Alaska Iways Architecture Update

Task 2 (Part 3 of 6): Chapter 3: ITS Long-Range Vision

FINAL

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3.1 Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF) is continually looking at ways to improve the efficiency, safety, and reliability of Alaska's transportation system. This effort includes the application of advanced communications, control, and information processing technologies including computer hardware and software at locations throughout the state. When used together, technologies like these form what is commonly referred to as an Intelligent Transportation System (ITS). To ensure that these relatively expensive technologies are implemented in an effective, coordinated, and cost-effective fashion the ADOT&PF developed the Alaska Statewide ITS or Iways Architecture. Iways is the state adopted label for ITS that stands for intelligence, integration, internet and information (the "I") for air, sea, and roadways (the "ways").

The Alaska Iways Architecture comprises the following six documents or chapters.

- Chapter 1: User Needs
- Chapter 2: User Services
- Chapter 3: ITS Long-Range Vision
- Chapter 4: Operational Concept
- Chapter 5: Physical ITS Architecture
- Chapter 6: Implementation Plan

Each chapter listed above correlates to one of the six main phases that were undertaken to develop Alaska's Iways Architecture. The process to develop Alaska's Iways Architecture began with the identification of transportation user needs and concluded with the Implementation Plan.

3.1.1 Purpose

The previous two chapters provided an understanding of Alaska's transportation user needs and the National ITS Architecture User Services that satisfy these needs. With this understanding Alaska's ITS Long-Range Vision will unfold, identifying and documenting the full set of desired and needed ITS elements while emphasizing that the complete set of ITS elements will not be in place for many years. The ITS Long-Range Vision is based on Alaska's transportation user needs which were specifically used to define goals for the ITS program. These goals were grouped into specific program areas in which ITS related technologies can provide significant benefit. Hypothetical but realistic narratives of how users may encounter and benefit from these technologies are provided at the end of this chapter to help users envision how ITS related technologies come together to address transportation user needs.

3.2 Project Goals

ADOT&PF's Iways Program is based on Alaska's key transportation needs. These needs led to the creation of the four program goals shown within Figure 3-1 and described below.

