, transit vehicles, and city maintenance vehicles.

Project to be implemented in conjunction with the Statewide mobile data terminal project.

**Material Usage Tracking System**

A Material Usage Tracking System may be used to store the amount of ice and snow fighting chemicals, fuel, and other resources consumed by various maintenance activities. Tracking the use of materials year after year will allow the MOA to purchase just enough resources to cover the amount that that is typically used, thus reducing over spending on unnecessary materials and helping to maintain the environment.

### Asset Management System

An Asset Management System stores pavement and infrastructure condition information so it can be used more effectively. This information can be integrated into a GIS and used to easily identify the condition of infrastructure at desired locations. This allows funding to be allocated among roadways and/or structures in the most need of repair.

### Automatic Vehicle Location (AVL)

AVL sensors installed on transit and maintenance vehicles will communicate with Global Positioning Systems (GPS) to provide dispatchers with real-time vehicle locations and movements. This information allows dispatchers to assign vehicles to a location (e.g., avalanche or transit stop) based on the current location of an available vehicle. Maintenance vehicles can use this information to locate streets that have/have not been cleaned or plowed, reducing costs and the time needed to complete these activities. This technology can also be used to quickly locate a stalled or disabled vehicle and to provide real-time bus arrival information to transit users via the Internet, kiosks, or message boards at transit stops.

### Shared Traveler and Traffic information Database

Individual agency data is a valued asset not only to the agency itself but to other agencies as well. A shared traveler and traffic information database allows agencies to share their electronic data (e.g., GIS data, crash data) in exchange for other agency data. This enhances operations of each participating agency by reducing data collection costs, and increasing data usefulness.

### Common Geographic Information System (GIS)

A GIS is a tool used to analyze text and numerical data quickly by displaying it in spatial format. Many agencies in Anchorage already own a GIS, however, these systems are not similar (i.e., files are incompatible between systems) and are operated in an isolated or “stove-pipe” manner. This project would specify a common GIS for the MOA, enabling agencies to exchange information easily thus resulting in reduced operating cost through more efficient use of existing data.

### Traffic Signal System Upgrade

The existing traffic signal system is aging and communications with the existing controllers are slow and limited. As part of the implementation of the Traffic Operations Center, the existing traffic signal and communication system should be evaluated to determine whether it should be updated or replaced to support full functionality of the Traffic Operations Center.

### Closed Circuit Television (CCTV) and Digital Camera Implementation

Projects that install cameras will enhance efficiency, reliability, and mobility by providing travelers with information and operating agencies with information that can use to respond to roadway conditions. Public access to travel conditions (especially visual images seen on television and via the Internet) should enhance public awareness and acceptance of the overall ITS program. CCTV and digital cameras will be installed at key areas of known traffic congestion to monitor traffic and visually verify incidents. This information helps enable more effective incident response. Transportation system operators can use this equipment to remotely view the roadway system and make more informed operational decisions, and the public can use this to make better travel plans.

# 4. 4. PROJECT IDENTIFICATION AND SELECTION METHODOLOGY

This section defines the criteria used in recommending projects for deployment in the MOA. It also presents the MOA's mission statement and policies that guided the development of selection criteria.

## 4.1 4.1 INCORPORATING ITS INTO THE TRANSPORTATION PLANNING PROCESS

Federal ITS requirements including the final FHWA Rule and FTA Policy were developed to foster integration of regional ITS components through use of the National ITS Architecture and applicable standards. With respect to the Federal ITS requirements, the regional ITS architecture, or framework for ITS integration, should among other things be consistent with the transportation planning process for statewide and metropolitan planning. Therefore, it will be important that the MOA include ITS projects in the traditional transportation planning process. This will likely require changes to be made to the current project nomination and scoring process.

An ITS project is defined as any project which applies electronics, communications, or information processing used solely or in combination to improve the efficiency or safety of a surface transportation system. Or it is a project that, in whole or in part, significantly contributes to the provision of one or more ITS user services as defined in the National ITS Architecture. Examples, include interconnecting traffic signals, transit signal priority systems, variable message signs, closed-circuit television cameras, automatic passenger counters, and traffic control software.

### Project Nomination

When nominating projects for inclusion into the transportation planning process, project sponsors should review their project to determine if it contains an ITS element, and determine if it should be considered an ITS project. Project sponsors should also determine how their project (if containing an ITS element) fits into the regional ITS architecture. This may require that existing project nomination sheets be updated to include a question on ITS applicability. If the project contains an ITS element, then project sponsors will be required to fulfill a checklist.

## 4.2 4.2 PROJECT SCORING

ITS project scoring can be completed through adaptation of the AMATS Roadway Ranking Criteria (1998-2000). The project scoring process consists of 17 criteria with weighted values ranging from 4 (highest/most important) to 1 (lowest/ least important). Each project is also individually scored and given an un-weighted value between 5 and -3 depending on its characteristics. The maximum score for each project is 5, however, the minimum score for an individual project can assume a value of 0 or -3. The project's score is multiplied by the project's weight to obtain its weighted score. After all weighted scores are calculated, they are added together to obtain the project's total score. After evaluating each project, the projects' total scores are ranked in ascending order to determine the priority of project selection and implementation. Brief descriptions of the criteria and the weight assigned to each are provided in Table 3-1.

Although several of the 17 AMATS roadway ranking criteria are suitable for ranking ITS projects, it is suggested that several criteria be adapted so they are relevant to ITS–related projects. Guidance and recommendations for adapting the criteria are provided following Table 3-1.

**Table 6-1: AMATS Project Ranking Criteria**

| Criterion | | Project Scoring Point Values and Guideline | | | | |
|---|---|---|---|---|---|---|
| | | 5 | 3 | 1 | 0 | -3 |
| 1 | Preservation of Existing System<br>(weight = 4) | Primarily 3-R (resurfacing, rehabilitation, restoration) | Primarily 3-R; a portion of the project addresses serious foundation problems | N/A | Primarily major reconstruction; addresses longer-range rehabilitation | N/A |
| 2 | Safety (% of Project that Addresses Safety Concerns)<br>(weight = 4) | Highway safety improvement program priority<br>or<br>100% - %80 of total (=5)<br>79% - %60 of total (=4) | 59% - 40% (=3)<br>39%-20% (=2) | 19% to %5 (=1) | < %5 of project addresses safety | N/A |
| 3 | Bridge Preservation<br>(weight = 4) | Project significantly contributes to bridge preservation | Project moderately contributes to bridge preservation | Project minimally contributes to bridge preservation | Project does not contribute to bridge preservation | N/A |
| 4 | Congestion<br>(weight = 4) | Project will help relieve congestion in corridor that operates at level of service “E” or “F” in AM **and** PM peak | Project will help relieve congestion in corridor that operates at level of service “E” or “F” in AM **or** PM peak | Project helps prevent congestion from occurring where it does not yet exist. Level of service at or approaching “D” | Project has no immediate impact on relieving or managing traffic congestion | N/A |

| | Criterion | Project Scoring Point Values and Guideline | | | | |
|---|---|---|---|---|---|---|
| | | 5 | 3 | 1 | 0 | -3 |
| 5 | Functional Class (Size of Area Served)<br>(weight = 3) | Major arterial | Minor arterial | Collector | Local | N/A |
| 6 | Design Standards<br>(weight = 3) | N/A | N/A | N/A | N/A | N/A |
| 7 | Benefit Cost*<br>(weight = 3) | Between:<br>$0.00 - $0.10 = 5<br>$0.11 - $0.25 = 4 | Between:<br>$0.26 - $0.50 = 3<br>$0.51- $0.75 = 2 | Between:<br>$0.76 - $1.00 = 1 | Between:<br>$1.01+ = 0 | N/A |
| 8 | Quality of Life<br>(weight = 2) | Project provides significant contribution to health and quality of life | Project contributes to health and quality of life | N/A | Project will have no affect on quality of life issues | Project will have negative affect on quality of life issues |
| 9 | Economic Benefits Following Completion<br>(weight = 2) | Project supports significant improvement to the movement of goods and services for areawide benefit | Project supports improvements to the movement of goods and services for local benefit | N/A | Projects supports speculative or temporary economic opportunities or benefits | N/A |

* Divide Cost (in thousands of dollars) and further divide by existing annual average daily traffic (AADT) or projected AADT 1st Year of Operation.

| Criterion | | Project Scoring Point Values and Guideline | | | | |
|---|---|---|---|---|---|---|
| | | 5 | 3 | 1 | 0 | -3 |
| 10 | Support of Project (weight = 2) | Significant support from community councils, affected users, elected officials and appointed bodies and from responsible local or state agencies | Moderate support from community councils, affected users, elected officials and appointed bodies or from responsible local or state agencies | Support from community councils, affected users, elected officials and appointed bodies or from responsible local or state agencies | N/A | N/A |
| 11 | Design Issues/ Amenities (weight = 2) | Project addresses deficiencies relative to design issues/ amenities (landscaping, lighting, pedestrian facilities, drainage or noise) | Project addresses deficiencies relative to design issues/ amenities (landscaping, lighting, pedestrian facilities, drainage or noise) | Project addresses deficiencies relative to design issues/ amenities (landscaping, lighting, pedestrian facilities, drainage or noise) | Project does not address landscaping, lighting, pedestrian facilities, drainage or noise | N/A |
| 12 | Recommended In Adopted Plans (weight = 2) | Included in LRTP, comprehensive plan or other adopted state or local plan and project is tied to other CIP project (ASD, AWWU, Etc.) | Consistent with an adopted plan | Not included in adopted plan but developed through a local neighborhood or combined organization effort | Not included in an adopted plan | Conflicts with adopted plan |

| | Criterion | 5 | 3 | 1 | 0 | -3 |
|---|---|---|---|---|---|---|
| | | **Project Scoring Point Values and Guideline** | | | | |
| 13 | Multi-Modal/ Inter-Modal Characteristics (weight = 2) | Includes significant multi-modal links (transit, bike, pedestrian facilities) **OR** improves access to port or airport | Includes moderate multi-modal improvements **OR** improves access to port or airport | Includes minimal multi-modal or inter-modal improvements | Includes no multi-modal or inter-modal improvements | N/A |
| 14 | Project Co-Funding or Leveraging Other Resources (Does not Include State Match for Federal Funds) (weight = 2) | Project is co-funded by responsible or other agency Greater than 25% of total estimated project cost = 5<br>25% to 16% = 4 | 15% to 11% = 3<br>10% to 6% =2 | 5% to 1% =1 | No funding or other resources contributed | N/A |
| 15 | Connectivity (weight = 2) | Provides significant roadway connections between large segments of the city such as downtown to midtown, etc. | Addresses improvements in roadway connections between neighborhoods while preserving neighborhood(s) integrity | Addresses improvements in roadway connections within a neighborhood while preserving neighborhood integrity | Isolated section of new roadway | N/A |

| Criterion | | Project Scoring Point Values and Guideline | | | | |
|---|---|---|---|---|---|---|
| | | **5** | **3** | **1** | **0** | **-3** |
| 16 | Project Operations and Maintenance Commitment (weight = 1) | Project will significantly reduce O&M commitment in immediate area of project **OR** project is very high maintenance priority for sponsor | Project will reduce O&M commitment in immediate area of project **OR** project is moderate maintenance priority for sponsor | N/A | Project will have no positive or negative impact on O&M costs in immediate area of project | Project will increase O&M costs in immediate area of project |
| 17 | Project Readiness (weight = 1) | Project is ready for construction | Project is ready for any necessary right-of-way or utility work | Project is ready for final design | Project in need of pre-design/ engineering location, or environmental review | N/A |

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**Project Scoring Guidance & Recommendations**

This section provides recommendations for using and adapting the roadway ranking criteria identified in Table 4-1.

**Preservation of Existing System** – ITS projects can contribute to the preservation of both pavement and non-pavement transportation assets. ITS elements, once implemented, become part of the transportation infrastructure. Projects that preserve ITS elements should meet the preservation criterion. Furthermore, some ITS elements may support decision-making regarding determining when specific transportation assets need to be rehabilitated or replaced. ITS elements, such as geographic information systems and traffic data recorders provide valuable information needed to determine which assets, pavement and non-pavement, are most in need of rehabilitation. Therefore, the project team recommends that the scoring guidelines be revised to recognize ways that some ITS-related projects can contribute to preserving the transportation system.

The project team recommends scoring two types of ITS related projects. First, projects that replace or rehabilitate ITS elements that are at the end of their design life should be treated as 3R projects. If the project's primary objective is to replace or rehabilitate systems or elements near the end of their useful (design) life, the project should score a 5. If the project significantly contributes to replacing or rehabilitating systems or elements near the end of their useful (design) life, the project should score a 3.

ITS projects that support rehabilitation decision-making should also score points against this criterion. If a project installs systems that provide information **required** by the decision-making process, the project should score a 5. If a project installs systems that provide information that **support** the decision-making process, the project should score a 3.

**Safety** – AMATS guidelines are satisfactory for ranking ITS Projects, although "percent of project" needs to be clarified. A determination needs to be made that specifies if the "percent of project" is by cost or project scope.

**Bridge Preservation** – Only a few ITS projects, such as bridge scour detection, would be relevant for the criterion. Such a project should score a 5. Other ITS projects may develop information critical to determining when a structure needs preservation attention. The team recommends that projects that install systems that provide information **required** by the bridge preservation decision-making process should score a 5. If a project installs systems that provide information that **support** the decision-making process, the project should score a 3.

**Congestion** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Functional Class** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Design Standards** – The guidelines for Design Standards are not relevant for ITS projects, however this criterion can be adapted so projects can be ranked by ITS Standards. Projects will then be ranked based on whether or not a project satisfies such guidelines as; 1) are projects included in the National ITS Architecture and, 2) do projects conform to NTICP and other Standard Development Organization's (SDO) approved standards. Projects clearly meeting both requirements should score a 5. Projects meeting one, but not the other, should score a 3. If it is not clear if these requirements are met, the project should score a 0. If the project clearly meets neither requirement, the score should be –3.

**Benefit Cost** – The formula provided in Table 4-1 for deriving the benefit cost ratio of roadway projects would be misleading for ITS projects. Deriving a ratio for ITS projects will be difficult to create, but at a minimum should include; 1) Influence on traveler behavior, 2) Influence on safety, 3) Influence on mobility. The project team, as an initial formulation, recommends that the project be given a weight in each of these 3 categories as follows:

Influence on traveler behavior. The project will have a positive influence on:

1.0 – nearly all travelers who use it

0.6 – most of the travelers who use it

0.3 – some travelers who use it

Influence on safety. The project will provide:

1.0 – critical safety benefits

0.6 – significant safety benefits

0.3 – some safety benefits

Influence on mobility. The project will provide:

1.0 – significant mobility benefits

0.5 – some mobility benefits

These factors should then be added and multiplied by the AADT. The product should then be divided into the cost of the project, and the same ratios be used as are shown in Table 4-1. In equation form, the formula would be:

Project cost (in thousands)/AADT x (driver behavior factor + safety factor + mobility factor)

While most projects will contribute to only one of these factors, this formulation recognizes the contributions made by projects that contribute to multiple objectives.

If this approach is selected, the team recommends that the MOA planners test this formulation on actual projects and adjust the factors accordingly.

**Quality of Life** – This criterion is very subjective. It will be difficult to determine how an individual ITS project affects the lives of the general public. For instance a Red Light Camera Enforcement Program, can be viewed by some as improving the safety of an intersection, while others may view it as an infringement of their personal rights. Even if a large percentage of the public believe an ITS project is beneficial, how is it's significance determined? More needs to be done to give this criterion a quantitative measurement.

**Economic Benefits** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Support of Project** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Design Issues/ Amenities** – This criterion's guidelines are orientated towards roadway projects. However, they can be applied to ITS projects. If the ITS project addresses pedestrian, bicycle, or environmental needs, the project can be scored in the same manner as a roadway project. The team recommends that the criterion be broadened to include projects that provide the foundation for other projects, such as communication and network infrastructure and geographic information systems. Thus, if a project supplies the support need by other projects, it would be scored the same as if it were providing any other amenity.

**Recommended in Adopted Plans** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Multi-Modal/ Inter-Modal Characteristics** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Project Co-Funding or Leveraging Other Resources** - This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Connectivity** – This project's guidelines are orientated toward roadway projects. For ITS projects, the team recommends that this criterion be viewed as Integration, and the following guidelines be adopted to judge how a project influences regional integration of systems and stakeholders.

5 – Provides significant integration between several systems identified in the Municipality's architecture

3 – Supports significant integration between several systems identified in the Municipality's architecture

1 – Provides limited integration between systems identified in the Municipality's architecture

0 – Isolated project that neither contributes to nor hinders integration.

-3 – Hinders integration

**Project Operations & Maintenance Commitment** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Project Readiness** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

### Additional Scoring and Process Recommendations

The project team recommends that the AMATS consider adding a scoring criterion specifically for contribution to security. Threats to security include threats to critical transportation infrastructure. Transportation is a key in responding to security breaches and in responding to the effects of security breaches. Projects that monitor or protect transportation assets should be scored highly. For instance, installation of closed circuit television cameras to monitor traffic operations may also be used as a tool for preserving homeland security by providing the ability to monitor important bridges, government facilities, or natural landmarks. Projects that aid in response to security threats or breaches should be scored highly as well.

Initially, it may prove difficult for those who normally score projects to score ITS projects. The project team recommends that AMATS form an ITS technical advisory team to help scorers make decisions on ITS projects. Members of the technical advisory team should be familiar with different aspects of ITS systems. Ideally, members would represent the following disciplines:

- Information technology
- Communications
- Traffic engineering
- Transportation planning
- Maintenance

Additional disciplines should be added as deemed necessary. The technical advisory team should test the scoring system on actual projects and determine if any adjustments are needed. The team would then provide training and/or assistance to those who score all of the AMATS transportation projects.

# 5. 5. INTEGRATION STRATEGY

An ITS produces the greatest benefits when individual systems or applications are integrated to form a single complete system. A complete system versus many isolated systems will maximize the potential, observed benefits in terms of safety, efficiency, and cost savings.

Section 5, Integration Strategy, provides recommendations on how to integrate the individual ITS systems planned for deployment in the MOA. This section also defines the recommended steps and actions that foster integrated ITS in the MOA. The extent of integration defined is based on the required functionality of projects and systems, as defined in Section 4 of this report and in the ITS Concept of Operations. Lastly, this section identifies the issues that may affect ITS integration.

## 5.1 5.1 CHARACTERISTICS OF INTEGRATION

ITS integration can be viewed from two very distinct and interrelated perspectives: institutional and technological. To fully realize the benefits of integration, both perspectives must be considered. Institutional and technical integration require a high-level conceptual view of the future system, institutional cooperation, and careful, comprehensive planning. The following sections describe the characteristics of both perspectives.

### Institutional Integration and Agreements

To achieve a regional ITS Architecture that is seamless from one agency's systems to another, institutional integration must occur. Institutional integration involves coordination and cooperation among the various departments within the MOA. Integration may occur if departments discuss and informally agree on the following issues:

- Benefits to be derived from the various systems
- Shared operational and maintenance responsibilities
- Functionality to be realized with system deployment
- Technologies and applicable standards to be implemented
- Operating procedures
- Opportunities for future system enhancements

The process of coming to an agreement on these issues can be a significant undertaking for all parties involved in developing, deploying, and operating an ITS in Anchorage. To achieve this goal, significant coordination and cooperation is required among traditional transportation service providers (e.g., ADOT&PF) and others that play an integral part in transportation safety and efficiency (e.g., Emergency Responders). Steps have already been taken to improve institutional coordination through MOA's participation in ITS America and development of ITS Alaska. Existing policies and procedures that affect ITS integration must also be considered during this process.

Specific agreements for ITS may be rarely needed because most agencies involved are part of the MOA. There have been agreements with the State (e.g., CARS, GIS, Cooperative Agreement require to develop the MOA's Regional ITS Architecture.)

