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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.

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