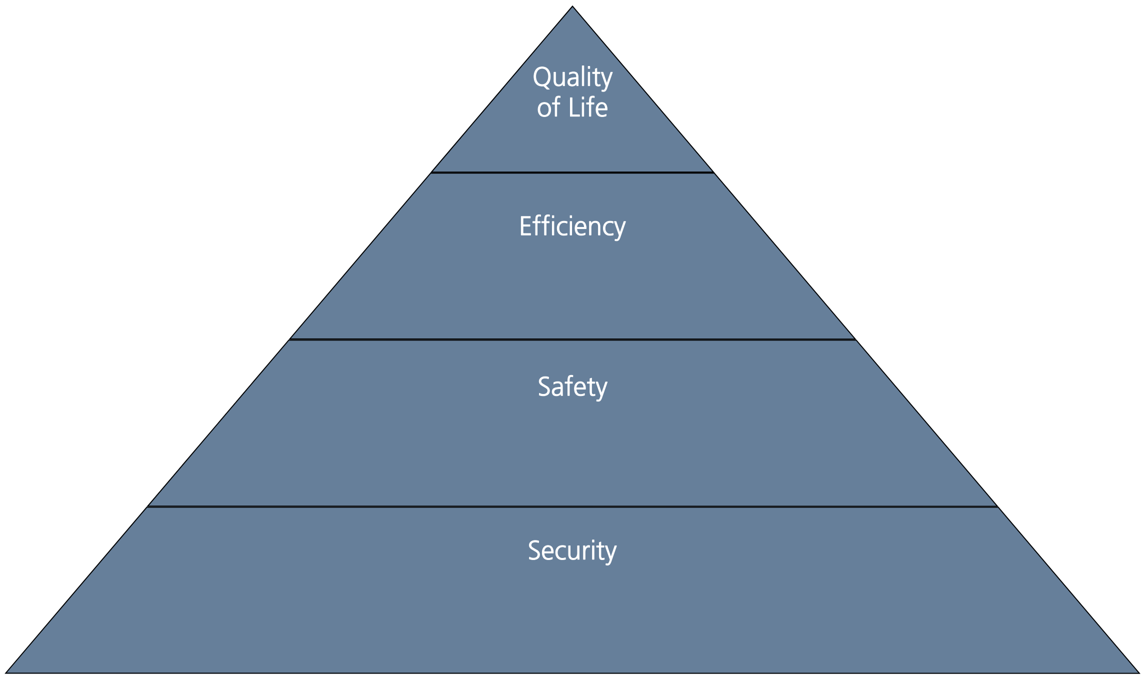

Figure 3-1:
Alaska Iways Program Goals

3.2.1 Enhance Quality of Life

Travel is a key component of daily life, commerce, and tourism in Alaska. This goal attempts to improve and enhance travel between and on all modes while minimizing the adverse impacts and effects of transportation on the natural environment.

3.2.2 Improve Efficiency of ADOT&PF Operations

ADOT&PF is responsible for maintaining and operating a multi-modal transportation network that covers a vast geographic area. The size of Alaska is only one of the challenges ADOT&PF faces. Other challenges, including limited financial and physical resources and harsh climate make it difficult to operate and maintain portions of the State's transportation network. Therefore, this goal seeks to install systems that promote efficient delivery of services to improve use of existing resources. This helps ADOT&PF, and its partner agencies, maximize their return on investment and enables them to operate Alaska's transportation network as efficiently as possible.

3.2.3 Improve Traveler and Staff Safety

Safety is the foundation of ADOT&PF's mission, and ensuring traveler and staff safety is the principal purpose of Alaska's Iways Program. An important aspect of this goal is emergency and incident response and management.

3.2.4 Secure Transportation Assets

Since the events of September 11th, 2001, governments and agencies within the U.S. have emphasized the security and safety of people and infrastructure. One aspect of this movement involves securing transportation assets in an effort to reduce exposure to acts of terror and other incidents that may damage or otherwise affect the operational status of critical infrastructure.

3.3 Program Areas

To meet the goals of Alaska's Iways Program, ADOT&PF and its partner agencies will deploy ITS infrastructure throughout the State. This infrastructure will gather data, process it to create useful information, and disseminate it to staff and travelers on all modes. The ITS strategy consists of the seven key program areas shown in Figure 3-2 and described below.

3.3.1 Snow and Ice Control

ADOT&PF and its partner transportation agencies apply a significant amount of financial resources and materials to remove snow and ice from Alaska's roadways. ITS systems can increase the efficiency of snow and ice operations, helping to improve driving conditions.

The snow and ice control program area addresses the capability to keep the roadway system in operation through plowing and repairs to damaged infrastructure. Snow and ice control includes an integrated approach to remotely sensing weather and roadway conditions using Closed Circuit Television (CCTV) cameras. Snow and ice control also includes collecting and integrating road condition reports from travelers, maintenance crews and other human sources. Lastly, it includes ADOT&PF-deployed point-source weather data (e.g., roadway weather information system) and data from military bases, FAA airport sites, and the National Weather Service. These weather information sources all contribute to the public's awareness of current regional weather and serve as input for developing short- and long-term weather forecasts.

There are some explicit concerns about the personal safety of the snow and ice removal crews in severe weather or weather related conditions (e.g., whiteouts, avalanches, landslides, drifts). On high-risk roadways, ADOT&PF has embedded sensors in the pavement to safely guide maintenance vehicles in these hazardous conditions. These sensors also monitor the amount of ice-fighting chemical remaining on the road surface, which reduces the use of excess chemicals and addresses concerns about the potential environmental impacts of roadway chemicals.