There may also be a need for Charters within the Municipality to document inter-departmental agreements. These agreements could include:

- Transit Signal Priority Design and Operations
- Regional Traffic Operations Center (Operations)
- CARS/511 Project

## 5.2 5.2 TECHNICAL INTEGRATION

Technical integration is the process of developing, implementing, operating, and maintaining the systems that enable various users and other systems to collect, process, store, access, and use electronic information. Technical integration can also include integrating existing systems with other existing and planned systems. Achieving technical integration is complicated when various components are owned and operated by multiple agencies. It is further complicated when these systems are not designed to be "open," thereby making integration more difficult. Institutional structures and agreements that support systems integration must be in place in order to achieve technical integration.

Anchorage's migration towards an integrated system of systems and services will occur over time. Integration in Anchorage will result from an evolutionary process that considers both technical and institutional issues.

A concerted effort needs to be made to integrate ITS standards compliant systems in Anchorage. Being compliant with ITS standards helps ensure that one system can be fully integrated with another. Systems that are not standards compliant risk being used in an isolated or stove pipe manner, thus making it much more difficult to maintain a system, or replace it when it fails.

### Institutional Coordination and Cooperation

Characteristics of successful institutional coordination and cooperation include:

- Champions that have been identified by each involved agency or service provider
- Partnerships that have been formed between the public, private, and academic sectors.
- Applicable policies that have been agreed upon, adopted, and put in place to support ITS deployment, operations and maintenance across multiple jurisdictions
- Signed written agreements that have been reached internally and with affected stakeholders, regarding the provision of adequate funding for the operations and management of systems that have a regional impact
- Adequate staffing that has been agreed to and secured to support ITS implementation, operations, and maintenance
- Regional public, private and academic stakeholders that have fostered operational and data exchange agreements

### Applicable Standards

ITS standards are industry-consensus communication standards that define how system components exchange data with one another. The use of standards is so crucial to the successful implementation of ITS, that the Transportation Equity Act for the 21$^{st}$ Century (TEA-21) requires that projects conform to adopted ITS standards. By specifying how systems and components interconnect, standards foster the integration and interoperability of multiple systems. To expedite integration and interoperability deployment process, the USDOT supports specific ITS standards initiatives, especially in areas that have significant public benefit. The USDOT ITS Standards Program is working toward the widespread use of standards to encourage ITS interoperability.

It will be important for the MOA to use applicable standards as they are developed and when MOA systems are installed to replace existing ones. However, the MOA should not replace existing systems before their useful functional life is completed simply to conform to standards. Rather, MOA should install standard-compliant systems over time, as replacement of existing equipment becomes necessary.

Applicable ITS Standards have been identified for projects in the Alaska Statewide IWAYS Architecture. Due to the close relationship of projects in this Architecture with ones in the MOA's Regional ITS Architecture, projects in the MOA's Architecture were mapped to Alaska's IWAYS Architecture program areas (see Table 5-1). From this mapping, ITS standards for projects in MOA's Regional ITS Architecture can be obtained from the Alaska Statewide ITS Standards Technical Memo.

**Table 6-2: Mapping of MOA ITS Projects to Alaska Statewide ITS Program Areas (to Determine Applicable ITS Standards)**

Municipality of Anchorage ITS Program Areas and Projects

| | Alaska IWAYS Program Areas | | | | |
|---|---|---|---|---|---|
| | Snow and Ice Control | Multi-Modal Information Connections | Traveler Communications | Internal Operations | Commercial Vehicle Operations |
| **Year Round Operations** | | | | | |
| Weather and Pavement Sensors | ■ | | | | |
| Smart Snowplows | ■ | | | | |
| Traffic Signal System | | | | ■ | |
| Highway Rail and Pre-emption Systems | | | | ■ | |
| Transit Signal Priority | | ■ | | | |
| Smart Farebox | | | | ■ | |
| Transit Vehicle Management | | | | ■ | |
| **Incident and Emergency Management Systems** | | | | | |
| Hazardous Materials Tracking and Reporting | | | | | ■ |
| Closed Circuit Television | | | | ■ | |
| Vehicle Detection | | | | ■ | |
| Dynamic Message Signs | | | ■ | | |
| Highway Advisory Radio | | | ■ | | |
| **Traveler Information Systems** | | | | | |
| 511 Traveler Information System | | ■ | ■ | | |
| Internet | | ■ | ■ | | |
| Wireless Web | | | ■ | | |
| **Systems for Internal Operations** | | | | | |
| Mobile Data Terminals | | | | ■ | |
| Material Usage Tracking | | | | ■ | |
| Asset Management | | | | ■ | |
| Automatic Vehicle Location | | | | ■ | |
| Shared Traveler and Traffic Information Database | | | | ■ | |
| Condition Acquisition and Reporting System | ■ | | | ■ | |
| Common Geographic Information System | | | | ■ | |

### Standardizing Field Equipment

Where possible, the MOA should strive to use applicable ITS standards to deploy standardized field equipment in addition to deploying systems.

Deploying standardized field equipment can reduce training requirements, because it limits the number of devices for which operations and maintenance staff must be trained. Additionally, the deployment of standardized equipment can reduce maintenance costs because it limits the number of spare parts that need to be kept in stock. Purchasing large quantities of the same type of equipment can also reduce the cost of ITS technologies. With these benefits in mind, the project team recommends that the MOA develop and adopt policies that promote equipment standardization.

### Standardizing Computing Platforms

To fully integrate ITS, it is becoming more and more important that the MOA continue to require a common computing platform, open databases and an operating system that enable systems to work together and exchange data. However, as with field devices, MOA should replace computing platforms and operating systems only as they reach the end of their useful lives.

## 5.3 5.3 ACTIONS FOSTERING INTEGRATION

To foster ITS integration in the MOA, it will be important to explore existing policies that relate to procuring, implementing, and operating ITS. Policies that can potentially foster the integration and interoperability of ITS are discussed below.

### Integrating ITS with Regional Plans

The ITS Architecture and Standards Conformity Rule contains a provision that requires ITS-related decision making to be mainstreamed into the transportation planning process. The rule requires that ITS technology investments be included in transportation plans, programs, and projects. The rationale for this requirement is to ensure that key ITS projects and initiatives are targeted early in the planning process, which in turn facilitates more effective integration.

It is important that Anchorage develop and adopt policies that include ITS initiatives and conform to traditional transportation planning activities. The MOA has already taken steps in this direction by partnering with the ADOT&PF in developing the Anchorage ITS Architecture. In addition, policies need to include provisions that require other architecture documentation, such as the conceptual design, to be updated in conjunction with the transportation plan.

### Inter-Agency Operational Coordination

Interagency coordination will provide a mechanism for agencies in Anchorage to agree upon and document goals, objectives, and data-sharing procedures. Interagency coordination should include discussions regarding the responsibilities and procedures as they relate to elements of the ITS within the region. It is also important to recognize that interagency agreements may lack effectiveness unless operations staff understands them. Interagency agreements can be formal memoranda of understanding (or agreement), or less formal letter agreements, depending on specifics to be covered, local conditions and specific relationships among the agencies covered by the agreement. Issues that should be discussed during the interagency coordination process are presented below.

<u>*Definition of Control and Operational Responsibilities*</u>

Agencies should discuss whether the MOA or another stakeholder will be responsible for the control of systems that are shared among agencies or affect the operation of multiple agencies. These discussions should address who is responsible for operating the various systems under both normal and emergency operations. In addition, they should include the thresholds that necessitate the transfer of operations. For example, it will be crucial to understand how agencies will integrate and who will have control responsibilities of traveler information systems in the event of a major incident, severe weather, or natural disaster.

*Developing Data Sharing Relationships*
A primary benefit associated with deploying ITS and supporting communications is the ability to exchange real-time and archived data between various operating agencies and service providers. However, agencies sharing information must agree upon several issues, including:

- Data security: This can be a significant issue when law enforcement agencies share data with other operating agencies, or when information contains personal information such as license plate numbers.
- The type of data that will be shared and how it will be used.
- Data formats and structure: For example, the geo-spatial coded data must be consistent, or it will not display properly in a computer mapping system.

### Role of the Private Sector

Private sector agencies may enhance the provision of ITS services. Public/private partnerships could significantly benefit the traveling public, the MOA, and the public sector, especially as it relates to tourism and telecommunications for the area. For example, an Internet website administered by the MOA could provide a variety of traveler-related information and links to other websites.

*Traveler Information Business Plan*
Fostering partnerships will be increasingly important for continuing to enhance the services provided to travelers in Alaska and the MOA. The MOA will be an important source of traveler information. To optimize this role, it will be necessary that a variety of private sector companies and other government agencies participate. A Traveler Information Business Plan will enhance the successful integration of these multiple participants. The private sector has the potential to play an integral role in providing traveler information in Alaska. In part, this is due to tourism's significance to the economy. In developing the Traveler Information Business Plan, it will be important to focus on the respective roles of both MOA and the private sector in providing traveler information.

### Updating the Regional ITS Architecture

Anchorage's ITS architecture will need to be updated periodically. Transportation challenges and user needs will change over time. As with current ITS deployments, future initiatives must focus on prevailing needs. As ITS is deployed over time in Anchorage, new opportunities for integration and functionality will be created.

Secondly, these updates provide an opportunity to ensure that emerging technological solutions are considered when identifying strategies to enhance travel safety and efficiency in Anchorage. This will help to ensure that the transportation systems in Anchorage continue to adequately meet travelers' needs. Based on these issues, the MOA needs to consider developing and adopting policies that require architecture and associated documentation to be updated when needed.

Before a new ITS project is funded, officials need to determine whether or not the project fits into the regional ITS Architecture. If all aspects of the project are completely covered then no action is needed and the project can be implemented. However, if some or all aspects are not accounted for in the Architecture, then a determination of whether or not the project actually satisfies a transportation need for the region. If so, then the MOA will be expected to update the Regional ITS Architecture to include the new project.

The procedure for updating the Architecture is provided in a separate memorandum to the Municipality and ADOT&PF.

## 5.4 5.4 CONCEPTUAL INTEGRATION FOR ANCHORAGE

As mentioned previously, ITS can not be integrated all at once. Various systems, both existing and new, can be integrated over time. The following section illustrates how various ITS components in Anchorage can be integrated over time to maximize the benefits of each system. The section discusses integration from the perspective of each program area, or function, that is enabled or enhanced by ITS deployment (e.g., snow and ice control). The functionality described in the following section is based on the individual project descriptions included in Section 4. This functionality is also predicated on the assumption that adequate and reliable communications will be provided.

***NOTE: Project sequencing is for conceptual integration only, and is not a ranking for program funding. Projects shown with an (*) have been programmed for funding at various levels in the AMATS Transportation Improvement Program (TIP.) Projects without an (*) have not yet been programmed for funding.**

### Near-Term (0-3 Years)

This section describes the level of integration envisioned for ITS deployments in the MOA within the next few years. During this period, ITS integration will be limited, in part because of limited ITS deployment. During this time, emphasis will be placed on deploying ITS elements that show the greatest potential to provide benefits, or that enable the implementation of other systems, thus forming the foundation for future ITS applications.

*Year Round Operations*
In the short-term, the following programs should be implemented to improve year round operations.

**Traffic Operations Center -** The Municipality of Anchorage Traffic Operations Center will enhance traffic operations, and interagency data sharing/ communication. This will enable agencies such as the Municipality of Anchorage's traffic department to communication more effectively with the Emergency Operations Center and other regionally significant agencies. Field devices will be connected with the Traffic Operations center for remote monitoring and control. For example, operators at the traffic operations center may monitor and analyze loop detector data to determine if equipment is functioning properly, and if a change in traffic signal time is needed.

**Needs Study for Transit Signal Priority** - It is envisioned that the MOA and its Public Transit Department will implement Transit Signal Priority systems to improve year round transit operations. The transit department recently released a RFP for its Integrator Project which will use several ITS technologies to increase operational efficiency. Transit signal priority will enable the municipality's transit provider to achieve and maintain on-time performance. In turn this will reduce travel time, making transit more favorable to the public. Increased ridership will reduce the number of vehicles on the roadway, which in turn reduces congestion, and improves roadway safety. Transit Signal Priority can also assist with emergency response during disasters for evacuation, triage, etc.

**Traffic Signal System Upgrade*** – The existing traffic signal system is old and communication with existing controllers is slow. In the near-term a study should be conducted to determine if the existing traffic signal system should be updated or replaced. If it is determined that the traffic signal system should be updated or replaced, work can begin in the short-term and be finished in the medium term.

*Traveler Information*
**5-1-1 for Traveler Information*** - In the short-term the MOA should participate in the implementation of the state 5-1-1 traveler information number. This number will eliminate a driver's need to remember multiple telephone numbers when obtaining roadside assistance in different parts of the state. For instance, a resident of Anchorage who is traveling in Fairbanks can dial the same number he or she would when in Anchorage. However, without the 5-1-1 telephone number, this motorist may not be familiar with Fairbanks's local traveler information number. A common number increases the chance that a motorist will remember and use it when a roadside emergency occurs, saving time

when a driver is stranded, or in need of medical assistance. This is of particular benefit for residents in Anchorage as well as the entire state, since much of the state is rural in nature and weather conditions can severely affect travel. Travelers that dial the 5-1-1 number will also gain access to an assortment of traveler information ranging from weather conditions to incidents to construction activities. Access to this information can influence driver behavior when traveling on snow or ice covered roadways and route selection when incidents occur and construction activities are taking place. In gaining awareness of localized weather conditions, travelers will be less likely to cause or be involved in an accident. Motorist awareness of incidents and construction can reduce delays, and the impact on traffic.

<u>*Internal Operations*</u>

**Mobile Data Terminals*** - Emergency response agencies, People Mover, and the city maintenance department should install Mobile Data Terminals in their respective vehicles to gain access to information quickly without assistance of a third party (i.e., operator). MDTs have been deployed in a few Anchorage Police Vehicles thus far. It is envisioned that mobile data terminals will be more widely installed to more effectively utilize information entered into the CARS database.

**Integration with ADOT&PF Condition Acquisition and Reporting System (CARS)*** - CARS can significantly enhance the way traffic information is reported and disseminated. The ADOT&PF CARS can be expanded rather quickly in the short-term, to allow authorized personnel in the MOA such as police, fire, and traffic operators, to input and retrieve traffic information into/from a single statewide database. These personnel can enter and receive data in-the-field through use of mobile data terminals, or verbal relay information to operators at a TMC who can then enter this information into the web-enabled database, where it can be graphically displayed for quick reference. Once entered, the information is available for everyone to see simultaneously, reducing the time needed to report this information to individual agencies.

**Automatic Vehicle Location (AVL) Systems*** - Automatic vehicle location sensors should be installed on maintenance and transit vehicles in the short term to enable quick identification of vehicle locations. It is envisioned that these sensors will be installed on maintenance vehicles to determine the areas that have and have not been treated. For instance, if systems are installed on snow plows, vehicle travel patterns can be tracked and analyzed to determine areas in most need of treatment. With regard to transit, funding has already been allocated for transit fleet improvements, and as part of fleet improvement program, AVL sensors are to be installed on vehicles. It is expected that improvements be expanded if needed to cover the entire transit vehicle fleet.

**Common Geographic Information System (GIS)*** - A common GIS should be a short-term priority for the MOA. Currently, a variety of GIS platforms are being used in the Anchorage Area, and as such, files cannot be exchanged between agencies. It is expected that a common GIS platform be implemented for all departments within the MOA and efforts be made to expand this common platform to other agencies within Anchorage. A common GIS platform will provide stakeholders with a greater ability to exchange information, thus leading to a sustainable cost savings in the short term.

**Shared Traveler Information and Traffic Database*** - Similar to the Common GIS, traveler information and traffic data should also be stored in a single server which can be accessed by permitted agencies. This will reduce the burden on agencies to collect data which may already exist on another agency's internal server, thus reducing internal operating costs. Shared data can be pulled from the server, and entered into a GIS to graphically display the information. Real-time traveler information may be obtained through CARS, and linked with the Shared Traveler Information and Traffic Database.

**Asset Management System*** – An asset management system stores pavement and infrastructure information (e.g., type, location, service inspections) in a database. This information is used to determine areas where maintenance is needed, and where funding should be allocated. This information can be integrated in a GIS, where it can be graphically plotted and color coded for quick identification of needs.

*Incident/Emergency Management*
**Hazardous Materials Tracking and Reporting*** - Due to the events of September 11th, 2001, hazardous material tracking and reporting has gained added significance in regards to protecting the Nation's infrastructure as well as that of the MOA. Hazardous Materials movements can be entered into CARS when the CARS system is operational.

### Medium-Term (3-5 Years)

This section describes the level of integration envisioned for ITS deployments in the MOA within the next five years. It is within the five-year horizon that ITS deployments will begin to migrate into an integrated system. In part, this will be fostered by an increasing number of ITS deployments and by the development of certain enabling technologies that will provide the basis for multiple functions.

*Year Round Operations*
***Highway-Rail Intersection (HRI) Warning and Preemption Systems*** – It is envisioned that the MOA will integrate HRI Warning and Preemption systems with traffic signals located near highway-rail intersections. This will improve knowledge of on-coming trains and improve safety at HRIs.

***Smart Fare Box Systems**** - Smart Fare Boxes installed on transit vehicles more effectively track fare payments and ridership data than existing methods. This can significantly enhance transit operations, and provide transit agencies the mechanism for allocating the different types of vehicles to appropriate routes. For instance, an articulated bus may not be the best use of equipment for an average daily passenger load of 25 people. Allocating the appropriate vehicle to a route will provide for the most effective use of transit resources.

*Internal Operations*
**Material Usage Tracking System** – Building off the Advanced Vehicle Location project proposed for the short term, a material usage and tracking system should be implemented shortly after, in the 3 to 5 year range. The material usage and tracking system will reduce costs associated with various maintenance operations. By tracking the use of materials, maintenance operations can be greatly enhanced. For instance, by tracking snow plows and street sweepers, the MOA can determine the areas that have been treated and those which have not. This is particularly beneficial during winter storms, where areas previously plowed and lightly covered in snow may appear similar to a plow operator as does an area not plowed and covered with several inches of snow. This reduces the time, money, and materials spent on treating areas repeatedly, many of which may not warrant additional treatment.

*Incident and Emergency Management*
**Closed Circuit Television (CCTV) and Digital Cameras** – CCTV will provide agencies, operators and the public with real-time images of traffic, and incidents that occur on regional roadways. Images can be used to verify reports from the field, and to determine the type of equipment needed to treat injured persons and remove accidents and/or debris from the roadway.

### Long-Term (5-10 Years)

This section describes the level of integration envisioned for ITS deployments in Alaska within the next ten years. It is within the ten-year horizon that ITS deployments will reach optimal levels of robustness in terms of both functionality and integration.

*Year Round Operations*
**Transit Vehicle Management*** – Transit Vehicle Management Systems provide benefits primarily to a single transit agency, and can provide significant benefits in terms of vehicle maintenance and up-keep. Since transit vehicle management systems are not typically integrated with other regional systems, the benefits are not as regionally significant as those in the short and mid terms. Transit

vehicle management systems, however, can reduce operational costs of transit agencies and promote more reliable service.

# 6. 6. FUNDING NEEDS AND OPPORTUNTIES

The costs associated with designing, deploying and operating an ITS requires jurisdictions to be flexible in their use of federal, state and local revenues. Since the advent of the Intermodal Surface Transportation Efficiency Act of 1991, and its successor the Transportation Equity Act for the 21st Century, the federal government has provided states with unprecedented flexibility and discretion in how Federal Highway Trust Fund money can be used to enhance the surface transportation system. However, this distributed responsibility results in more demands from all sectors of the transportation community. Furthermore, budgets are becoming more and more limited as local revenues are restrained due to economic shortfalls or other factors. Because of this, ITS projects will encounter greater competition with other types of both traditional and non-traditional transportation projects.

This chapter describes the specific cost considerations when developing and implementing ITS. Potential funding sources are also described.

## 6.1 6.1 FUNDING NEEDS

This section describes the specific items that must be funded in order to successfully develop, implement, operate, and maintain ITS.