Because of these concerns, the prediction or earliest detection of snow and ice conditions is most important. A well-planned, efficient response that includes the use of "smart vehicles" that have location tracking and reporting capability is crucial. Finally, it is important to either automate or enhance the control of the mix and dispersal of sand and chemicals. This will effectively restore the roadway to service, and minimize environmental impacts and damage to infrastructure.

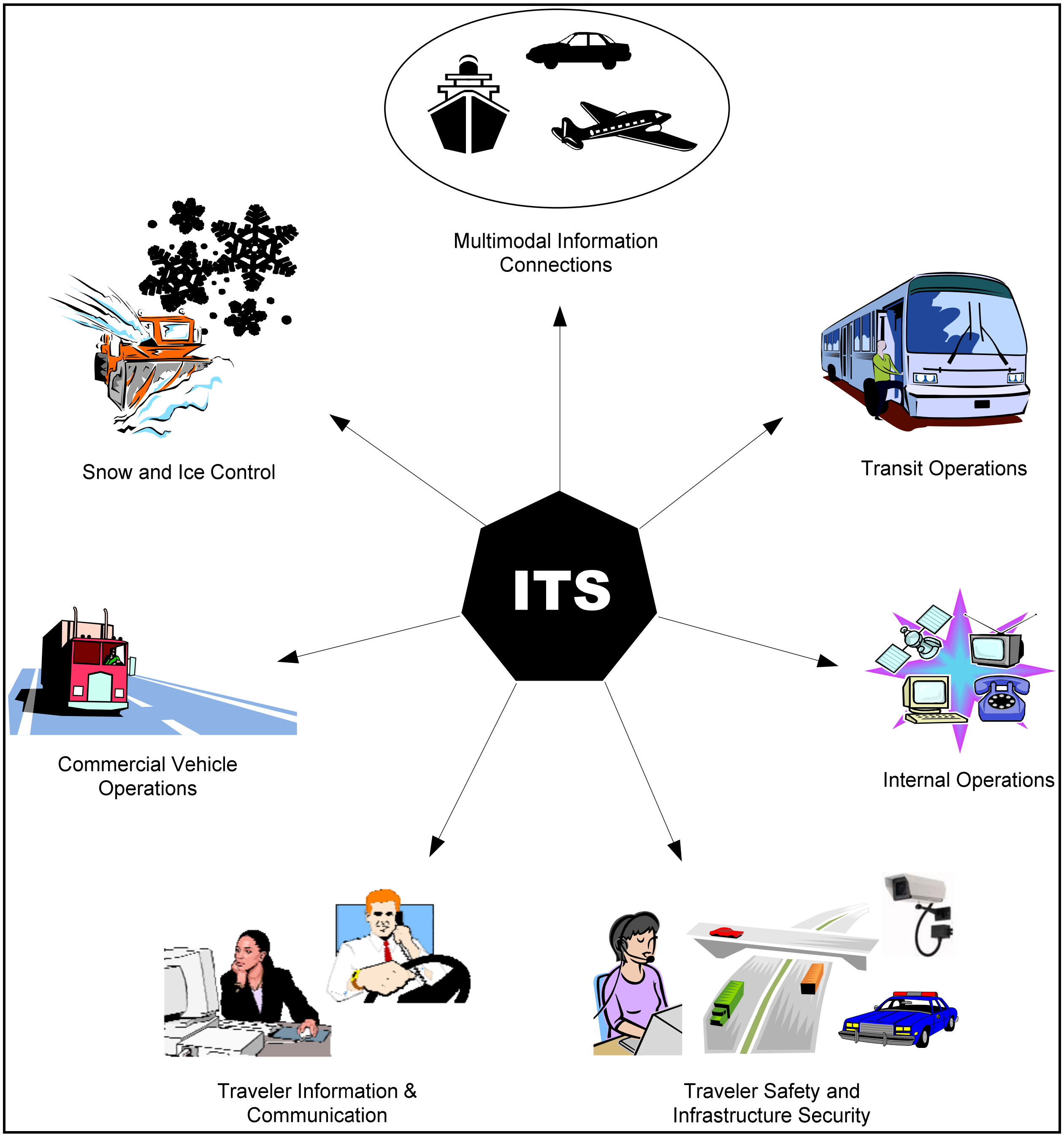

Figure 3-2:
Alaska's ITS Program Areas

Information dissemination could include making travel demand management advisories to travelers so they can choose to avoid weather-related problems or restricted travel areas.

Key components of the planned snow and ice control infrastructure are described below.

Weather Stations and Pavement Sensors

Weather stations installed along the roadside measure weather characteristics such as ambient air temperature, wind speed, and relative humidity. Sensors installed within and beneath the pavement measure pavement and subsurface temperature and help monitor the amount of ice-fighting chemicals remaining on the road surface. Pavement sensors will be integrated with anti-icing systems installed along a roadway to apply chemicals to the roadway only when conditions warrant.

Smart Snow Plows

Smart snow plows are specially equipped to measure road surface friction. Based on the friction information and data collected from weather sensors and on-board geographic location information systems (from the satellite-based location systems), they calibrate the proper amount of chemical and sand to apply. When less sand is applied to the road, less is dispersed in the air as particulate pollution, and less sand and chemicals are fed into streams via surface runoff. Smart snow plows are equipped with satellite-based vehicle location systems and on-board computers that allow real-time tracking of snow and ice operations. Roadways in critical mountain pass areas are equipped with magnets that smart snow plows can sense, helping improve safety by helping operators keep snow plows on the roadway under the most adverse weather and roadway conditions.

Weather Prediction

Information gathered from weather sensors, and provided by, the national weather service and military bases provide the basis for improved, micro-scale (small location–specific) weather forecasts. This helps in planning snow and ice control operations. Rather than reacting to snow and road conditions after the weather event has occurred, maintenance decision-makers can plan and target their operations before the event occurs.

Weather and Road Condition Information Dissemination

Smart snow plow data and the information collected from weather sensors contribute to the information that meteorologists and automated systems use to provide reliable, up-to-date road condition information and weather forecasts.

3.3.2 Multi-Modal Information Connections

Alaska's transportation system consists of air, water, and surface transportation modes, each of which is critical to ensure access to cities and villages across the State. Connecting these modes through shared information improves the satisfaction of residents, tourists, and commercial vehicle operators.

Within this program area, the operational and functional challenges and issues focus on integrating the "connectivity" of the several modes, so travelers (e.g., residents, commuters, tourists, and commercial vehicle operators) can inquire about choices, plan trips, and execute a seamless and possibly multi-modal journey. These service goals apply to travelers arriving from outside Alaska, traveling within Alaska, and traveling within the several municipalities served by local or regional transit operations.

Alaska's multi-modal transportation system is an integrated system of air, water, and surface transportation modes that are critical for ensuring vital access throughout the state. Each mode is a critical component of the ability to move people, goods and services throughout Alaska's vast area. Of specific interest are the integrated connectivity of the roadway system with the Alaska Marine Highway System, the Alaska Railroad, commercial air carriers and tourism sight-seeing flight services, and fixed-route or on-demand transit providers in metropolitan or tourism areas. Many of these transportation services already provide or are capable of providing on-line Internet services and reservations, toll-free 1-800 access or the new "511" services for recorded traffic and roadway condition information or human operator inquiries and personalized trip planning. There is a need for seamless integration across travel modes, to resolve traveler uncertainty and provide a safe, efficient and comfortable travel experience.

The key components of the multi-modal information connection systems include multi-modal, real-time schedule and reservation information and route-specific, real-time road condition and tourist information. Real-time road condition and tourist dissemination could include making travel demand management suggestions to travelers, to encourage the use of other travel modes if they want to choose to avoid roadway condition or traffic problems.