### Planning and Design

As with most capital projects, ITS projects require planning and design work to determine what will be built, how it will be built, what level of mitigation (if any) is required. Special attention needs to be paid to ensure that enough funds are allocated for planning and design. This is crucial for adequately defining the project, so that cost estimates are reasonably accurate to budget for the construction, operations, and maintenance phases.

### Project Capital

Capital expenditures for ITS will include, but are not limited to:

- Infrastructure, including roadside devices, communications media (e.g., fiber-optic cable), and the infrastructure required for the Integrated Transportation Operations and Communications Center.
- Software
- Other materials directly tied to the project implementation (e.g., marketing, training materials, etc.). These are generally one-time charges.

### Operations and Maintenance

Adequate operations and maintenance funding is needed for effective system development. The level of sophisticated technical and software systems inherent in most ITS projects is substantial. The MOA needs to account for routine maintenance to ensure a full design lifecycle for each system. These investments need to be protected to avoid premature system(s) replacement.

One positive attribute of ITS standards adoption will be the development of more interoperable equipment and common system platforms, which will encourage more choices among vendors, thus helping to reduce replacement costs.

### Training

As the MOA continues to deploy ITS, it will be increasingly important to ensure that the staff responsible for operating and maintaining these devices receive adequate training. Training will be required for all existing and new employees who will be responsible for operating and maintaining

ITS. Providing proper and adequate training will help ensure that maximum benefits are derived and that system life is maximized.

## 6.2 6.2 FUNDING OPPORTUNITIES

Opportunities to fund ITS design, implementation, and operation in Anchorage are identified below.

### Traditional Funding Mechanisms

The following traditional funding mechanisms need to be examined before implementing ITS in Anchorage:

Federal

Transportation funding at the federal level, unlike most other federal programs, is authorized as a massive nation-wide package every six years. The current package, signed into law in 1998 and known as TEA-21, authorizes $217 million in funds for deploying multimodal transportation projects, including ITS, over a six-year period. This national package includes the following funding programs that may be tapped to support the ITS deployment:

- National Highway System (NHS)
- Surface Transportation Program (STP)
- Congestion Mitigation Air Quality (CMAQ)

This program funds improvements to rural and urban roadways that are part of the NHS. Under the NHS Designation ACT of 1995, over 160,995 miles of roads, which are most critical to interstate travel and national defense, those that connect with other transportation modes, and those essential for international trade are eligible for funding. Until 1991, the NHS funding program limited the period in which funding could be used for traffic management and control to two years. However, TEA-21 and its predecessor (ISTEA) eliminated this limitation. This is inclusive of start-up and operating costs. TEA-21 also includes “infrastructure-based intelligent transportation system capital improvements” as eligible projects for NHS funding. Additionally, as defined in 23 USC 103(b)(6), the term “operating costs for traffic monitoring, management, and control” now includes a much broader range of eligible expenditures, including the following:

- Labor costs
- Administrative costs
- Utilities and rent
- Other costs associated with the continuous operation of traffic control, such as integrated traffic control centers

Operating expenses are now defined to include hardware and software upgrades, as well as major systems maintenance activities (i.e., those undertaken to ensure peak performance). The replacement of defective or damaged computer components and other traffic management system hardware, including street-side hardware, is also eligible. However, restrictions still preclude the use of these funds for the routine maintenance of computer components and system hardware.

The **Surface Transportation Program (STP)** is a block-grant type program that can be used by state and local governments on any road (including NHS) that is functionally classified as a local or rural minor collector or higher. Infrastructure-based intelligent transportation system capital improvements are eligible for STP funding. STP funds can be used for capital and operating costs for traffic monitoring, management, and control facilities. However, as with NHS funding, they cannot be used for maintenance.

As part of the federal Clean Air Act, the **Congestion Mitigation and Air Quality Program (CMAQ)** channels air quality improvement resources to non-attainment areas for ozone, carbon monoxide, and particulate matter. Traffic and congestion management strategies are eligible for CMAQ funding, provided that the sponsor can demonstrate that these strategies will improve air quality.

Operating expenses for traffic monitoring, management, and controls are eligible for CMAQ funding under the following conditions:

- The project produces demonstrable air quality benefits
- Project expenses are incurred as the result of new or additional service levels
- Previous funding mechanisms, such as fees for services, are not replaced

In addition to the funds authorized specifically for ITS, ITS activities are eligible for funding from other programs. Both NHS and STP funds may be used for infrastructure-based ITS capital improvements and CMAQ funding may be used for implementing ITS strategies to improve traffic flow, which contributes to air quality improvement. Transit-related ITS projects are defined to be capital projects and are therefore eligible for funding under specific transit capital programs, such as the Urbanized Area Formula Grant Program and the formula grant program for non-urbanized areas. This is in addition to the STP, NHS and CMAQ programs.

**ITS Earmarks**

ITS earmarks will continue to be another source for ITS project funding. Although the predictability of this funding is somewhat limited, this source can provide supplemental resources for various ITS projects in the pipeline for implementation, or help start ITS projects that haven't faired well through other more established TEA-21 funding programs. After the State receives ITS earmark monies the MOA apply to the State to receive funding. The DOT ITS Policy Committee decides how the Earmark money is allocated.

**Innovative Funding Mechanisms and Special Programs**

"Innovative financing" refers to changing the traditional federal highway financing process from a single strategy of funding on a "grants reimbursement" basis, to a diversified approach that provides new options. Many of these ideas come from the most innovative financing concepts developed in the public and private sectors. A prime objective of innovative financing is to maximize the states' ability to leverage federal capital for needed investment in transportation systems and to foster the efficient use of funds.

**Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA)**

TEA-21 established a new innovative financing program called the "Transportation Infrastructure Finance and Innovation Act of 1998" (TIFIA). Eligibility for TIFIA extends to projects that are of critical national importance such as intermodal facilities, border crossing infrastructure, multi-state highway trade corridor expansion, and other investments that have regional and national benefits. The TIFIA credit program is designed to fill market gaps and leverage substantial private co-investment, thru supplemental and subordinate capital.

TIFIA permits USDOT to provide financial assistance to projects in the form of direct loans, loan guarantees, and lines of credit. Almost any project that costs over $100 million is eligible for this program. ITS projects are specifically included for costs of $30 million or more. Federal credit assistance may not exceed 33% of the total project cost.

**Partnerships**

A public/private partnership is a business relationship between the public and private sectors. Both entities, to a specific degree, share responsibilities and the costs, risks, and rewards associated with delivering goods and/or services. From a transportation standpoint, a public/private partnership is a form of service delivery with a collaborative approach based on reallocating traditional responsibilities, costs, risks, and rewards between the public agency and private entities.

# 7. 7. PROCUREMENT STRATEGY

This section identifies the potential challenges associated with procuring the ITS software and hardware that will be required to realize the Municipality's ITS Vision. In addition, potential ITS procurement strategies that the MOA may apply to most effectively achieve the ITS Vision are also identified.

## 7.1 7.1 PROCUREMENT CHALLENGES

This section is meant to serve as a reminder to those who have used non-traditional methods to procure technologies in the past. It documents some of these options for those who have not been involved with ITS or technology procurement.

It can be very challenging for the MOA to procure ITS software and hardware. Methods (such as low-bid) that have traditionally been employed to procure transportation infrastructure (such as bridges and roadways) are not generally applicable to ITS hardware or software due of the dynamic nature of ITS project scopes. Furthermore, because of this dynamism, ITS projects often require more flexibility in the procurement process than other more traditional transportation improvement projects. This flexibility is necessary for responding to changes in the environment, which frequently come with ITS projects. For example, one of the most common reasons for many failed ITS software development projects is that the original project definition changes due to advances in technology. Another reason is users often want to seek new or refined changes to system requirements. With this in mind, it is very important that the MOA allow for flexibility in procuring ITS.

The MOA also has access to the State's software task order contract. This contract allows an agency to work with a software team that was chosen on the basis of qualifications. Generally, tasks are written to determine a detailed scope, and cost estimates are written to determine the effort.

Traditional construction procurement methods are useful for projects where construction processes are standardized and fairly predictable, and cost estimates for equipment and services are available and reliable. This is not the common scenario for ITS projects. In simple terms, for traditional construction projects, its proponents generally know what they are facing, and risks for scope changes are fairly low. Construction procurements require low-bid (rather than qualifications-based) selections, have difficult change-order processes, and include liability and completion clauses that do not apply well to the dynamic nature of software development. These aspects of construction procurements, among others, resulted in the issuance of a USDOT memorandum to all FHWA Division Administrators noting that ITS software development should never be procured as "low bid".

## 7.2 7.2 EFFECTIVE ITS PROCUREMENT METHODS

Although there are no current procurement processes designed specifically for ITS, existing methods can be applied to better respond to ITS project needs. This section describes why ITS projects can have uncertain outcomes, and describes the available procurement methods that can be used given various levels of uncertainty.

ITS is different from traditional road and bridge projects. The key differences relate to the following factors:

### Maturity of the Technology

ITS technologies are relatively new and rapidly changing. In contrast, roads and bridges have been constructed for many years and have a long history of lessons learned. For example, a primary focus of ITS in the MOA is maintenance operations. At its inception, the ITS industry primarily focused on traffic operations related applications. However, it is evolving to consider other application focus areas such as maintenance operations, as is the case in the MOA and the State of Alaska. With this in mind, it is likely that there will be rapid and significant development in systems that support needed functions in the MOA.

Because technology planned for implementation at the beginning of an ITS project may change by the end, the outcome is not always certain. A related factor is that ITS can be implemented quickly (and should be, due to the rapid change in technology). In contrast, roads and bridges take decades from concept to implementation. Because the related technology changes so little, road and bridge projects can withstand a long implementation cycle. Many times, traditional transportation improvement and development projects have substantial impacts on the local community, and communities demand significant mitigation strategies that further slow down the project. ITS projects, on the other hand, generally don't have the level of impact that road/bridge projects have on communities, and therefore are generally immune to the same level of scrutiny from the external environment. The short cycle time required for ITS procurements requires responsive management processes and procurement processes.

**Design Criteria and Standards**

Because ITS is new and dynamic, few design or process criteria and standards exist to guide implementation. In contrast, significant design criteria and standards information is available for traditional transportation capital projects. This means that there are many more decisions required of the ITS design team than required for roads and bridges. Since there are a myriad of ITS options to choose from, outcomes are not certain. Many decisions are required, and with each new decision affecting each subsequent decision, the management processes for ITS must respond to an incremental implementation approach. This is not to say that each system recommended for implementation in the MOA is a new concept. As mentioned previously, the MOA has been involved in previous ITS initiatives, such as those focusing on CVO and RWIS. However, it is understood that many of the systems recommended for implementation in the MOA are new concepts, and special care should be taken in developing design criteria and standards.

**The Ability to Innovate**

Because the technology industry is constantly introducing new systems, software solutions, and systems concepts, ITS sparks our imaginations and spurs innovation. Anchorage has moved forward in identifying innovative ways to procure technology-based transportation projects. This is reflected in their development and use of a task order contract to procure information technology projects.

These ITS project features are no different from technology projects implemented in other sectors. However, they are drastically different from traditional public sector transportation projects. Sectors that focus on software, systems, and technology implementations have developed specific procurement processes that are currently in place. Ideally, the public transportation sector would also adopt new procurement processes for ITS. However, the regulatory process often introduces major barriers to refining the procurement processes needed to respond to dynamic ITS projects.

Even without a more standardized procurement process for ITS, agencies can adapt elements of existing procurement processes already available to them to ITS needs. Most agencies are not aware of the range of procurement strategies available to them, because they haven't needed to use them under more unusual circumstances. The following section outlines procurement methods that are available to public transportation agencies across the U.S.

## 7.3 7.3 POTENTIAL ITS PROCUREMENT STRATEGIES

The U.S. Codes outline how traditional road and bridge projects must be procured. A condensed and simplified description of available procurement methods follows. Key concepts in the law that are pertinent to ITS are:

**Engineering and Design Services**

This procurement type is defined in the U.S. Code as:

"Professional services of an architectural or engineering nature, as defined by State law…"

"Such other professional services of an architectural or engineering nature, or incidental services…including studies, investigations, surveying, and mapping, tests, evaluations, consultations, plans and specifications, value engineering, construction phase services…"

- The method of award is qualifications-based.
- The contract type (method of payment) is not restricted.
- The amount of hard goods that can be procured is restricted to less than ten percent of the contract value.

No licenses are required for software and systems engineering. Therefore, Engineering and Design Services is not the required method for procuring ITS, which relies primarily on those services. However, Engineering and Design Services procurement methods are often appropriate.

**Construction**

This type of procurement is defined in the U.S. Code as:

"…the supervising, inspecting, actual building, and all expenses incidental to the construction or reconstruction of a highway…"

- The method of award is cost-based, and must always be low bid.
- The contract type (method of payment) is not restricted in the U.S. Code.
- It is highly restricted to combine services and construction. Only services directly related to the construction (and no design services) can be included.

Many ITS projects should not be defined as construction, although some (e.g., those that share the same certainty in installation as road and bridge projects, such as off-the-shelf software) can be defined as construction. Today, most field device projects are successfully procured as construction projects. The exception is when an experimental device, communications, or other uncertainty is introduced. If this is the case, consideration needs to be given to procuring the uncertain elements separately. It is also appropriate to contract site preparation work (for example, trenching for conduits and installing equipment cabinet bases) as construction, and procure the equipment and software necessary using a procurement process that will allow the MOA to select a vendor using a variety of criteria (not cost alone).

**Common Rule**

The U.S. Code allows agencies (other than federal agencies) to procure projects that are NOT defined as construction (per the U.S. code), using their own laws and rules. This is referred to as the Common Rule. In addition, if no federal funds are included in the project, agencies can use their own procurement methods. Most agencies have adopted some form of the American Bar Association's Model Procurement Code. There are three common categories under that code:

_Construction_

Federal law constrains the definition of construction, so most agencies use the same definition as the U.S. Code. State and local agency construction laws are often more restrictive than the U.S. Code requirements.

- The method of award is cost-based, and must always be low bid.
- The contract type (method of payment) is not restricted in the U.S. Code, but is often restricted due to state and local laws.
- Services not directly related to construction cannot be included.

*Goods*
Commodities such as paper and sand.

- The method of award is cost-based, and must always be low bid.
- The contract type (method of payment) is not restricted in the U.S. Code, but is often restricted due to state and local laws.
- No services other than warranties, minor installation, and other items directly related to the provision of the goods can be included.

*Services*
Services are defined as procurements that are neither goods nor construction. This category includes engineering, meeting planning, network management, and other services. State and local laws sometimes further define professional and non-professional services categories. Professional services are those that require a license in a particular jurisdiction and can include engineering and planning for example. Non-professional services are those that are not defined as professional services.

- The method of award for services can be based on either qualifications alone, or on cost and qualifications, depending on local law. It is never based on cost alone.
- The contract type (method of payment) is not restricted in the U.S. Code, but is often restricted under state and local laws.
- The amount of goods that can be purchased under a services contract varies greatly from agency to agency. In general, there are usually no explicit legal restrictions if the goods are not considered part of construction or protected by labor and trade laws. Rather, the restrictions are policy-based.

There are a variety of procurement methods available. Methods available under the Common Rule can be very flexible and appropriate for ITS. Most agency staff are surprised by the options allowed under law. A common trap is assuming that current processes are required "law" or "policy" and the only process available. The fact that procurements have always been done in a certain way does not mean that changes cannot be made. Agencies should ask themselves how the agency as a whole or individual departments with the agency procure systems such as phones, computers, information technology services and other items comparable to ITS. Consideration needs to be given to more flexible strategies when procuring ITS.

## 7.4 7.4 ADDITIONAL TOOLS

For all types of procurements (except construction procurements), two tools are available that can be very useful in managing dynamic, quick turn-around, uncertain ITS projects that require many decisions.

### Indefinite Quantity Contracts

Indefinite Quantity Contracts (IQCs) are used to procure both goods and services. They help reduce the length of time between advertising and Notice to Proceed, by pre-qualifying and signing contracts with one or more contractors to supply required goods or services with no guaranteed minimum. Because the process of advertising, awarding and contracting is already complete, when a service or good is required it can be procured expeditiously by simply defining the service or good and agreeing on the price.

### Task Order Methods

Task Order contracts are used when the project goal can be reasonably well defined, but the processes and methods used to accomplish the goal cannot be clearly defined initially. For example, a project can be procured to implement a freeway management system on a specific portion of freeway, and include central control software. The project can be divided into small tasks to help reduce uncertainty, and to better manage overall costs. The first task might be to confirm the needs and the project vision, goals and objectives. The next might be to develop a high-level ITS architecture and functional requirements. The following tasks could be to craft documentation on various aspects of the system and requirements to further define them. Once these requirements are understood, the tasks to write functional and testable modules of the system software can be written. The number of tasks depends on the scope and complexity of the work. Most ITS projects can benefit from using a Task Order approach. As mentioned above, ADOT&PF has used a statewide task order contract for certain software efforts.

## 7.5 7.5 POLICY CONSIDERATIONS

Because most agencies do not have appropriate policies and standards to guide ITS procurement, they often find that software deliveries will fail to meet functional requirements, be over budget, and/or be delivered late. As such, software procurement policies should rely on good management practices.

Alaska procurement laws and Municipality procurement rules appear sufficiently flexible to deploy new approaches. Federal procurement requirements, applicable when federal-aid highway funds are used to procure future ITS projects, may be more restrictive. Generally, the Federal Highway Administration has shown growing latitude in this area and has sponsored national courses addressing the unique aspects of ITS procurement.

# 8. 8. SUMMARY

ITS shows significant potential to improve safety and efficiency of travel in the MOA. In part, the need for ITS in the MOA revolves around improving internal operations and management, emergency management, traffic operations, and year round operation. This Implementation Plan has outlined a set of projects identified by various stakeholders in the MOA to enhance traffic operations. Further, it has focused on identifying potential strategies and policies that will foster integration of ITS services in the MOA.

# Anchorage
# Regional ITS Architecture

# EXECUTIVE SUMMARY

*Prepared for*:
**Municipality of Anchorage**

*Prepared by*:
**PB Farradyne**
**In cooperation with Battelle**

**Version 1.1**
**Revised and Approved by**
**AMATS Policy Committee 10-14-04**

# MUNICIPALITY OF ANCHORAGE ITS ARCHITECTURE EXECUTIVE SUMMARY

The Municipality of Anchorage (MOA) initiated the development of a regional Intelligent Transportation System (ITS) architecture to manage implementation of a range of technologies that will improve transportation within the municipality. ITS is the use of advanced sensor, computer, electronics, and communications ***technologies*** and management ***strategies*** in an ***integrated*** manner to increase the safety and efficiency of the surface transportation system. An ITS architecture defines the institutional and technical links necessary to plan, design, implement, operate, and maintain ITS.

The Anchorage Intelligent Transportation Systems (ITS) Architecture project was conducted as a series of six steps, each with a separate document. The six documents are:

- User Needs Report
- User Services Report
- ITS Concept of Operations
- Regional ITS Architecture
- ITS Architecture Final Report
- Implementation Plan

The final report for this project incorporates these six documents as chapters. A Summary Report provides sufficient detail to be the primary document for most readers. This Executive Summary provides a high level summary of the results of the project.

## NATIONAL ITS ARCHITECTURE CONFORMITY

On January 8, 2001, the USDOT released the final FHWA rule and FTA Policy requiring regions that currently have ITS in place, such as the MOA, to have a regional ITS architecture in place within four years of the date the rule policy became effective, or by April 8$^{th}$, 2005. The regional architecture developed as part of this project meets these Federal requirements.