This program area will build upon the initial system planning and schedule coordination at inter-modal transfer points, on current initiatives for on-line reservations for the Alaska Marine Highway System (AMHS), Alaska Railroad Corporation (ARRC), commercial airlines and on bus reservation and schedule information. This can be provided as static information or as an interactive dialogue with travelers when planning trips, or while en-route. Although this information can be provided via the Internet, at kiosks on ferries and trains or via interactive touch screens at rest stops, tourism welcome centers and truck stops—this does not include the full spectrum of other traveler information services, which is covered in the following section. The baseline information is derived from the static, pre-planned coordination of several modes. Enhancements are needed to provide for real-time status information and to adapt schedules and services to specific situations, in order to avoid stranded travelers or missed connections when scheduled service performance does not go as planned.

This planning, en-route and system status information can help travelers plan connections between modes in real-time, before or during a trip. With this information, they can learn of potential schedule delays and provider adaptations and responses in service so that they can make alternative connection plans if necessary. The information collected and disseminated to travelers may include:

- Road conditions
- Weight and height restrictions
- Closures and surface conditions
- Route-specific weather conditions and forecasts
- Incident or congestion information
- Localized information on tourism and attractions
- General information on local services such as restaurants, hotels, and service stations.

This information can be supplied via the Internet, transmitted to in-vehicle devices, to pagers and cellular telephones or (in the not-too-distant future) to heads-up displays in vehicles.

The key components of the multi-modal information connection program area are described below.

Multi-modal, Real-time Schedule and Reservation Information

Building on the initiative to provide on-line reservations for the Alaska Marine Highways, transportation operators can provide real-time ferry, airline, train, and bus reservation and schedule information to improve the connectivity of the modes. Transportation personnel and information systems can supply this information to the public via the Internet, kiosks on ferries and trains, or interactive touch screens at rest stops, tourism welcome centers and truck stops. A real-time schedule and reservation system will enable travelers to plan their connections between modes before or during a trip. Additionally, travelers will be able to learn of potential schedule delays and make alternative connection plans if needed.

Route-specific, Real-time Road Condition and Tourist Information

Providing en-route and pre-trip traveler information will enhance a traveler's trip and make it more comfortable. This information can include:

- Road conditions such as weight and height limits, closures and surface conditions
- Real-time, route-specific weather conditions and forecasts
- Incident (natural and man-made) or congestion information
- Localized information on tourism and attractions
- Special events
- Construction activities (e.g., closures, delays, detours, etc.)
- Information on local services such as restaurants, hotels, and service stations

Transportation agencies can provide this information via the Internet, to in-vehicle devices, to pagers and cellular phones, or (in the not-too-distant future) heads-up displays in vehicles.

3.3.3 Traveler Information and Communication

This program area addresses improvements in communicating data and information both to and from travelers that are en-route. This is very important for the overall safety and efficiency of the roadway system, especially in remote areas and areas that are under adverse weather conditions. The detection of and efficient response to emergencies, crashes and other incidents is a key objective. ADOT&PF supports three categories of technology to provide these services.

Three general operational function areas are needed to support traveler communication services: surveillance of the roadway network and connecting transportation systems, dissemination of collected information to travelers while en-route, and the ability for travelers to communicate their locations when assistance is needed. The en-route dissemination of information to drivers could include travel demand management suggestions that allow them to choose to avoid roadway closures or restrictions, weather problems, or traffic congestion areas.

The status information to be communicated to travelers will be collected from operations in other program areas (e.g., snow and ice control, multi-modal coordination, internal and commercial vehicle operations). The roadway system will be monitored with CCTV cameras to detect and confirm congestion, incidents, weather and road surface conditions. Electronic sensors will be used for vehicle detection to monitor traffic volumes and congestion. A variety of weather sensors, landslide sensors and bridge scour sensors will also be used to monitor and help predict events that may impact the transportation network.

This localized, regional and statewide information will be integrated and then disseminated to travelers en-route, by using route-specific means like roadway variable message signs or highway advisory radio as well as through the broadcast radio or TV media.

When travelers need assistance, they will call "911", use smart call boxes or kiosks located along the roadside, or use mayday systems in their vehicles. Many of these systems can automatically send information on location and gather road and traffic condition information. Eventually, many vehicles will be equipped with automated, in-vehicle, emergency alert mayday systems installed by manufacturers or added as an after-market item. At the touch of a button or through speech recognition, these devices will automatically detect and communicate an alert to a regional public service answering point or a subscription service provider. The use of any of these traveler system options can initiate the appropriate emergency or non-emergency response in case of crash incidents, breakdowns, or other situations.

These systems, and improved connections to Alaska State Troopers (AST), other police, trauma centers, hospitals, and other emergency responders will be used to enhance support for emergency incident response and management. This will improve information exchange, response to emergencies and incidents, help manage traffic, clear incidents and restore the roadways to service as quickly as possible.

These services require wide-area (rural) telecommunications to support them. In many parts of Alaska, needed telecommunications are limited or non-existent. It is envisioned that, in partnership with telecommunications providers, enhancements and additions to the communications infrastructure will be developed concurrently with the deployment of ITS subsystems.

3.3.4 Internal Operations

ADOT&PF's internal operations include the day-to-day operation, traffic management and control of Alaska's highways and roadways. They also include system maintenance, including pavement, snow and ice, and deployed infrastructure and ITS equipment. ADOT&PF will use ITS technology to supplement limited manpower and achieve additional benefits using the limited resources they have.

Decision support systems will be used for snow and ice controls to allow staff to treat roadways more quickly and efficiently. As mentioned earlier, these systems ensure that the optimal mix of chemical and/or sand is applied to the road surface. This enhances the efficiency of operations and management in applying sand and chemicals as well as in the subsequent removal of sand from roadways.

Decision support will also be used for detecting and monitoring natural environmental effects on transportation infrastructure, including bridge scour, landslides and floods. Sensors will be deployed in locations prone to natural environmental effects, to provide critical data in advance of or during events. This will enable appropriate responses and help avoid major damage to transportation infrastructure and operations.

Automated Maintenance Management Systems will be used to track equipment, vehicles, staff and field assets to help better manage these resources and allow efficient deployment.

The coordination and integration of multi-agency crash data reporting systems will be improved. Local and regional crash data are currently gathered by responding police authorities. These data consist of information that is non-electronic or are entered and stored in systems that are incompatible, thus requiring manual extraction and input to the statewide system. Automating and integrating crash reports will allow quicker compilation and analysis of data, allowing ADOT&PF to more quickly identify and respond to planning and design needs at high-crash locations.

This focus on integrating and synthesizing data and information includes sources from ADOT&PF and partner agencies. A regional and statewide archival data system will integrate formerly stove-piped data from within ADOT&PF and its partner agencies. These data are currently created, used and stored in a variety of heterogeneous systems. An integrated archive of merged data will allow improved near real-time and post-analyses of operations, and will result in more efficient operations.

Systems that support this commitment are described below.

Decision Support Systems for Snow and Ice Control

Decision support systems, including on-board, pavement and environmental sensors, Automatic Vehicle Location (AVL) systems and software, and mobile data terminals allow staff to allocate snow removal resources more effectively and treat roadways with sand or anti-icing compounds more quickly and efficiently. These systems ensure that only the necessary amount of chemicals and/or sand is applied to the roadway, and help speed sand removal by monitoring conditions to help determine the best time to remove it. Reduced sand application and speedier removal can reduce the amount of particulates released into the air.

Decision Support Systems to Monitor Transportation Infrastructure

These decision support systems include those used for detecting bridge scour, landslides, avalanches and floods. Sensors in locations prone to natural environmental effects can provide critical information in advance of an event. ADOT&PF can respond before natural events cause major damage to transportation features and systems, potentially reducing their adverse effects. At the very least, the correct response to natural events will be faster than if systems were not in place.

Maintenance Management Systems

Maintenance Management Systems (MMS) track equipment, vehicles, staff and field assets to help agency personnel manage and efficiently deploy these resources. An MMS also keeps mileposts data and route coordinates, storing this information using a GIS database.