## MOA'S USER NEEDS

The first step to a successful ITS deployment is to identify user needs. User needs specify issues plaguing travelers or transportation agencies that can be satisfied through ITS. User needs defined in this project are from the perspective of those who operate and maintain transportation systems in the Anchorage metropolitan area, as well as those who use the transportation system in the region. The project team wrote the *User Needs Report* using the terminology stakeholders used during the outreach process. The stakeholders identified User Needs in the following areas:

- Internal Operations and Management
- Emergency Management
- Inter-agency Communications
- Inter-agency Data Sharing
- Traffic Operations
- Traveler Information
- Transit Management
- Commercial Vehicle Operations

## USER SERVICES

The National ITS Architecture identifies User Services, or ITS functions, that meet various user needs. "Mapping" or connecting **user needs** to the applicable **user services** documented in the National ITS Architecture explains how each need will be ultimately satisfied. The purpose of mapping user needs to ITS user services is to clearly illustrate that ITS solutions can satisfy stakeholder needs. The applicable user service bundles and user services that meet Anchorage needs are described in the Summary Report and in the User Services Chapter of the Final Report.

## LONG-RANGE VISION

Mapping the current and future User Needs to the User Services, the ITS Long-Range Vision for the Municipality of Anchorage (MOA) is to:

- Ensure public safety
- Support public security
- Support the community vision
- Deliver services effectively

Figure ES-1 represents the relationships between the goals. Developing a strong community is at the center of the goals. Meeting the community's safety and security needs helps to protect the core community values. Because all services must be provided effectively, that goal forms the outer ring.

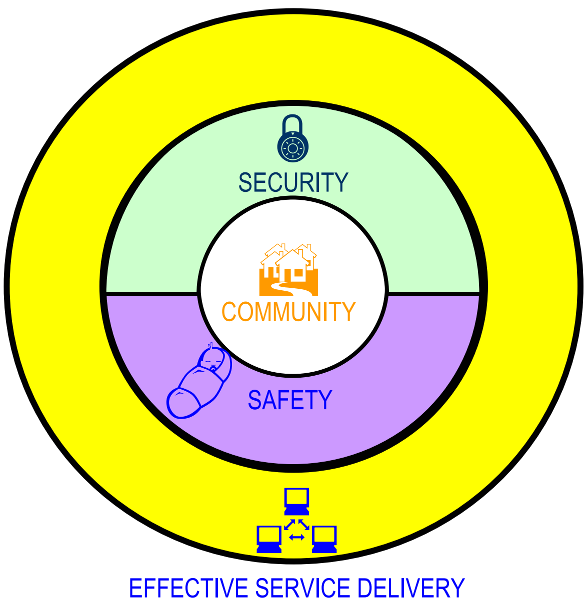


**Figure ES-1. Anchorage ITS Goals**

## CONCEPT OF OPERATIONS

The Concept of Operations defines operational and institutional relationships, as well as communication elements of the municipality's regional ITS architecture. To realize the ITS vision operational strategies will need to be implemented by both the municipality and their stakeholders. The ITS strategy for Anchorage consists of four key program areas illustrated in Figure ES-2.

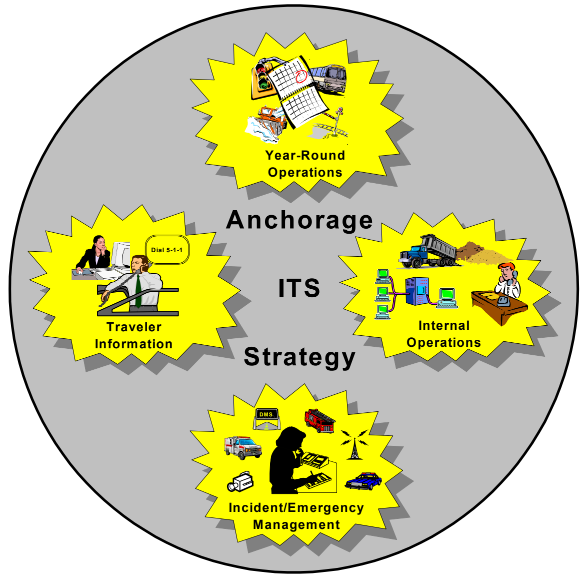


**Figure ES-2. Anchorage ITS Strategy**

## REGIONAL ITS ARCHITECTURE

The Regional ITS Architecture Chapter describes in detail the framework for implementing ITS in the Anchorage area. The Regional Architecture emphasizes the interfaces that are needed among systems and the combination of products and services needed to meet the stated needs for: year round operations, incident and emergency management systems, traveler information systems or internal operations.

## ANCHORAGE ITS IMPLEMENTATION PLAN

ITS projects must compete for funding with other more traditional transportation, construction, and improvement projects. With this in mind, phased ITS implementation will prove effective and help the Plan's recommended ITS technologies meet both Anchorage's and its travelers' diverse and unique needs. The purpose of the Implementation Plan is to define a set of projects that are proposed for implementation in the MOA over the next ten years and the criteria that has been developed to prioritize the projects. The Summary Report and the Implementation Plan describe the projects considered and provide a recommendation for the timing for implementing these projects.

*NOTE: Project sequencing is for conceptual integration only, and is not a ranking for program funding. Projects shown with an (*) have been programmed for funding at various levels in the AMATS Transportation Improvement Program (TIP.) Projects without an (*) have not yet been programmed for funding.

Near Term (0-3 Years)

- MOA Traffic Operations Center
- Needs Study for Transit Signal Priority
- Traffic Signal System Upgrade*
- 511 for Traveler Information*
- Condition Acquisition and Reporting System (CARS) *
- Automatic Vehicle Location (AVL) Systems *
- Common Geographic Information System (GIS) *
- Shared Traveler Information and Traffic Database*
- Asset Management System*
- Hazardous Materials Tracking and Reporting*
- Mobile Data Terminals*

Medium Term (3-5 Years)

- Highway-Rail Intersection (HRI) Warning and Preemption Systems
- Smart Fare Box Systems *
- Material Usage Tracking System
- Closed Circuit Television and Digital Cameras

Long Term (5-10 Years)

- Transit Vehicle Management *

The Implementation Plan recommends ways to apply the existing AMATS project selection criteria for scoring ITS projects. The plan also recommends that the AMATS consider adding a scoring criterion specifically for contribution to security. Finally, the plan recommends that AMATS form an ITS technical advisory team to help scorers make decisions on ITS projects.

The Implementation Plan recommends methods to combine these various projects into a consistent program. These methods comprise the Integration Strategy. The Plan also discusses funding needs and opportunities and recommends a procurement strategy that suggests using indefinite quantities and task order contracts.

## SUMMARY

ITS shows significant potential to improve safety and efficiency of travel in the MOA. In part, the need for ITS in the MOA revolves around improving internal operations and management, emergency management, traffic operations, and year round operation. This effort identified a vision and concept of operations for addressing the needs identified by users. It outlined a set of projects identified by various stakeholders in the MOA to enhance transportation operations. Further, it focused on identifying potential strategies and policies that will foster integration of ITS services in the MOA.

# Anchorage
# Regional ITS Architecture

# SUMMARY REPORT

*Prepared for*:
**Municipality of Anchorage**

*Prepared by*:
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**In cooperation with Battelle**

**Version 1.1**
**Revised and Approved by**
**AMATS Policy Committee 10-14-04**

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# 1. INTRODUCTION

## 1.1 WHAT IS ITS?

The Municipality of Anchorage (MOA) initiated the development of a regional Intelligent Transportation System (ITS) architecture to manage implementation of a range of technologies that will improve transportation within the municipality. ITS is the use of advanced sensor, computer, electronics, and communications technologies and management strategies in an integrated manner to increase the safety and efficiency of the surface transportation system, and its interfaces with other modes. An ITS architecture defines the institutional and technical links necessary to plan, design, implement, operate, and maintain ITS.

**Coverage of the MOA Regional ITS Architecture**

In 2000, the Alaska Department of Transportation and Public Facilities (ADOT&PF) initiated a similar effort to develop a statewide ITS architecture. The statewide initiative also included the development and implementation of roadway weather information systems (RWIS). As the project progressed, it became clear that the development of ITS initiatives in the Municipality of Anchorage would benefit, not only from the development of the statewide ITS architecture, but also from the development of a regional ITS architecture that specifically focuses on the needs and requirements of traveler and transportation agency needs within the geographic boundaries of the Municipality of Anchorage. The development of the regional ITS for Anchorage serves as a logical extension of the statewide initiative, which focuses primarily on the needs, systems, and integration requirements specific to the region defined by the geographic boundaries of the Municipality of Anchorage.

The Anchorage Intelligent Transportation Systems (ITS) Architecture project was conducted as a series of six steps, each with a separate document. The six documents are:

- User Needs Report
- User Services Report
- ITS Concept of Operations
- Regional ITS Architecture
- ITS Architecture Final Report
- Implementation Plan

The final report for this project incorporates these six documents as chapters. This report summarizes the results of the project and the content of final report.

## 1.2 NATIONAL ITS ARCHITECTURE CONFORMITY: FINAL FHWA RULE AND FTA POLICY

On January 8, 2001, the United States Department of Transportation (USDOT) released the final Federal Highway Administration (FHWA) rule and Federal Transit Administration (FTA) Policy for applying the National ITS Architecture at the regional level. The rule/policy became effective on April 8th, 2001 and requires regions that have yet to deploy ITS to have a regional ITS Architecture in place four years after the first ITS deployment if the deployment is using National Highway Funds. Regions that currently have ITS in place such as the MOA, are required to have a regional ITS architecture in place by four years after the rule policy became effective (April 8th, 2005).

The rule/policy requires regions (i.e., area in which an ITS Plan is developed and is relevant) including the MOA, to develop ITS projects using a systems engineering approach. A systems engineering approach is simply defined as an approach that considers total life cycle costs and value of a project compared to other alternatives. At minimum the systems engineering approach considers the following:

- Portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of the National ITS Architecture).
- Participating agencies' roles and responsibilities.
- Requirements definitions.
- Analysis of alternative system configurations and technology options to meet requirements.
- Procurement options.
- Applicable ITS standards and testing procedures.
- Procedures and resources necessary for operations and management of the system.

In addition to the above system engineering requirements, the regional ITS architecture must also include the following:

- A description of the region.
- Participating agencies and other stakeholders.
- An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the systems included in the regional ITS architecture.
- Any agreements (existing or new) required for operations including, at a minimum, those affecting ITS project interoperability, ITS related standards, and the operation of the projects identified in the regional ITS architecture.
- System functional requirements.
- Interface requirements and information exchanges with planned and existing systems and subsystems (for example, subsystems and architecture flows as defined in the National ITS Architecture).
- ITS standards supporting regional and national interoperability.
- The sequence of projects required for implementation.

The federal ITS requirements identified above apply only to projects using funds from the National Highway Trust Fund including the mass transit account. These include funds from such sources as the National Highway System (NHS) Program, Surface Transportation Program (STP), Congestion Management and Air Quality (CMAQ) Program, and Federal Transit Administration (FTA) program.

The following scenarios illustrate how ITS could work in the Municipality of Anchorage:

**Traveler Information Scenario**

It's the year 2012 and Steve Lindstrom, Vice President of Operations with the Northwest Frontier Fishing Company out of Seattle, Washington, needs to go to Anchorage in late September on business to meet with local boat operators and discuss upcoming fishing season staffing needs. Steve needs to spend three days in Anchorage—Tuesday, Wednesday, and Thursday—and decides to make hotel and rental car reservations for the trip. On a cool and windy Monday afternoon, Steve flies out of SeaTac Airport for Anchorage. Because he is flying on one of Boeing's new Sonic Cruiser jets, he makes the trip to Anchorage in less than three hours—Wow!

Upon arrival at Anchorage International Airport, he proceeds through baggage check and secures his rental car. Immediately adjacent to the rental car area are a series of five-foot-tall electronic kiosks. These kiosks provide real-time traffic conditions, web-based trip planning for the People Mover transit system, and other traveler information for such items as hotels, restaurants, and destination resorts.

After viewing the real time traffic conditions page, Steve makes his way to the rental car holding lot. The car he reserves has on-board telematics[1] whereby Steve can plot his origin (the airport rental car lot) and destination (the hotel). The system guides him on the quickest path between the two points, and he is able to get from the airport to his hotel without the need of a paper map. The system also comes equipped with an on-board global positioning system (GPS), which can interface with the on-board computer to accurately pinpoint where his car in the greater Anchorage area. This system is tied to a database, which provides audio information about restaurants, retail establishments, recreation sites, and other information. Through this system, he was able to find the location of a restaurant that serves a good steak dinner in downtown Anchorage. Being in the fishing industry for many years, Steve has long grown tired of eating fish.

While en-route to the hotel, Steve encounters a road re-surfacing project that is taking place on Minnesota Drive and local traffic is backed up approximately a quarter of a mile. Luckily, the State DOT has installed a portable dynamic message sign upstream and provided a detour route for through travelers. The system came equipped with the ability to send a traffic alert warning to Steve's screen in his rental car. Steve reaches over and touches the screen and the detour message (with suggested alternative route) comes up both in visual and audio formats. Steve listens to the detour message and through the integration of his onboard GPS, is able to take the audio directions and follow the detour route.

Why is this section of the highway being resurfaced at this time? Data from the recycled asphalt system has informed the state that this section of the state highway needs repair presently to minimize further damage to the roadway and to vehicles. Based on good planning, there is budget to complete the resurfacing at this location prior to the onset of winter. The maintenance project is in its last week and traffic operations should be back to normal by the weekend.

As Steve is unpacking in his hotel room, he monitors the Weather Channel on the television. Weather forecasters are predicting a severe early winter storm to hit Anchorage within the next 12-24 hours. At the State Operations Center at Ft. Richardson, detailed weather information has been provided to the state's roadway weather information system (RWIS). (The RWIS website has been updated with the latest weather report). The following morning, it starts to snow lightly. After he looks out the window to see how the roads are (they're clear), Steve checks the website and determines that he can make it to his first meeting across town by car. Upon returning to the hotel later in the afternoon, it is snowing more heavily and the winds are approaching 20 miles per hour. Steve anguishes about having to drive in this weather.

By the next morning, the storm has taken a turn for the worse. Visibility is minimal due to the blowing snow. The snowplows have already been dispatched but can't keep up with the amount of snow that is falling. Prior to leaving his room for his second day of meetings, he listens to the traffic reports on the radio and the "picture" outside is not good. Traffic on the streets is barely moving and there are a number of reports that cars have stalled or slid off of roads. He turns on to the TV and consults the municipality's traffic channel, which provides continuous real-time images of the highway system via a distributed network of closed circuit television cameras (CCTV).

After viewing the images on the TV and consulting the 5-1-1 web site (511.alaska.gov), he determines that traveling by car is too risky and decides to take the bus to his meeting. He consults the People Mover website and using their Trip Planner tool, is able to determine which bus he needs to take to get to his meeting. Luckily for Steve, a bus stop with a shelter is located just outside the front door of his hotel. It has a reader board that announces when his particular bus will arrive. Looking at the reader board, Steve realizes that the bus won't reach the hotel location for another 15 minutes. He takes the time to order a cup of coffee, pick up a local newspaper, and relax in the warmth of the hotel lobby until the bus arrives.

[1] Telematics is an emerging market of automotive communications technology that combines wireless voice and data to provide location-specific security, information, productivity, and in-vehicle entertainment services to drivers and their passengers.

The buses, which have GPS/automatic vehicle location (AVL) capabilities, can transmit location data and automatic passenger counts, make stop announcements on board the bus, and transmit CCTV images back to the central dispatch center, all in real-time mode. Data from this system has helped People Mover transit system plan better service and reduce operating costs.

The advanced weather information via RWIS provides the municipality public works personnel with information to more effectively stage snow removal operations. The CCTV images are fed back to a central operations center where staff work with public safety and maintenance/operations personnel to respond to incidents caused by the storm. Messages to field operations personnel are dispatched to onboard mobile data terminals (MDTs) installed in their trucks. Preprogrammed message sets help to reduce the need for voice communication channels thereby freeing up more radio channels for emergency personnel (police and fire) where needed.

Systems to track snow and ice have been in place for five years and public works staff is using output reports to support operations. In fact, data gathered from the system has helped the municipality plan ahead and store enough de-icing chemicals to handle a severe winter storm like the one currently taking place in the Anchorage area. This data has led to the savings of on average $200,000 per year in operations costs since the system was established five years earlier. The system paid for itself within the first year of operation.

The staff easily accesses much of the data supporting the municipality maintenance and operations functions. Efforts a few years ago to integrate files and build off of a common GIS base layer has made it much easier to conduct "what if" scenarios during the storm. Sure, there was a struggle to coordinate the data files from a number of departments. However, a study eight years earlier stated that the municipality could coordinate its databases and GIS among its many Departments and achieve greater functionality to provide more analyses to support planning, operations, and maintenance functions citywide. It took a few years to fix the data so that it was coordinated and to set up the maintenance procedures for new and edits layer files. However, despite the time it took to do the work, there is general consensus that the integration project is a success across all municipality departments. Folks wouldn't have it any other way.

One common "what if" scenario that is being played out using the GIS is the impacts of run-off of melted snow on the municipality's drainage system. Three years earlier a severe winter storm followed by a warm period saw extreme flooding. The drainage system in some locations was over-taxed, but staff did not have data to help them mitigate the emergency. It was determined that a drainage GIS could have helped the municipality better respond to the incident. Efforts were made at that time to link this set of drainage files to the broader municipality-wide system to ensure consistency and reduce the need to build the system from the ground up, saving thousands of dollars in the process.

By Thursday, the storm has subsided and municipality snow removal teams are hard at work plowing snow and distributing sand and de-icing chemicals on the major thoroughfares. Steve has had a successful trip and is able to take his car back to airport. He leaves with the memory of experiencing a strong winter storm, but content in the realization that he was able to get around and get his work done. Little does he know that a great deal of technology worked behind the scenes to enrich his experience.

### Earthquake Incident Scenario

A tired, but enthusiastic state trooper named Amy begins the day at her house in Eagle River. It is a calm sunny day in the low 40's. On her way to work, she drops off her two-year-old son at daycare. Her son was up frequently the night before and she didn't get much sleep. Ah, the joys of parenthood! After dropping her son off, she heads for her job as manager of the dispatch unit for the state patrol, which is headquartered at Fort Richardson.

Later that afternoon, around 3:30 p.m., a severe earthquake hits the region. The quake, with a magnitude of 7.2 on the Richter scale, is centered 5 miles northwest of Wasilla. Because the epicenter of the quake is five miles below the surface, the damage isn't as extensive as it could have been. Amy and her co-workers are a "little shook up", but no injuries are reported. The dispatch center communications system is operational. Within seconds, the dispatchers are getting flooded with calls.

The municipality of Anchorage and other federal and state government agencies have immediately initiated their earthquake response plan. It is determined that the central operations center at Fort Richardson has received minor damage and the LAN is still operational. Cellular phone service demand is extreme and most people cannot make calls. Interestingly, five years earlier, a multi-agency committee was established to coordinate protocols on the use of radio channels during emergencies. Those protocols were made a part of the disaster plan. Their foresight is being rewarded as the radio system is working perfectly and there is adequate supply of voice channels to facilitate communication. Messaging capabilities are also engaged with public safety personnel via mobile data terminals installed in their vehicles.

Highway operations personnel at Ft. Richardson are monitoring closed circuit television cameras at key highway and bridge locations. Operators have the ability to use the pan, tilt and zoom features of the cameras to pinpoint incidents and determine the nature of problems on the highway system. A train derailment near Minnesota Drive and W. Tudor Road has caused an accident with some automobiles involved. Cameras in this location have helped determine that there are possible injuries and the local hospital is alerted. Paramedic personnel are dispatched to the scene. The paramedic vehicles come equipped with cameras that can provide a wireless video feed back to the hospital. Because of this capability, doctors are better able to determine the nature of the injuries and prescribed treatment instructions to paramedics on the scene.

Personnel at various operations centers are using a coordinated GIS to analyze scenarios such as impacts to the utility infrastructure (namely, sewer, water, electrical and others) to ascertain possible by-pass routes around damaged systems. Fortunately, there was a backup redundant GIS server in place as the primary server was damaged in the earthquake. Electrical power was out in Palmer and utility crews have been dispatched to repair the downed electrical lines.

On the roadside, the Fort Richardson operations have begun dispatching trucks with emergency supplies to disaster spots around the area. En route, the trucks receive up-to-the-minute travel and disaster response information via mobile data terminals onboard their vehicles.

Severe traffic is backing up city streets. Initially, the traffic signals in the downtown area are not functioning and travelers see only flashing red lights. Within an hour, the central traffic operations center got the signal control system under control and functioning normally. Traffic is anything but normal. Gridlock conditions still exist on many of the city's major arterials. However, bus vehicles equipped with transit signal priority equipment are able to communicate with signal controllers on the street. Signals from the buses to the controllers call for longer green times, thereby allowing the buses to move more quickly through congested intersections.

In other areas not equipped with transit signal priority capability, excessive starts and stops are putting a strain on bus engines. One bus is experiencing high engine temperatures, and breakdown is imminent. This information is fed directly to the People Mover maintenance department where another bus is deployed to intercept the ailing bus and to transfer passengers in a timely manner. Once the bus operator informs the perplexed passengers about why they need to transfer buses, they are greatly relieved that they won't get stranded on a disabled bus.

Across town, the Knik River Bridge has received structural damage and large commercial vehicles and buses are temporarily precluded from crossing. The state's structural engineers have inspected the bridge and determined that heavy loads on the bridge pose a high risk to the facility. Dynamic message signs (DMS) are immediately deployed upstream to warn travelers of this fact. To facilitate the flow of heavyweight vehicles, the folks back at Fort Richardson, use their GIS to define an appropriate detour route. Signage and traffic control crews are dispatched to the area to install temporary DMS that inform travelers of the detour. This message is also broadcast over Highway Advisory Radio and the 511 web site.

Amy is able to get through to the daycare facility back in Eagle River. Her neighbor, Susan, was able to pick up her son and take him back home until Amy could leave the office. Because of the emergency, Amy has to work two extra hours, but it could have been worse. The upfront planning, coordination, and technology has been working well, despite the earthquake. The general situation has stabilized within a few hours after the quake.

Months later, various personnel from the military, state and municipality receive commendations from the Governor and the head of the Federal Emergency Management Agency (FEMA) for their professional response to the emergency. Amy's team received a commendation from the Governor for their efforts in keeping the lines of communication open with essential State Patrol field officers and other support personnel. Amy was especially proud, as her son and family were in attendance to see her get the commendation.

## 1.3 MOA'S TRANSPORTATION NEEDS

The first step to a successful ITS deployment is the identification and proper consideration of user needs. User needs specify issues plaguing travelers or transportation agencies that can be satisfied through ITS. User needs defined in this report are from the perspective of those who operate and maintain transportation systems in the Anchorage metropolitan area, as well as those who use the transportation system in the region. The project team wrote the *User Needs Report* using the terminology stakeholders used during the outreach process. The stakeholders identified the following User Needs:

### Internal Operations and Management

Several internal operations and management needs that affect travel in the Anchorage metropolitan area. Internal operations and management issues have also been identified as a primary need on a statewide level. The foremost internal operations and management needs addressed were:

*Material Usage Tracking*
Material Usage Tracking will better track and document the use of road maintenance materials.

*Maintenance Operations and Vehicle Management*
Maintenance Operations and Vehicle Management will automate the process to track the usage of equipment, document work activities, and identify other maintenance activities required.

*Snow and Ice Control*
The severe climate in Alaska requires effective and efficient snow and ice control. This is one of the focus areas for the municipality's Street Maintenance Division and has been emphasized on a statewide level as well.

*Infrastructure Management and Maintenance*
Infrastructure Management and Maintenance in needed to provide the following functions:

- Accurately identifying and inventorying transportation assets,
- Remotely monitoring subsurface temperatures around drainage structures for maintenance planning,
- Tolls to pro-actively manage the roadway system – tracking potholes and other surface damage,
- Utilizing ADOT&PF's laser profiling system to identify rutting in pavements, and
- Seismic monitoring to identify bridges that require emergency maintenance.

**Emergency Management**

The following needs were identified in interviews:

*Field Communications*
The primary concern is the lack of a common communication capability in the field for emergency responders to use during emergency operations.

*Current Roadway Conditions*
Responders need access to current roadway conditions when they are in their vehicles, especially for incident information.

*Tsunami Warnings*
Accurate and timely Tsunami warnings are needed, including advance public warnings to prepare for Tsunami evacuations, real-time information during the actual evacuation operations, and signal priority for buses to foster expedient evacuations in the event of a Tsunami, earthquake, or windstorm.

**Inter-agency Communications**

Inter-agency communications is an over-riding need and is critical to support a number of transportation functions, including both routine and emergency operations.

**Inter-agency Data Sharing**

Shared databases and a common Geographic Information System were cited by numerous stakeholders as the primary desired elements of inter-agency data sharing.

**Traffic Operations**

Enhanced surveillance is a primary need to support traffic operations in Anchorage.

**Traveler Information**

Distributing transportation information to travelers could enhance the efficiency and safety of travel and increase the efficiency of travel in Anchorage. (Enhanced traveler information dissemination was also identified as a need on the statewide level.)

**Transit Management**

Stakeholders in Anchorage recognized the benefits of providing enhanced transit services to travelers. The following defines the identified needs as they relate to transit management.

*Needs Study for Transit Signal Priority*
Transit signal priority to improve transit operations in Anchorage can enhance on-time arrival, ensure service reliability, and assist with emergency response when transit vehicles are used during disasters for evacuation, triage, etc.

*Smart Fare Box*
A smart fare box system to foster efficiency and enhance transit services in operations would automate passenger counting, and obtain fare and run data so that it can be compared to route data.

*Transit Vehicle Management*
An automated maintenance system on transit vehicles would transmit engine diagnostics to the maintenance shop and enable mechanics in the shop to identify potential equipment problems sooner, thereby potentially reducing overall maintenance costs.

**Commercial Vehicle Operations**

Needs pertaining to commercial vehicle operations have been explored in detail as part of the statewide ITS project. However, as it relates to commercial vehicle operations in Anchorage, commercial vehicle operators would benefit from enhanced traveler advisories, including information on closures, construction activities, weight restrictions, and traffic information.

# 2. USER SERVICES

The National ITS Architecture identifies User Services, or ITS functions, that meet various user needs. "Mapping" or connecting **user needs** to the applicable **user services** documented in the National ITS Architecture explains how each need will be ultimately satisfied. Since user needs were recorded using terminology expressed by stakeholders, they do not directly match the terminology used by the National ITS Architecture. The "mapping" process rectifies this discrepancy by connecting the two different terminology types used. Identifying the User Services is one part of the vision for ITS in Anchorage. In addition, User Services will identify functions that the regional transportation agencies provide directly, and those that they should support other agencies in providing (such as enforcement activities).

The purpose of mapping user needs to ITS user services is to clearly illustrate that ITS solutions can satisfy stakeholder needs. The User Services Chapter of the final Anchorage ITS Architecture report presents user services documented in the National ITS Architecture, describing the ITS-related services that travelers and transportation agencies can expect after the Anchorage ITS architecture is complete. The National ITS Architecture user services presented were developed to address the types of needs that stakeholders identified in the interview process. Only the user services defined by the National ITS Architecture that satisfy a user need are provided in the User Services Chapter. This prevents the inclusion of irrelevant user services, and ensures that every ITS-related user need can be satisfied through the National ITS Architecture.

The U.S. Department of Transportation defined 31 user services. These user services are identified in the National ITS Architecture where they are classified into seven user service bundles. These user service bundles are as follows:

- Travel and Traffic Management
- Public Transportation Management
- Electronic Payment
- Commercial Vehicle Operations
- Emergency Management
- Advanced Vehicle Safety Systems
- Information Management

MOA's user services have been adapted from the National ITS Architecture to ensure consistency with other state and national ITS plans and deployments. In most cases, needs expressed by stakeholders were mapped (i.e., converted) to user services in the National ITS Architecture. In a few cases however, a new user service had to be used to clearly state how user needs will be satisfied.

New or updated user service bundles and/or user services may be added to the National ITS Architecture in the future. An example of a new user service bundle that has been created but not yet adopted to the National ITS Architecture focuses on maintenance and construction operations. In addition, user services in the maintenance and construction operations user service bundle are applicable to Anchorage. Therefore, the maintenance and construction operations user service bundle has been included in this report. The applicable user service bundles and user services that meet Anchorage needs are described below.

## 2.1 TRAVEL AND TRAFFIC MANAGEMENT

The travel and traffic management user service bundle consists of ten user services, seven of which map to needs expressed by stakeholders. These seven user services are listed below.

- Pre-Trip Traveler Information
- En Route Driver Information
- Traveler Services Information
- Route Guidance
- Traffic Control
- Incident Management
- Highway-Rail Intersection

## 2.2 PUBLIC TRANSPORTATION MANAGEMENT

The public transportation user service bundle consists of four user services. Three public transportation management user services will partly satisfy ITS-related needs for Anchorage:

- Public Transportation Management
- En Route Transit Information
- Personalized Public Transit

## 2.3 COMMERCIAL VEHICLE OPERATIONS

The commercial vehicle operations user service consists of six user services. Two of these user services are required to meet the needs of stakeholders in Anchorage. Additional commercial vehicle operations user services are included in the statewide ITS architecture.

- Commercial Fleet Management
- Hazardous Material Incident Response

## 2.4 EMERGENCY MANAGEMENT

The emergency management user service bundle consists of the emergency notification and personal security and emergency vehicle management user services. The latter will in part satisfy stakeholder needs.

- Emergency Vehicle Management

## 2.5 INFORMATION MANAGEMENT

The archived data function is the only user service in the information management user service bundle.

- Archived Data Function

## 2.6 MAINTENANCE AND CONSTRUCTION OPERATIONS USER SERVICE

As mentioned previously, this user service bundle has yet to be included in the National ITS Architecture. This bundle, however, is useful in defining the ITS functions needed to meet the unique needs expressed by stakeholders. Two of the four user services contained in this user service bundle will partly satisfy stakeholder needs. These user services are described below.

- Maintenance Vehicle Fleet Management
- Roadway Treatment Management

## 2.7 ROADWAY MAINTENANCE CONDITIONS AND WORK PLAN DISSEMINATION

This user service is responsible for scheduling maintenance activities through identification of infrastructure conditions. This task involves center-to-vehicle dispatching to improve vehicle dispatching.

# 3. LONG-RANGE VISION

Mapping the current and future User Needs to the User Services, the ITS Long-Range Vision for the Municipality of Anchorage (MOA) is to:

- Ensure public safety
- Support public security
- Support the community vision
- Deliver services effectively

The ITS plan is supportive of the mission of the various departments of the MOA and the surrounding communities within the Anchorage Metropolitan Area Transportation Study (AMATS) region. The following describes the goals of the ITS plan. Figure SR-1 represents the relationships between the goals. Developing a strong community is at the center of the goals. Meeting the community's safety and security needs helps to protect the core community values. Because all services must be provided effectively, that goal forms the outer ring.

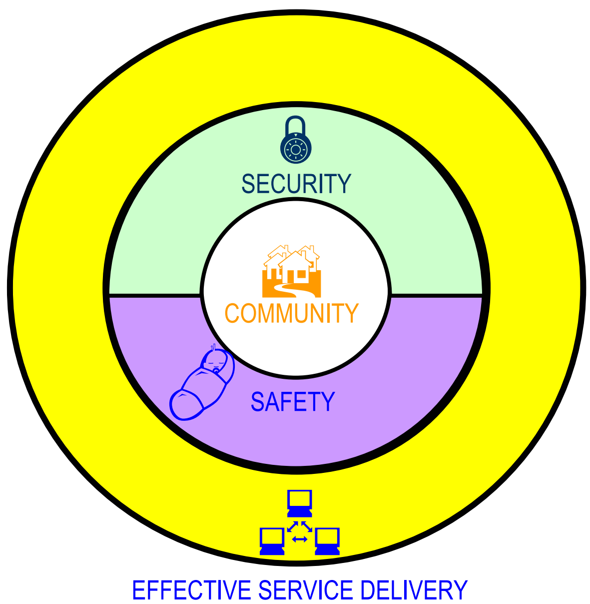


**Figure SR-1: Anchorage ITS**

## FUTURE ITS ELEMENTS

The ITS strategy for Anchorage consists of four key program areas:

### Year Round Operations

Several ITS elements will provide year round information that will improve mobility and traveler safety in and around Anchorage.

### Incident and Emergency Management Systems

Identifying and reporting incidents soon after they occur can decrease response time, improve safety, and minimize delays and other traffic related effects. The impact of incidents on travel safety and roadway efficiency can be minimized through several ITS technologies. These technologies enhance incident identification, verification, notification, and response. Thus, these systems enable operators to dispatch appropriate personnel and equipment quickly, clearing incidents and treating victims in an efficient and timely manner.

**Traveler Information Systems**

In the future, travelers will utilize land-line and wireless communications for obtaining travel-related information. Wireless communications will provide access to traveler information at all times and in most locations.

**Systems for Internal Operations**

ITS can help facilitate better internal operations. ITS provides the capability for agencies to minimize the use of financial and physical resources. The following technologies will help streamline operations, reduce costs, and improve the safety and efficiency of the roadway network.

The ITS-related elements are illustrated in Figure SR-2.

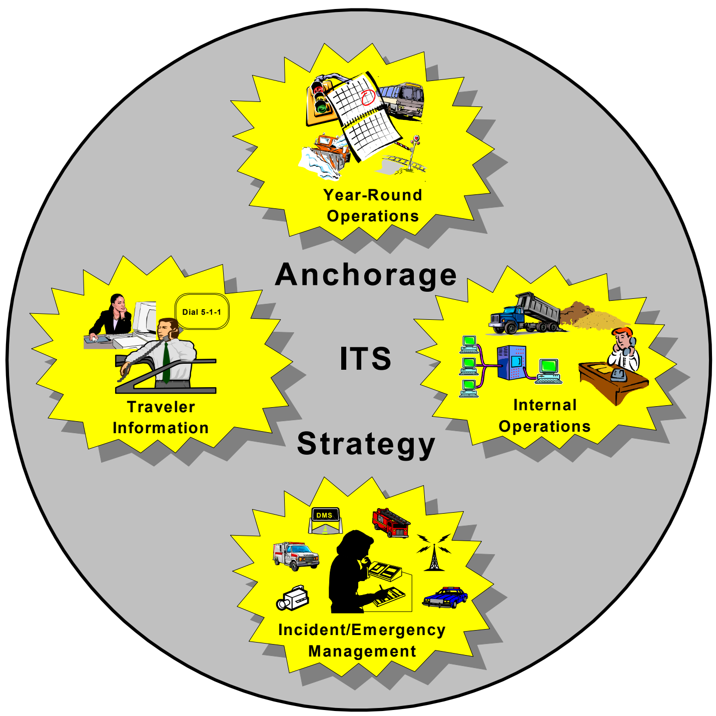


**Figure SR-2: Anchorage ITS Strategy**

# 4. CONCEPT OF OPERATIONS

The project team developed the Concept of Operations for the Municipality of Anchorage (MOA) as part of its effort to create a regional Intelligent Transportation System (ITS) plan and architecture. The Concept of Operations defines operational and institutional relationships, as well as communication elements of the municipality's regional ITS architecture.

## 4.1 CURRENT MOA OPERATIONS

Functions currently performed by the municipality and partner agencies are:

- Municipality of Anchorage – Traffic Engineering
- Municipality of Anchorage – Information Technology Department
- Municipality of Anchorage – Project Management
- Municipality of Anchorage – Emergency Management
- Municipality of Anchorage – Purchasing Department
- Municipality of Anchorage – Public Transportation
- Municipality of Anchorage – Office of Planning, Development, & Public Works Project Management & Engineering Department
- Municipality of Anchorage – Street Maintenance
- Municipality of Anchorage Police Department
- Municipality of Anchorage Fire Department
- Alaska Trucking Association
- United States Air Force – Elmendorf Air Force Base
- United States Army – Fort Richardson
- University of Alaska Anchorage
- ADOT&PF Central Region Traffic and Safety
- ADOT&PF Division of Statewide Design and Engineering (Bridge Design and Materials)
- ADOT&PF Maintenance and Operations
- ADOT&PF Division of Statewide Planning – Highway Data
- Alaska Department of Administration – Division of Motor Vehicles
- Department of Environmental Conservation – Division of Air and Water Quality
- Department of Military and Veterans Affairs – Division of Emergency Services
- ADOT&PF Division of Statewide Planning – Highway Safety Office
- Alaska Department of Community and Business Development
- Alaska Department of Public Safety – Division of Alaska State Troopers

## 4.2 FUTURE MOA STRATEGIES

### Needed Future Operational Strategies

To realize the ITS vision provided in the previous section various additional operational strategies will need to be implemented by both the municipality and their stakeholders. Table SR-1 summarizes the functions that will be required in the future to realize the vision. In addition, this table illustrates the relationship of required functions to the program area. The first column identifies the ITS program area supported by the function. The second column identifies the functions that are identified in the vision. The third column identifies the current status of the functions that are required to support the ITS strategy. The fourth column identifies the functions that will need to be implemented in the future.

**Table SR-1: Future Operational Strategy**

| ITS Program Area | ITS Strategy | Required Functions | Existing System Requiring Enhancements/ Expansion | Future Functional Needs |
|---|---|---|---|---|
| Year-Round Operations | Weather and Pavement Sensors | Measure:<br>• Ambient air and pavement temperature<br>• Wind speed and direction<br>• Relative humidity<br>• Visual observations | | Measure:<br>• Ambient air and pavement temperature<br>• Wind speed and direction<br>• Relative humidity<br>• Visual observations |
| | Smart Snowplows | • Measure road surface friction<br>• Compile data from roadway sensors<br>• Calibrate appropriate amount of chemical and sand<br>• Track snow and ice operations including use of sand by rate and vehicle<br>• Snowplow guidance | | • Measure road surface friction<br>• Compile data from roadway sensors<br>• Calibrate appropriate amount of chemical and sand<br>• Track snow and ice operations including use of sand by rate and vehicle<br>• Snowplow guidance |
| | Traffic Signal System | • Integrated and remote signal control | • Existing centrally controlled signal system | • Integrated and remote signal control |
| | Highway Rail Intersection Warning System | • Advance warning of trains to motorists | | • Advance warning of trains to motorists |
| | Transit Signal Priority | • In-field Signal Control | | • In-field signal control |

| ITS Program Area | ITS Strategy | Required Functions | Existing System Requiring Enhancements/ Expansion | Future Functional Needs |
|---|---|---|---|---|
| Year-Round Operations, Cont. | Smart Fare Box | Collect:<br>• Origin/destination, and passenger characteristics | | Collect:<br>• Origin/destination, and Passenger characteristics |
| | Transit Vehicle Management | • Track real-time location of transit vehicles<br>• Collect ridership data | | • Track real-time location of transit vehicles<br>• Collect ridership data |
| Incident and Emergency Management | Hazardous Materials Tracking and Reporting | • Monitor movement of vehicles caring hazardous materials | | • Monitor movement of vehicles caring hazardous materials |
| | Closed Circuit Television | • Monitor and confirm, incidents, and roadway surface conditions | • Monitor and confirm weather conditions | • Monitor and confirm, incidents, and roadway surface conditions |
| | Vehicle Detection | • Detect and classify vehicles | | • Detect and classify vehicles |
| | Dynamic Message Signs | • Provide en route traveler information | | • Provide en route traveler information |
| | Highway Advisory Radio | • Provide en route traveler information | | • Provide en route traveler information |
| Traveler Information | 5-1-1 | • Provide en route traveler information | | • Provide en route traveler information |
| | Internet | • Provide pre-trip traveler information | | • Provide pre-trip traveler information |
| | Wireless Web | • Provide pre-trip traveler information | | • Provide pre-trip traveler information |

| ITS Program Area | ITS Strategy | Required Functions | Existing System Requiring Enhancements/ Expansion | Future Functional Needs |
|---|---|---|---|---|
| Internal Operations | Mobile Data Terminals | • In-field communications | APD's MDTs | • In-field communications |
| | Materials Usage Tracking | • Inventory materials used | | • Inventory materials used |
| | Asset Management | • Inventory and management of infrastructure | | • Inventory and management of infrastructure |
| | Automatic Vehicle Location | • Provide real-time vehicle location data<br>• Monitor vehicle movements | | • Provide real-time vehicle location data<br>• Monitor vehicle movements |
| | Condition Acquisition and Reporting System | • Provide near real-time weather data | | • Provide near real-time weather data |
| | Shared Traveler and Traffic Information Database | • Data storage and retrieval | | • Data storage and retrieval |
| | Common Geographic Information System | • Data storage and analysis | • Data storage and analysis | • Establishment of common platform (file type). |

# 5. REGIONAL ITS ARCHITECTURE

This section presents a synthesis of that information as a next stage—represented as a top-level graphical illustration of each of the four key program areas.

## 5.1 FOUR PROGRAM AREAS: A HIGH-LEVEL VIEW

The four figures that follow illustrate the integration of the one or more market packages to meet the stated needs for: year round operations, incident and emergency management systems, traveler information systems or internal operations. For continuity, the user services that will be enabled are listed beside each figure.

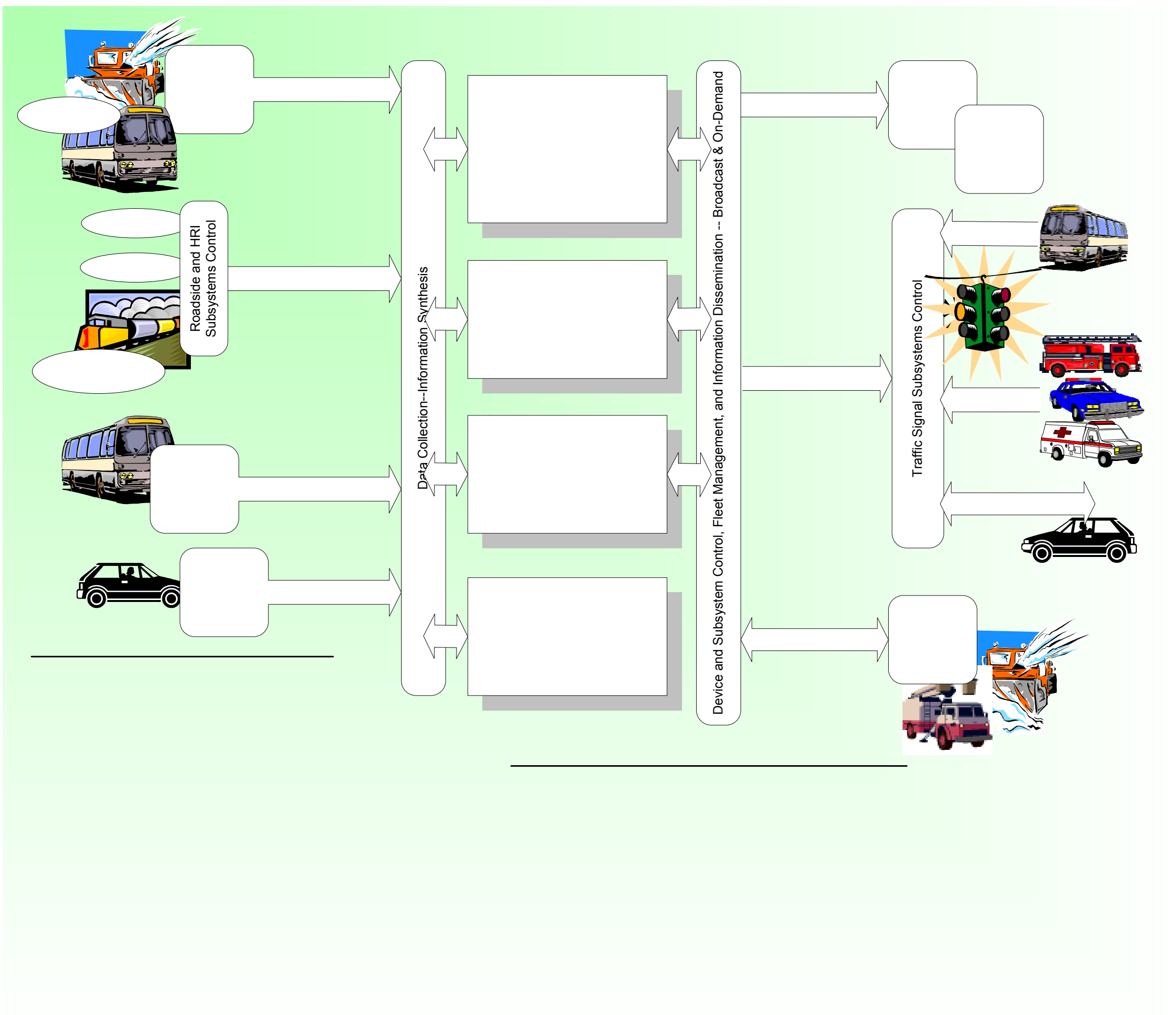


**Figure SR-3: Year-Round Operations -- High-Level View**



Snow Plows

## Year-Round Operations

The left side of the figure shows the sensors and mechanisms for data collection, visual surveillance of the roadway for weather conditions, and vehicle emissions monitoring. It also illustrates that MOA maintenance crews and transit vehicles will serve as sources to relay roadway environmental conditions using on-board sensor systems. MOA will also acquire rail-roadway intersection data for standard and high-speed rail crossings.

The right side of the figure shows several mechanisms for dissemination of roadway and weather conditions. The MOA can use CARS to disseminate information directly to drivers en-route using the 5-1-1 telephone service or through information sharing with the commercial broadcast media. The figure also illustrates the MOA's mechanism for snowplow and fleet vehicle management.

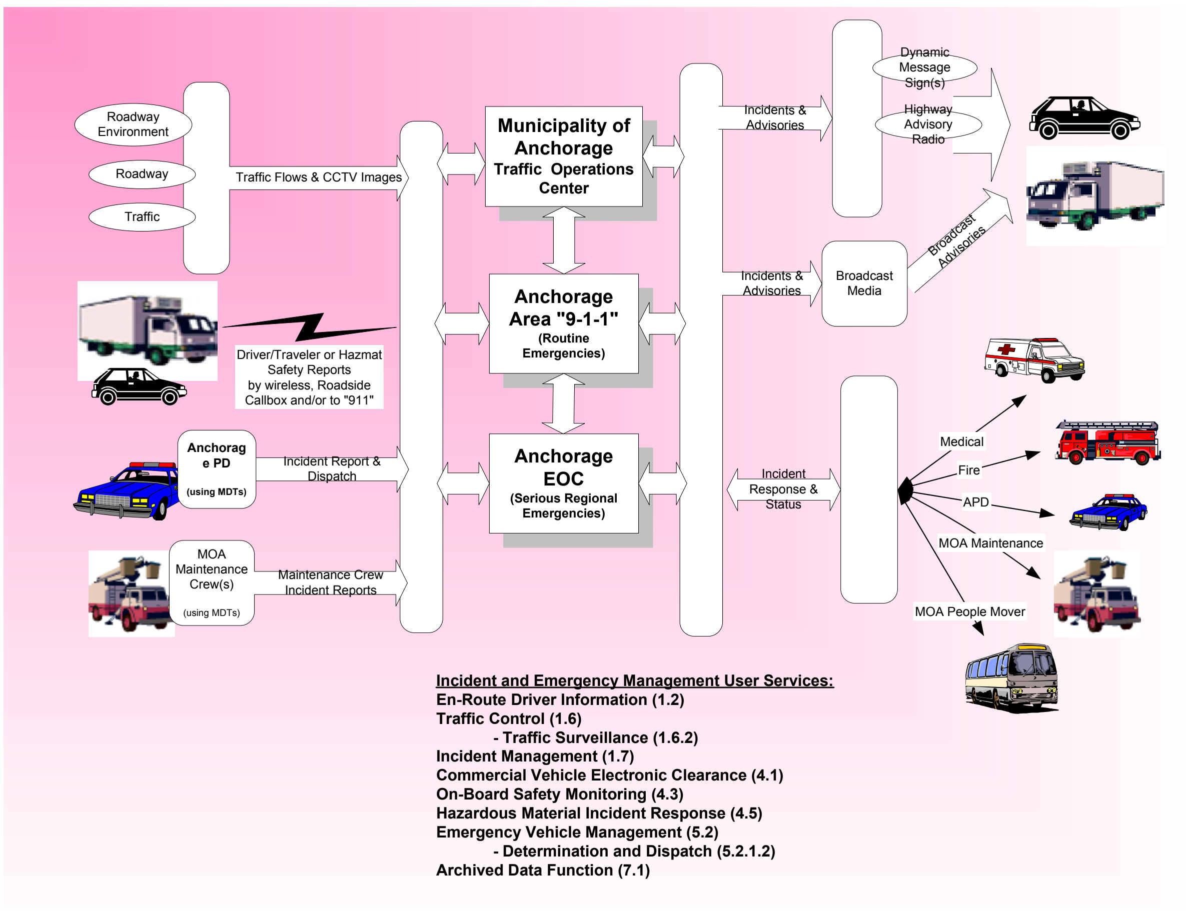


**Figure SR-4: Incident and Emergency Management Systems -- High-Level View**

## Incident and Emergency Management Systems

The left side of the figure shows the sensors that produce the data used to automatically detect traffic anomalies—potential incidents. It also illustrates that drivers and travelers report incidents, and that commercial vehicles operating as Hazmat carriers will be instrumented for cargo safety and pre-credentialed—able to report a Hazmat safety incident should one occur. The Anchorage PD (or any law enforcement agency) and the MOA maintenance fleet operators can discover and report incidents or emergency situations by radio or by using their mobile data terminals (MDTs).

The right side of the figure shows several mechanisms for delivery of the incident or emergency status information that affects regional travel, and the initiation and coordination of incident or emergency response actions by first responders or MOA maintenance crews. The MOA can disseminate directly to the traveling public and commercial fleet operators en-route using public agency-owned roadway signs and advisory radio, or more broadly through the commercial broadcast media. The EOC, 911 or the first responder agencies use the incident report, regional status data, and then on-scene reports to manage and tailor their coordinated incident or emergency response resources as needed.

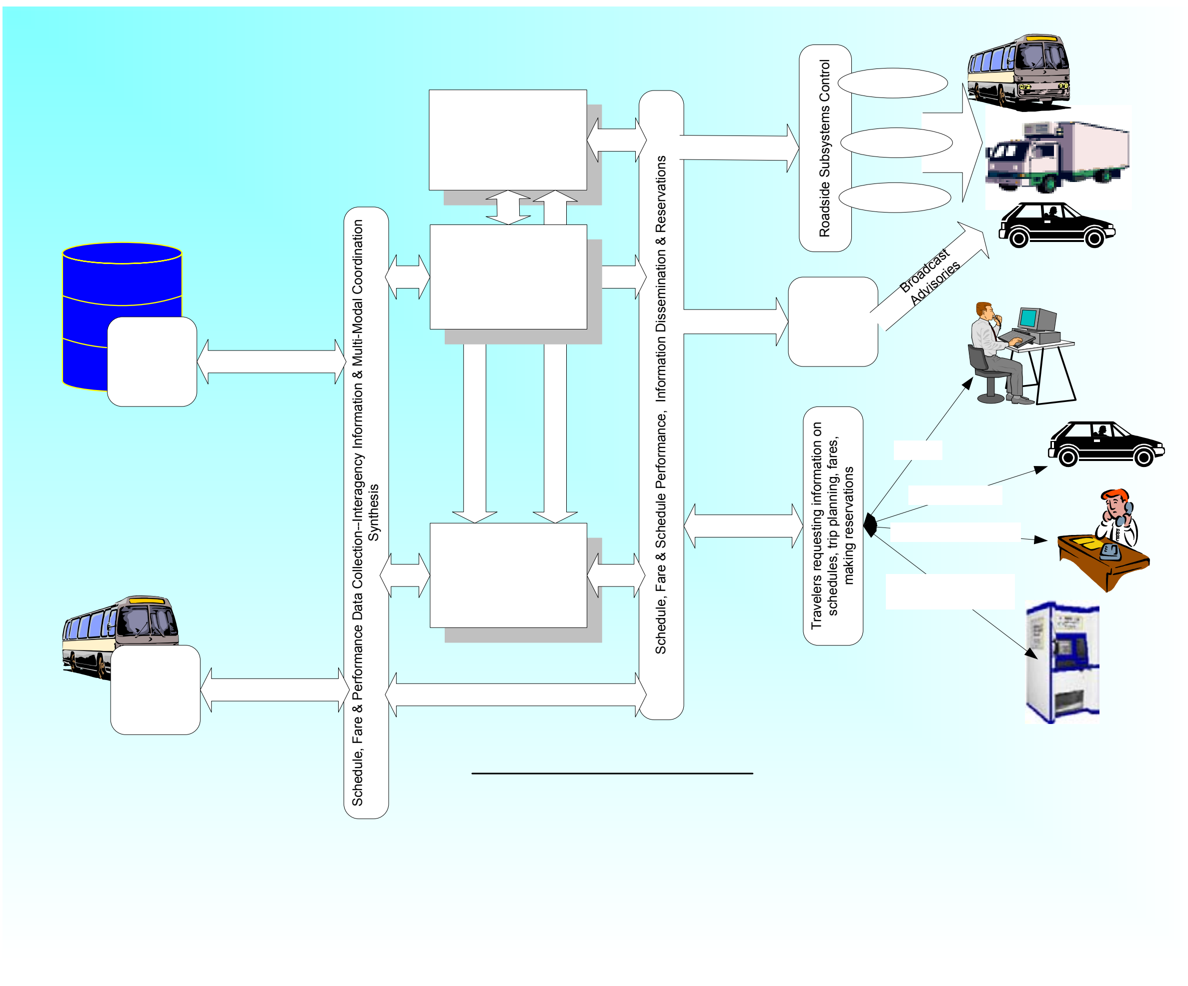


**Figure SR-5: Traveler Information Systems -- High-Level View**

### Traveler Information Systems

The left side of the figure shows the specific sources of information, including real-time or archived (near real time) traffic, weather, accidents, and roadway conditions that could affect safe, efficient travel. It includes provisions for use of data and information stored in the common regional archive or for direct interaction between a traveler and Anchorage transit. The information resident in the regional archive is produced by the Internal Operations capability (see next figure and discussion).

The right side of the figure shows several mechanisms for delivery of the collected or archived travel, weather, and roadway conditions information to the traveler. The MOA can disseminate directly to drivers en-route using public agency-owned roadway signs, in-vehicle systems and advisory radio, or through the broadcast media. Additionally, the information can be disseminated via the Internet to fixed or mobile users, by pre-recorded or interactive telephone systems (e.g., 511), or to remote fixed facilities (e.g., an airport or rest stop kiosk).

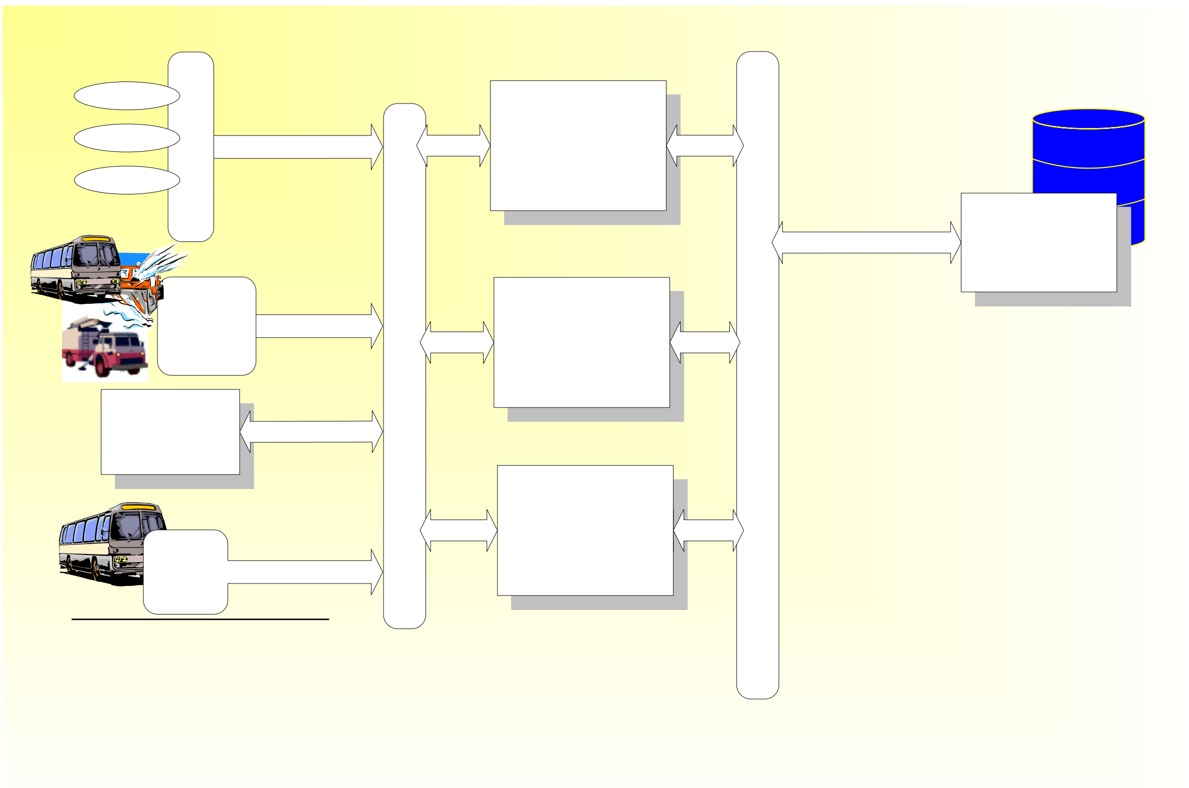


**Figure SR-6: Internal Operations -- High-Level View**

**Internal Operations**

Figure SR-6 illustrates the Municipality's architecture for Internal Operations, including monitoring and/or examination of the roadways, infrastructure, and surrounding environments (e.g., bridges)—this asset identification, status, and management data then goes into the regional data archive (on the right of the illustration). In general, the left side of the figure shows the several sources for this data and information drawn from roadway surveillance, condition and status reports from MOA maintenance and snowplow crews as they do their work and consume their materials, the status of road construction and maintenance obtained through the Condition Acquisition and Reporting System (CARS), and reports from Anchorage transit's AVL instrumented buses.

The right side of the figure illustrates the Anchorage regional data archive and repository. The data and information stored in this archive is contributed by the operating agencies, and made available for regional use in unfiltered (e.g., between public agencies) or filtered (e.g., to an external ISP) form. It is intended that this process be aided by decision support tools to deploy resources and track use of materials (e.g., treatments) most effectively and efficiently in response to a roadway situation. These decision support tools are perhaps supported by the response models and empirical data that have and will accumulate in the DOT&PF archive.

# 6. ANCHORAGE ITS IMPLEMENTATION PLAN

Over the next several years the MOA may have difficulty implementing all the systems outlined in the Anchorage ITS Concept of Operations. ITS projects must compete for funding with other more traditional transportation, construction, and improvement projects. With this in mind, phased ITS implementation will prove effective and help the Plan's recommended ITS technologies meet Anchorage's unique needs.

The purpose of the Implementation Plan is to define a set of projects that are proposed for implementation in the MOA over the next ten years and the criteria that has been developed to prioritize the projects.

This report focuses on implementing ITS strategies that enhance travel safety and efficiency in the MOA. The report fully considers the resources available to implement technologies and the existing and planned systems that enhance the transportation system's operations and management.

## 6.1 PROJECT DESCRIPTIONS

This section describes approved and potential ITS projects for the MOA. The first section provides a detailed description of projects that the MOA has already selected for deployment. The next section describes other potential projects that have been evaluated and prioritized for deployment, based on the criteria defined in the Architecture section.

### Approved Projects

*DMV&I/M Program Data Link (now complete)*
This link allows for real-time transmission of a passing inspection to DMV, thus allowing for a "paperless" certificate of inspection.

*I/M Enhancement Program (now complete)*
The EPA-mandated On-Board Diagnostic (OBD) test for 1996 and newer vehicles where a vehicle's computer determines an I/M pass/fail.

*People Mover*
This system automates operation of the fixed route buses, including vehicle location, operating characteristics, customer real-time information, passenger counting equipment, and improved management reporting capability.

*AnchorRIDES*
This project improves the system by collecting real-time vehicle location information and further automates the scheduling/dispatch functions that will substantially improve the system.

*Fleet Improvement*
This project funds improvements to existing transit and paratransit fleets. Projects could include a ticket reader and issue attachment; security systems; transit/signal improvements for headway enhancements; mobile display terminals; and vehicle communications and locations systems.

*Management Information Systems*
These systems are necessary for efficient management of the public transportation system. Typical projects include: Geographic Information Systems (GIS) capabilities; upgrades to the automated maintenance, refueling, and inventory systems; a new computerized dispatch system; upgrades to the scheduling/run-cutting process, customer information, and telephone communications system; and desktop computers.

*Area-wide Study for Emergency Response Preemption (now complete)*
While emergency response preemption is installed at select locations within the Municipality and projects have been identified to provide additional installations, an area-wide study will allow for a planned, phased implementation of a complete emergency response preemption system.

*Downtown Traffic Signal System Project*
First-year design money has been allocated for the rehabilitation of the traffic signal system in downtown Anchorage. The project will include repair of existing electrical deficiencies, mast arm and foundation replacement where necessary, and installation of emergency response preemption.

**Potential ITS Projects**

*Municipality of Anchorage Traffic Operations Center*
The center will enhance traffic operations and interagency data sharing/communication. This will enable agencies to communicate more effectively with the Emergency Operations Center and other agencies.

*Highway-Rail Intersection (HRI) Warning and Preemption Systems*
These systems may increase motorist safety by reducing the number of train/vehicle conflicts. HRI Warning Systems determine the probability of a collision at an equipped intersection and provide timely warnings to drivers and train operators.

*Needs Study for Transit Signal Priority*
The use of transit versus personal vehicle may be greatly strengthened through the deployment of Transit Signal Priority Systems. These systems extend traffic signal “green time” to transit vehicles in an effort to reduce delay, maintain schedule adherence, and assist with emergency response when transit vehicles are used during disasters for evacuation, triage, etc.

*Smart Fare Box*
Smart Fare Box Systems may be installed on transit vehicles to collect ridership, fare, and origin-destination information, streamlining transit operations by enabling better route assignment, equipment usage, and route planning.

*Transit Vehicle Management*
If implemented in the future, these systems may significantly enhance transit operations and roadway safety by automatically detecting vehicle mechanical problems and transmitting the relevant data to the maintenance department.

*Hazardous Materials Tracking and Reporting Systems*
Since September 11th, 2001, the importance of hazardous materials tracking has taken on a new meaning. Tracking systems deployed at weigh stations enable drivers to process manifests and weigh their vehicles without stopping. This will enable staff at the weigh station to identify commercial vehicles carrying hazardous materials and, if necessary, divert them to alternate routes.

*5-1-1 for Traveler Information*
The 5-1-1 telephone number has recently been approved for the dissemination of traveler information. The MOA will tie into the State 5-1-1 project. Drivers can call the 5-1-1 number on their cell phones to obtain near real-time traveler information (e.g., weather information, road closures, event information).

_Condition Acquisition and Reporting System (CARS)_
CARS is a web-based software tool that allows authorized staff within the Municipality to input accident, construction, delay, and other roadway and weather information into statewide databases. This information can be displayed spatially on a web or similar application.

_Mobile Data Terminals (MDTs)_
These systems can greatly enhance internal agency communication by providing personnel in the field with greater flexibility to collect and report information. MDTs also provide easier means to disseminate information from the field to the operation center.

_Material Usage Tracking System_
A Material Usage Tracking System may be used to track and store data on resources consumed by various maintenance activities. Tracking materials will allow the MOA to reduce overspending on unnecessary material purchases.

_Asset Management System_
An Asset Management System stores pavement and infrastructure condition information. This information can be integrated into a GIS and used to easily identify the condition of infrastructure at desired locations. This allows funding to be allocated among roadways and/or structures in the most need of repair.

_Automatic Vehicle Location (AVL)_
AVL sensors installed on transit and maintenance vehicles will communicate with Global Positioning Systems (GPS) to provide dispatchers with real-time vehicle locations and movements. Maintenance vehicles can use this information to locate streets that have/have not been cleaned or plowed, reducing costs and the time needed to complete these activities. This technology can also be used to quickly locate a stalled or disabled vehicle and to provide real-time bus arrival information to transit users via the Internet, kiosks, or message boards at transit stops.

_Shared Traveler and Traffic information Database_
Individual agency data is a valued asset not only to the agency itself but to other agencies as well. A shared traveler and traffic information database allows agencies to share their electronic data (e.g., GIS data, crash data) in exchange for other agency data. This enhances operations of each participating agency by reducing data collection costs, and increasing data usefulness.

_Common Geographic Information System (GIS)_
A GIS is a tool used to analyze text and numerical data quickly by displaying it in spatial format. Many agencies in Anchorage already own a GIS, however, these systems are not compatible and are operated in an isolated or “stove-pipe” manner. This project will specify a common GIS for the MOA, resulting in reduced operating costs through more efficient use and exchange of existing data. This project has received earmark funding and is currently slated to start in June 2003.

_Traffic Signal System Upgrade_
The existing traffic signal system is aging and communications with the existing controllers are slow and limited. As part of the implementation of the Traffic Operations Center, the existing traffic signal and communication system should be evaluated to determine whether it should be updated or replaced to support full functionality of the Traffic Operations Center.

_Closed Circuit Television (CCTV) and Digital Camera Implementation_
Projects that install cameras will enhance efficiency, reliability, and mobility by providing travelers with information and operating agencies with information that can use to respond to roadway conditions. Public access to travel conditions (especially visual images seen on television and via the Internet) should enhance public awareness and acceptance of the overall ITS program. CCTV and digital

cameras will be installed at key areas of known traffic congestion to monitor traffic and visually verify incidents. This information helps enable more effective incident response. Transportation system operators can use this equipment to remotely view the roadway system and make more informed operational decisions, and the public can use this to make better travel plans.

## 6.2 PROJECT SELECTION CRITERIA

This section defines the criteria used to select and prioritize projects for deployment in the MOA. It also presents the MOA's mission statement and policies that guided the development of selection criteria.

### Incorporating ITS into the Transportation Planning Process

Federal ITS requirements, including the final FHWA Rule and FTA Policy, were developed to foster integration of regional ITS components through use of the National ITS Architecture and applicable standards. With respect to the federal ITS requirements, the regional ITS architecture, or framework for ITS integration, should, among other things, be consistent with the transportation planning process for statewide and metropolitan planning. Therefore, it will be important that the MOA include ITS projects in the traditional transportation planning process. This will likely require changes to be made to the current project nomination and scoring process.

An ITS project is defined as any project which applies electronics, communications, or information processing used solely or in combination to improve the efficiency or safety of a surface transportation system. Or it is a project that, in whole or in part, significantly contributes to the provision of one or more ITS user services as defined in the National ITS Architecture. Examples include interconnecting traffic signals, transit signal priority systems, variable message signs, closed-circuit television cameras, automatic passenger counters, and traffic control software.

*Project Nomination*

When nominating projects for inclusion into the transportation planning process, project sponsors should review their project to determine if it contains an ITS element, and determine if it should be considered an ITS project. Project sponsors should also determine how their project (if containing an ITS element) fits into the regional ITS architecture. This may require that existing project nomination sheets be updated to include a question on ITS applicability. If the project contains an ITS element, then project sponsors will be required to fulfill a checklist.

*Project Scoring*

ITS project scoring can be completed through adaptation of the AMATS Roadway Ranking Criteria (1998-2000). The project scoring process consists of 17 criteria with weighted values ranging from 4 (highest/most important) to 1 (lowest/ least important). Each project is also individually scored and given an un-weighted value between 5 and -3 depending on its characteristics. The maximum score for each project is 5, however, the minimum score for an individual project can assume a value of 0 or -3. The project's score is multiplied by the project's weight to obtain its weighted score. After all weighted scores are calculated, they are added together to obtain the project's total score. After evaluating each project, the projects' total scores are ranked in ascending order to determine the priority of project selection and implementation. Brief descriptions of the criteria and the weight assigned to each are provided in Table SR-2.

Although several of the 17 AMATS roadway ranking criteria are suitable for ranking ITS projects, it is suggested that several criteria be adapted so they are relevant to ITS–related projects. Guidance and recommendations for adapting the criteria are provided following Table SR-2.

**Table SR-2: AMATS Project Ranking Criteria**

| Criterion | | Project Scoring Point Values and Guideline | | | | |
|---|---|---|---|---|---|---|
| | | 5 | 3 | 1 | 0 | -3 |
| 1 | Preservation of Existing System (weight = 4) | Primarily 3-R (resurfacing, rehabilitation, restoration) | Primarily 3-R; a portion of the project addresses serious foundation problems | N/A | Primarily major reconstruction; addresses longer-range rehabilitation | N/A |
| 2 | Safety (% of Project that Addresses Safety Concerns) (weight = 4) | Highway safety improvement program priority or<br>100% - %80 of total (=5)<br>79% - %60 of total (=4) | 59% - 40% (=3)<br>39%-20% (=2) | 19% to %5 (=1) | < %5 of project addresses safety | N/A |
| 3 | Bridge Preservation (weight = 4) | Project significantly contributes to bridge preservation | Project moderately contributes to bridge preservation | Project minimally contributes to bridge preservation | Project does not contribute to bridge preservation | N/A |
| 4 | Congestion (weight = 4) | Project will help relieve congestion in corridor that operates at level of service “E” or “F” in AM **and** PM peak | Project will help relieve congestion in corridor that operates at level of service “E” or “F” in AM **or** PM peak | Project helps prevent congestion from occurring where it does not yet exist. Level of service at or approaching “D” | Project has no immediate impact on relieving or managing traffic congestion | N/A |

| Criterion | | Project Scoring Point Values and Guideline | | | | |
|---|---|---|---|---|---|---|
| | | 5 | 3 | 1 | 0 | -3 |
| 5 | Functional Class (Size of Area Served)<br>(weight = 3) | Major arterial | Minor arterial | Collector | Local | N/A |
| 6 | Design Standards<br>(weight = 3) | N/A | N/A | N/A | N/A | N/A |
| 7 | Benefit Cost*<br>(weight = 3) | Between:<br>$0.00 - $0.10 = 5<br>$0.11 - $0.25 = 4 | Between:<br>$0.26 - $0.50 = 3<br>$0.51- $0.75 = 2 | Between:<br>$0.76 - $1.00 = 1 | Between:<br>$1.01+ = 0 | N/A |
| 8 | Quality of Life<br>(weight = 2) | Project provides significant contribution to health and quality of life | Project contributes to health and quality of life | N/A | Project will have no affect on quality of life issues | Project will have negative affect on quality of life issues |
| 9 | Economic Benefits Following Completion<br>(weight = 2) | Project supports significant improvement to the movement of goods and services for areawide benefit | Project supports improvements to the movement of goods and services for local benefit | N/A | Projects supports speculative or temporary economic opportunities or benefits | N/A |

* Divide Cost (in thousands of dollars) and further divide by existing annual average daily traffic (AADT) or projected AADT 1st Year of Operation.

| | Criterion | Project Scoring Point Values and Guideline | | | | |
|---|---|---|---|---|---|---|
| | | 5 | 3 | 1 | 0 | -3 |
| 10 | Support of Project (weight = 2) | Significant support from community councils, affected users, elected officials and appointed bodies and from responsible local or state agencies | Moderate support from community councils, affected users, elected officials and appointed bodies or from responsible local or state agencies | Support from community councils, affected users, elected officials and appointed bodies or from responsible local or state agencies | N/A | N/A |
| 11 | Design Issues/ Amenities (weight = 2) | Project addresses deficiencies relative to design issues/ amenities (landscaping, lighting, pedestrian facilities, drainage or noise) | Project addresses deficiencies relative to design issues/ amenities (landscaping, lighting, pedestrian facilities, drainage or noise) | Project addresses deficiencies relative to design issues/ amenities (landscaping, lighting, pedestrian facilities, drainage or noise) | Project does not address landscaping, lighting, pedestrian facilities, drainage or noise | N/A |
| 12 | Recommended In Adopted Plans (weight = 2) | Included in LRTP, comprehensive plan or other adopted state or local plan and project is tied to other CIP project (ASD, AWWU, Etc.) | Consistent with an adopted plan | Not included in adopted plan but developed through a local neighborhood or combined organization effort | Not included in an adopted plan | Conflicts with adopted plan |

| | Criterion | Project Scoring Point Values and Guideline | | | | |
|---|---|---|---|---|---|---|
| | | **5** | **3** | **1** | **0** | **-3** |
| 13 | Multi-Modal/ Inter-Modal Characteristics (weight = 2) | Includes significant multi-modal links (transit, bike, pedestrian facilities) **OR** improves access to port or airport | Includes moderate multi-modal improvements **OR** improves access to port or airport | Includes minimal multi-modal or inter-modal improvements | Includes no multi-modal or inter-modal improvements | N/A |
| 14 | Project Co-Funding or Leveraging Other Resources (Does not Include State Match for Federal Funds) (weight = 2) | Project is co-funded by responsible or other agency Greater than 25% of total estimated project cost = 5 25% to 16% = 4 | 15% to 11% = 3 10% to 6% =2 | 5% to 1% =1 | No funding or other resources contributed | N/A |
| 15 | Connectivity (weight = 2) | Provides significant roadway connections between large segments of the city such as downtown to midtown, etc. | Addresses improvements in roadway connections between neighborhoods while preserving neighborhood(s) integrity | Addresses improvements in roadway connections within a neighborhood while preserving neighborhood integrity | Isolated section of new roadway | N/A |

| | Criterion | Project Scoring Point Values and Guideline | | | | |
|---|---|---|---|---|---|---|
| | | **5** | **3** | **1** | **0** | **-3** |
| 16 | Project Operations and Maintenance Commitment (weight = 1) | Project will significantly reduce O&M commitment in immediate area of project **OR** project is very high maintenance priority for sponsor | Project will reduce O&M commitment in immediate area of project **OR** project is moderate maintenance priority for sponsor | N/A | Project will have no positive or negative impact on O&M costs in immediate area of project | Project will increase O&M costs in immediate area of project |
| 17 | Project Readiness (weight = 1) | Project is ready for construction | Project is ready for any necessary right-of-way or utility work | Project is ready for final design | Project in need of pre-design/ engineering location, or environmental review | N/A |

## 6.3 PROJECT SCORING GUIDANCE & RECOMMENDATIONS

This section provides recommendations for using and adapting the roadway ranking criteria identified in Table SR-2.

**Preservation of Existing System** –If the project's primary objective is to replace or rehabilitate systems or elements near the end of their useful (design) life, the project should score a 5. If the project significantly contributes to replacing or rehabilitating systems or elements near the end of their useful (design) life, the project should score a 3.

ITS projects that support rehabilitation decision-making should also score points against this criterion. If a project installs systems that provide information **required** by the decision-making process, the project should score a 5. If a project installs systems that provide information that **support** the decision-making process, the project should score a 3.

**Safety** – AMATS guidelines are satisfactory for ranking ITS Projects.

**Bridge Preservation** – Only a few ITS projects, such as bridge scour detection, would be relevant for the criterion. Such a project should score a 5. Other ITS projects may develop information critical to determining when a structure needs preservation attention. The team recommends that projects that install systems that provide information **required** by the bridge preservation decision-making process should score a 5. If a project installs systems that provide information that **support** the decision-making process, the project should score a 3.

**Congestion** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Functional Class** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Design Standards** – The guidelines for Design Standards are not relevant for ITS projects, however this criterion can be adapted so projects can be ranked by ITS Standards. Projects will then be ranked based on whether or not a project satisfies such guidelines as; 1) are projects included in the National ITS Architecture and, 2) do projects conform to NTICP and other Standard Development Organization's (SDO) approved standards. Projects clearly meeting both requirements should score a 5. Projects meeting one, but not the other, should score a 3. If it is not clear if these requirements are met, the project should score a 0. If the project clearly meets neither requirement, the score should be –3.

**Benefit Cost** – The formula provided in Table SR-2 for deriving the benefit cost ratio of roadway projects would be misleading for ITS projects. Deriving a ratio for ITS projects will be difficult to create, but at a minimum should include; 1) Influence on traveler behavior, 2) Influence on safety, 3) Influence on mobility. The project team, as an initial formulation, recommends that the project be given a weight in each of these 3 categories as follows:

Influence on traveler behavior. The project will have a positive influence on:

1.0 – nearly all travelers who use it

0.6 – most of the travelers who use it

0.3 – some travelers who use it

Influence on safety. The project will provide:

1.0 – critical safety benefits

0.6 – significant safety benefits

0.3 – some safety benefits

Influence on mobility. The project will provide:

1.0 – significant mobility benefits

0.5 – some mobility benefits

These factors should then be added and multiplied by the AADT. The product should then be divided into the cost of the project, and the same ratios be used as are shown in table SR-2. In equation form, the formula would be:

Project cost (in thousands)/AADT x (driver behavior factor + safety factor + mobility factor)

While most projects will contribute to only one of these factors, this formulation recognizes the contributions made by projects that contribute to multiple objectives.

If this approach is selected, the team recommends that the MOA planners test this formulation on actual projects and adjust the factors accordingly.

**Quality of Life** – This criterion is very subjective. It will be difficult to determine how an individual ITS project affects the lives of the general public. For instance a Red Light Camera Enforcement Program, can be viewed by some as improving the safety of an intersection, while others may view it as an infringement of their personal rights. Even if a large percentage of the public believe an ITS project is beneficial, how is it's significance determined? More needs to be done to give this criterion a quantitative measurement.

**Economic Benefits** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Support of Project** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Design Issues/ Amenities** – If the ITS project addresses pedestrian, bicycle, or environmental needs, the project can be scored in the same manner as a roadway project. The team recommends that the criterion be broadened to include projects that provide the foundation for other projects, such as communication and network infrastructure and geographic information systems. Thus, if a project supplies the support need by other projects, it would be scored the same as if it were providing any other amenity.

**Recommended in Adopted Plans** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Multi-Modal/ Inter-Modal Characteristics** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Project Co-Funding or Leveraging Other Resources** - This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Connectivity** – For ITS projects, the team recommends that this criterion be viewed as Integration, and the following guidelines be adopted to judge how a project influences regional integration of systems and stakeholders.

5 – Provides significant integration between several systems identified in the Municipality's architecture

3 – Supports significant integration between several systems identified in the Municipality's architecture

1 – Provides limited integration between systems identified in the Municipality's architecture

0 – Isolated project that neither contributes to nor hinders integration.

-3 – Hinders integration

**Project Operations & Maintenance Commitment** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Project Readiness** – This criterion and its associated guidelines may be used as-is for ranking ITS projects.

**Additional Scoring and Process Recommendations**

The project team recommends that the AMATS consider adding a scoring criterion specifically for contribution to security. Projects that monitor or protect transportation assets should be scored highly. Projects that aid in response to security threats or breaches should be scored highly as well.

Initially, it may prove difficult for those who normally score projects to score ITS projects. The project team recommends that AMATS form an ITS technical advisory team to help scorers make decisions on ITS projects. Members of the technical advisory team should be familiar with different aspects of ITS systems. Ideally, members would represent the following disciplines:

- Information technology
- Communications
- Traffic engineering
- Transportation planning
- Maintenance

Additional disciplines should be added as deemed necessary. The technical advisory team should test the scoring system on actual projects and determine if any adjustments are needed. The team would then provide training and/or assistance to those who score all of the AMATS transportation projects.

## 6.4 INTEGRATION STRATEGY

An ITS produces the greatest benefits when individual systems or applications are integrated to form a single complete system. A complete system versus many isolated systems will maximize the potential, observed benefits in terms of safety, efficiency, and cost savings.

This section provides recommendations on how to integrate the individual ITS systems planned for deployment in the MOA. This section also defines the recommended steps and actions that foster integrated ITS in the MOA. The extent of integration defined is based on the required functionality of projects and systems, as defined in the ITS Concept of Operations. Lastly, this section identifies the issues that may affect ITS integration.

ITS integration can be viewed from two very distinct and interrelated perspectives: institutional and technological.

*Institutional Integration*

To achieve a regional ITS Architecture that is seamless from one agency's systems to another, institutional integration must occur. Institutional integration involves coordination and cooperation among the various departments within the MOA. Integration may occur if departments discuss and informally agree on the following issues:

- Benefits to be derived from the various systems
- Shared operational and maintenance responsibilities
- Functionality to be realized with system deployment
- Technologies and applicable standards to be implemented
- Operating procedures
- Opportunities for future system enhancements

*Technical Integration*

Technical integration is the process of developing, implementing, operating, and maintaining the systems that enable various users and other systems to collect, process, store, access, and use electronic information. Technical integration can also include integrating existing systems with other existing and planned systems. Achieving technical integration is complicated when various components are owned and operated by multiple agencies. It is further complicated when these systems are not designed to be "open," thereby making integration more difficult. Institutional structures and agreements that support systems integration must be in place in order to achieve technical integration.

Anchorage's migration towards an integrated system of systems and services will occur over time. Integration in Anchorage will result from an evolutionary process that considers both technical and institutional issues.

A concerted effort needs to be made to integrate ITS standards compliant systems in Anchorage. Being compliant with ITS standards helps ensure that one system can be fully integrated with another. Systems that are not standards compliant risk being used in an isolated or stove pipe manner, thus making it much more difficult to maintain a system, or replace it when it fails.

**Actions Fostering Integration**

To foster ITS integration in the MOA, it will be important to explore existing policies that relate to procuring, implementing, and operating ITS. Policies that can potentially foster the integration and interoperability of ITS are discussed below.

*Integrating ITS with Regional Plans*

The ITS Architecture and Standards Conformity Rule contains a provision that requires ITS-related decision making to be mainstreamed into the transportation planning process. The rationale for this requirement is to ensure that key ITS projects and initiatives are targeted early in the planning process, which in turn facilitates more effective integration. It is important that Anchorage develop and adopt policies that include ITS initiatives and conform to traditional transportation planning activities.

*Role of the Private Sector*

Private sector agencies may enhance the provision of ITS services. Public/private partnerships could significantly benefit the traveling public, the MOA, and the public sector, especially as it relates to tourism and telecommunications for the area. For example, an Internet website administered by the MOA could provide a variety of traveler-related information and links to other websites.

*Updating the Regional ITS Architecture*

Anchorage's ITS architecture will need to be updated periodically. Transportation challenges and user needs will change over time. As with current ITS deployments, future initiatives must focus on prevailing needs. As ITS is deployed over time in Anchorage, new opportunities for integration and functionality will be created.

Secondly, these updates provide an opportunity to ensure that emerging technological solutions are considered when identifying strategies to enhance travel safety and efficiency in Anchorage. This will help to ensure that the transportation systems in Anchorage continue to adequately meet travelers' needs. Based on these issues, the MOA needs to consider developing and adopting policies that require architecture and associated documentation to be updated when needed.

Before a new ITS project is funded, officials need to determine whether or not the project fits into the regional ITS Architecture. If all aspects of the project are completely covered then no action is needed and the project can be implemented. However, if some or all aspects are not accounted for in the Architecture, then a determination of whether or not the project actually satisfies a transportation need for the region. If so, then the Regional ITS Architecture should be updated to include the new project.

**Conceptual Integration**

As mentioned previously, ITS can not be integrated all at once. Various systems, both existing and new, can be integrated over time. The following section illustrates how various ITS components in Anchorage can be integrated over time to maximize the benefits of each system. The section discusses integration from the perspective of each program area, or function, that is enabled or enhanced by ITS deployment (e.g., snow and ice control). The functionality described in the following section is based on the individual project descriptions. This functionality is also predicated on the assumption that adequate and reliable communications will be provided.

***<u>NOTE:</u> Project sequencing is for conceptual integration only, and is not a ranking for program funding. Projects shown with an (*) have been programmed for funding at various levels in the AMATS Transportation Improvement Program (TIP.) Projects without an (*) have not yet been programmed for funding.**

*<u>Near-Term (0-3 Years)</u>*

In the next three years, ITS integration will be limited, in part because of limited ITS deployment. During this time, emphasis will be placed on deploying ITS elements that show the greatest potential to provide benefits, or that enable the implementation of other systems, thus forming the foundation for future ITS applications. The following are projects recommended for the near-term (for details of the individual projects, please refer to the Implementation Plan):

## Year Round Operations

- MOA Traffic Operations Center
- Needs Study for Transit Signal Priority
- Traffic Signal System Upgrade*

## Traveler Information

- 5-1-1 for Traveler Information (incorporate with Statewide 5-1-1 program)*

## Internal Operations

- Mobile Data Terminals*
- Tie-in to State's Condition Acquisition and Reporting System*
- Automatic Vehicle Location (AVL) Systems*
- Common Geographic Information System (GIS)*
- Shared Traveler Information and Traffic Database*
- Asset Management System*

## Incident/Emergency Management

- Hazardous Materials Tracking and Reporting*

*Medium Term (3-5 Years)*
It is within the five-year horizon that ITS deployments will begin to migrate into an integrated system. In part, this will be fostered by an increasing number of ITS deployments and by the development of certain enabling technologies that will provide the basis for multiple functions. The following are projects recommended for the medium-term (for details of the individual projects, please refer to the Implementation Plan):

## Year Round Operations

- Highway-Rail Intersection (HRI) Warning and Preemption Systems
- Smart Fare Box Systems*

## Internal Operations

- Material Usage Tracking System

## Incident/Emergency Management

- Closed Circuit Television (CCTV) and Digital Cameras

*Long Term (5-10 Years)*
It is within the ten-year horizon that ITS deployments will reach optimal levels of robustness in terms of both functionality and integration. The following are projects recommended for the long-term (for details of the individual projects, please refer to the Implementation Plan):

## Year Round Operations

- Transit Vehicle Management*

## 6.5 FUNDING NEEDS AND OPPORTUNITIES

The costs associated with designing, deploying and operating an ITS requires jurisdictions to be flexible in their use of federal, state and local revenues. Since the advent of the Intermodal Surface Transportation Efficiency Act of 1991, and its successor the Transportation Equity Act for the 21st Century, the federal government has provided states with unprecedented flexibility and discretion in how Federal Highway Trust Fund money can be used to enhance the surface transportation system. However, this distributed responsibility results in more demands from all sectors of the transportation community. Furthermore, budgets are becoming more and more limited as local revenues are restrained due to economic shortfalls or other factors. Because of this, ITS projects will encounter greater competition with other types of both traditional and non-traditional transportation projects.

### Funding Needs

This section describes the specific items that must be funded in order to successfully develop, implement, operate, and maintain ITS.

*Planning and Design*
As with most capital projects, ITS projects require planning and design work to determine what will be built, how it will be built, what level of mitigation (if any) is required. Special attention needs to be paid to ensure that enough funds are allocated for planning and design. This is crucial for adequately defining the project, so that cost estimates are reasonably accurate to budget for the construction, operations, and maintenance phases.

*Project Capital*
Capital expenditures for ITS will include, but are not limited to:

- Infrastructure, including roadside devices, communications media (e.g., fiber-optic cable), and the infrastructure required for the Integrated Transportation Operations and Communications Center.
- Software and other materials directly tied to the project implementation (e.g., marketing, training materials, etc.). These are generally one-time charges.

*Operations and Maintenance*
Adequate operations and maintenance funding is needed for effective system development. The level of sophisticated technical and software systems inherent in most ITS projects is substantial. The MOA needs to account for routine maintenance to ensure a full design lifecycle for each system. These investments need to be protected to avoid premature system(s) replacement.

One positive attribute of ITS standards adoption will be the development of more interoperable equipment and common system platforms, which will encourage more choices among vendors, thus helping to reduce replacement costs.

*Training*
As the MOA continues to deploy ITS, it will be increasingly important to ensure that the staff responsible for operating and maintaining these devices receive adequate training. Training will be required for all existing and new employees who will be responsible for operating and maintaining ITS. Providing proper and adequate training will help ensure that maximum benefits are derived and that system life is maximized.

**Funding Opportunities**

Opportunities to fund ITS design, implementation, and operation in Anchorage are identified below.

*Traditional Funding Mechanisms*

The following traditional funding mechanisms need to be examined before implementing ITS in Anchorage:

Federal – Transportation funding at the federal level, unlike most other federal programs, is authorized as a massive nation-wide package every six years. The current package, which was signed into law in 1998, is the "Transportation Equity Act for the 21st Century" (TEA-21). TEA-21 authorizes $217 million in funds for deploying multimodal transportation projects, including ITS, over a six-year period. This national package includes the following funding programs that may be tapped to support the ITS deployment:

- National Highway System (NHS)
- Surface Transportation Program (STP)
- Congestion Mitigation Air Quality (CMAQ)

This program funds improvements to rural and urban roadways that are part of the NHS. Under the NHS Designation ACT of 1995, over 160,995 miles of roads, which are most critical to interstate travel and national defense, those that connect with other transportation modes, and those essential for international trade are eligible for funding. Until 1991, the NHS funding program limited the period in which funding could be used for traffic management and control to two years. However, TEA-21 and its predecessor (ISTEA) eliminated this limitation. This is inclusive of start-up and operating costs. TEA-21 also includes "infrastructure-based intelligent transportation system capital improvements" as eligible projects for NHS funding. Additionally, as defined in 23 USC 103(b)(6), the term "operating costs for traffic monitoring, management, and control" now includes a much broader range of eligible expenditures, including the following:

- Labor costs
- Administrative costs
- Utilities and rent
- Other costs associated with the continuous operation of traffic control, such as integrated traffic control centers

Operating expenses are now defined to include hardware and software upgrades, as well as major systems maintenance activities (i.e., those undertaken to ensure peak performance). The replacement of defective or damaged computer components and other traffic management system hardware, including street-side hardware, is also eligible. However, restrictions still preclude the use of these funds for the routine maintenance of computer components and system hardware.

The **Surface Transportation Program (STP)** is a block-grant type program that can be used by state and local governments on any road (including NHS) that is functionally classified as a local or rural minor collector or higher. Infrastructure-based intelligent transportation system capital improvements are eligible for STP funding. STP funds can be used for capital and operating costs for traffic monitoring, management, and control facilities. However, as with NHS funding, they cannot be used for maintenance.

As part of the federal Clean Air Act, the **Congestion Mitigation and Air Quality Program (CMAQ)** channels air quality improvement resources to non-attainment areas for ozone, carbon monoxide, and particulate matter. Traffic and congestion management strategies are eligible for CMAQ funding, provided that the sponsor can demonstrate that these strategies will improve air quality.

Operating expenses for traffic monitoring, management, and controls are eligible for CMAQ funding under the following conditions:

- The project produces demonstrable air quality benefits
- Project expenses are incurred as the result of new or additional service levels
- Previous funding mechanisms, such as fees for services, are not replaced

In addition to the funds authorized specifically for ITS, ITS activities are eligible for funding from other programs. Both NHS and STP funds may be used for infrastructure-based ITS capital improvements and CMAQ funding may be used for implementing ITS strategies to improve traffic flow, which contributes to air quality improvement. Transit-related ITS projects are defined to be capital projects and are therefore eligible for funding under specific transit capital programs, such as the Urbanized Area Formula Grant Program and the formula grant program for non-urbanized areas. This is in addition to the STP, NHS and CMAQ programs.

ITS Earmarks – ITS earmarks will continue to be another source for ITS project funding. Although the predictability of this funding is somewhat limited, this source can provide supplemental resources for various ITS projects in the pipeline for implementation, or help start ITS projects that haven't faired well through other more established TEA-21 funding programs. After the State receives ITS earmark monies the MOA applies to the State to receive funding. The DOT ITS Policy Committee decides how the Earmark money is allocated.

*Innovative Funding Mechanisms and Special Programs*

"Innovative financing" refers to changing the traditional federal highway financing process from a single strategy of funding on a "grants reimbursement" basis, to a diversified approach that provides new options. Many of these ideas come from the most innovative financing concepts developed in the public and private sectors. A prime objective of innovative financing is to maximize the states' ability to leverage federal capital for needed investment in transportation systems and to foster the efficient use of funds.

Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA) – TEA-21 established a new innovative financing program called the "Transportation Infrastructure Finance and Innovation Act of 1998" (TIFIA). Eligibility for TIFIA extends to projects that are of critical national importance such as intermodal facilities, border crossing infrastructure, multi-state highway trade corridor expansion, and other investments that have regional and national benefits. The TIFIA credit program is designed to fill market gaps and leverage substantial private co-investment, thru supplemental and subordinate capital.

TIFIA permits USDOT to provide financial assistance to projects in the form of direct loans, loan guarantees, and lines of credit. Almost any project that costs over $100 million is eligible for this program. ITS projects are specifically included for costs of $30 million or more. Federal credit assistance may not exceed 33% of the total project cost.

Partnerships – A public/private partnership is a business relationship between the public and private sectors. Both entities, to a specific degree, share responsibilities and the costs, risks, and rewards associated with delivering goods and/or services. From a transportation standpoint, a public/private partnership is a form of service delivery with a collaborative approach based on reallocating traditional responsibilities, costs, risks, and rewards between the public agency and private entities.

## 6.6 PROCUREMENT STRATEGY

This section identifies the potential challenges associated with procuring the ITS software and hardware that will be required to realize the Municipality's ITS Vision. In addition, potential ITS procurement strategies that the MOA may apply to most effectively achieve the ITS Vision are also identified.

### Procurement Challenges

This section is meant to serve as a reminder to those who have used non-traditional methods to procure technologies in the past. It documents some of these options for those who have not been involved with ITS or technology procurement.

It can be very challenging for the MOA to procure ITS software and hardware. Methods (such as low-bid) that have traditionally been employed to procure transportation infrastructure (such as bridges and roadways) are not generally applicable to ITS hardware or software due of the dynamic nature of ITS project scopes. Furthermore, because of this dynamism, ITS projects often require more flexibility in the procurement process than other more traditional transportation improvement projects. This flexibility is necessary for responding to changes in the environment, which frequently come with ITS projects. For example, one of the most common reasons for many failed ITS software development projects is that the original project definition changes due to advances in technology. Another reason is users often want to seek new or refined changes to system requirements. With this in mind, it is very important that the MOA allow for flexibility in procuring ITS.

The MOA also has access to the State's software task order contract. This contract allows an agency to work with a software team that was chosen on the basis of qualifications. Generally, tasks are written to determine a detailed scope, and cost estimates are written to determine the effort.

Traditional construction procurement methods are useful for projects where construction processes are standardized and fairly predictable, and cost estimates for equipment and services are available and reliable. This is not the common scenario for ITS projects. In simple terms, for traditional construction projects, its proponents generally know what they are facing, and risks for scope changes are fairly low. Construction procurements require low-bid (rather than qualifications-based) selections, have difficult change-order processes, and include liability and completion clauses that do not apply well to the dynamic nature of software development. These aspects of construction procurements, among others, resulted in the issuance of a USDOT memorandum to all FHWA Division Administrators noting that ITS software development should never be procured as "low bid."

### Effective ITS Procurement Methods

Although there are no current procurement processes designed specifically for ITS, existing methods can be applied to better respond to ITS project needs. This section describes why ITS projects can have uncertain outcomes, and describes the available procurement methods that can be used given various levels of uncertainty.

ITS is different from traditional road and bridge projects. The key differences relate to the following factors:

*Maturity of the Technology*
ITS technologies are relatively new and rapidly changing. In contrast, roads and bridges have been constructed for many years and have a long history of lessons learned.

*Design Criteria and Standards*
Because ITS is new and dynamic, few design or process criteria and standards exist to guide implementation. In contrast, significant design criteria and standards information is available for traditional transportation capital projects.

*The Ability to Innovate*
Since the technology industry is constantly introducing new systems, software solutions, and systems concepts, ITS sparks our imaginations and spurs innovation.

### Potential ITS Procurement Strategies

The U.S. Codes outline how traditional road and bridge projects must be procured. A condensed and simplified description of available procurement methods follows. Key concepts in the law that are pertinent to ITS are:

*Engineering and Design Services*

No licenses are required for software and systems engineering. Therefore, Engineering and Design Services is not the required method for procuring ITS, which relies primarily on those services. However, Engineering and Design Services procurement methods are often appropriate.

*Construction*

Many ITS projects should not be defined as construction, although some (e.g., those that share the same certainty in installation as road and bridge projects, such as off-the-shelf software) can be defined as construction. Today, most field device projects are successfully procured as construction projects. The exception is when an experimental device, communications, or other uncertainty is introduced. If this is the case, consideration needs to be given to procuring the uncertain elements separately. It is also appropriate to contract site preparation work (for example, trenching for conduits and installing equipment cabinet bases) as construction, and procure the equipment and software necessary using a procurement process that will allow the MOA to select a vendor using a variety of criteria (not cost alone).

*Common Rule*

The U.S. Code allows agencies (other than federal agencies) to procure projects that are NOT defined as construction (per the U.S. code), using their own laws and rules. This is referred to as the Common Rule. In addition, if no federal funds are included in the project, agencies can use their own procurement methods. Most agencies have adopted some form of the American Bar Association's Model Procurement Code. There are three common categories under that code: Construction, Goods, and Services.

### Additional Tools

For all types of procurements (except construction procurements), two tools are available that can be very useful in managing dynamic, quick turn-around, uncertain ITS projects that require many decisions.

*Indefinite Quantity Contracts*

Indefinite Quantity Contracts (IQCs) are used to procure both goods and services. They help reduce the length of time between advertising and Notice to Proceed, by pre-qualifying and signing contracts with one or more contractors to supply required goods or services with no guaranteed minimum. Because the process of advertising, awarding and contracting is already complete, when a service or good is required it can be procured expeditiously by simply defining the service or good and agreeing on the price.

*Task Order Methods*

Task Order contracts are used when the project goal can be reasonably well defined, but the processes and methods used to accomplish the goal cannot be clearly defined initially. For example, a project can be procured to implement a freeway management system on a specific portion of freeway, and include central control software. The project can be divided into small tasks to help reduce uncertainty, and to better manage overall costs.

### Policy Considerations

Because most agencies do not have appropriate policies and standards to guide ITS procurement, they often find that software deliveries will fail to meet functional requirements, be over budget, and/or be delivered late. As such, software procurement policies should rely on good management practices.

Alaska procurement laws and Municipality procurement rules appear sufficiently flexible to deploy new approaches. Federal procurement requirements, applicable when federal-aid highway funds are used to procure future ITS projects, may be more restrictive. Generally, the Federal Highway Administration has shown growing latitude in this area and has sponsored national courses addressing the unique aspects of ITS procurement.

## 6.7 SUMMARY

ITS shows significant potential to improve safety and efficiency of travel in the MOA. In part, the need for ITS in the MOA revolves around improving internal operations and management, emergency management, traffic operations, and year round operation. This Implementation Plan has outlined a set of projects identified by various stakeholders in the MOA to enhance traffic operations. Further, it has focused on identifying potential strategies and policies that will foster integration of ITS services in the MOA.

# APPENDIX A: REFERENCES

Department of Transportation's Intelligent Transportation Systems (ITS) Projects Book. Compiled by: U.S. Department of Transportation - Intelligent Transportation Systems (ITS) Joint Program Office, Federal Highway Administration - Operations Core Business Unit, Federal Transit Administration - Office of Mobility Innovation, National Highway Traffic Safety Administration - Office of Associate Administrator for Research and Development, Federal Motor Carrier Safety Administration - Office of Research and Technology

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