Improved Crash Data Reporting Systems

Responding police authorities currently gather crash data that are either non-electronic or reside within systems that are incompatible with the statewide crash data system. Therefore, agency personnel must re-enter the data into the statewide system. Automating and integrating crash reports will allow quicker compilation and analysis of data. This will help ADOT&PF to quickly target high-crash locations and make plans to improve the safety of travelers in those locations.

Synthesized Data and Information Systems

Data and information systems collect data from across ADOT&PF and partner agencies. An archival data system will merge data from various agency systems into a consolidated repository. Operators and analysts will be able to more efficiently use these data to improve operations.

Real-time Automated Traffic Data Collection

Automated Traffic Recorders (ATR) deployed on select roadways in Alaska automatically collect traffic volumes and at some sites, vehicle classifications and speed. These data reside with the individual recording unit until they are routinely downloaded (usually on a weekly basis) via telemetry. If the data from ATR are made available in real-time and cameras are added, traffic operation managers could use the data to quickly implement control strategies based on real-time problems and conditions. This reduces the extent of congestion and helps minimize its adverse effects.

Centralized Traffic Signal System Control

In general, traffic signals in operation throughout the State are stand alone systems (either isolated intersections or part of a closed loop signal system) that operate independently of other systems. Those traffic signals that are part of a closed loop system can be remotely monitored and operated from a workstation located within a center or other similar facility. Operators can change traffic signal timing patterns when conditions warrant or simply monitor traffic signal operations to determine faults and identify malfunctioning equipment quickly and easily. This reduces the effects that these events have on traffic flow and reduces motorist confusion when traffic signals are not operating properly. Centralized traffic signal systems also reduce the time and effort currently needed to routinely inspect traffic signals via field visits.

ADOT&PF envisions a larger percentage of the signals operating under some form of centralized control. In addition, ADOT&PF envisions traffic signal systems that share information and data among each other and with other transportation systems. Data from traffic signal systems can augment data collected by traffic data and other monitoring systems. Traffic signal systems can also interact with transit management systems to provide improved transit priority and to exchange data with transit systems. Traffic signal systems can also integrate equipment such as Dynamic Message Signs (DMS) and Closed Circuit Television (CCTV) cameras to become arterial or regional traffic management systems. Agencies often house integrated or regional traffic management systems within a regional or even statewide traffic or transportation management center.

3.3.5 Commercial Vehicle Operations

Commercial Vehicle Operations (CVO) evolve to be paperless as ADOT&PF and Alaska State Troopers (AST) deploy roadside and on-board vehicle subsystems. Initially, the continental and international ports of entry and en-route weigh stations will shift from paper-based to instrumentation that queries and weighs commercial traffic at highway speeds. ADOT&PF staff will use handheld computing equipment to perform more focused and efficient roadside safety inspections, and gather broader historical and more accurate safety information on commercial vehicles and their operators.

Specific CVO functions that will be implemented include; credentials administration, electronic screening (clearance), and safety information exchange.

The transition of credentialing from paper to electronic form will enable a data interface between ADOT&PF, the Alaska DMV, and CVO. This will allow near real-time access to available information on carriers, drivers, and specific vehicles. The participating CVO carriers will electronically submit applications for registration renewal, and oversize and overweight permits to the State through WEBCAT. WEBCAT is a Web-Based Electronic Registration System for Carrier Automated Transaction (e.g., Web-CAT or WEBCAT) used by participating motor carriers to complete their credentialing and use permit transactions electronically.

Electronic screening and clearance enhances roadside operations at ports of entry by supporting the efficient examination of safety and credentials information based on electronic identifiers read from vehicles' on-board transponders. This is correlated with data and information from the registration and credentialing process, and helps make a rapid determination of whether safety inspection or re-verification of credentials is required.

The exchange of current, timely CVO safety information between countries and law enforcement agencies provides a more focused and efficient safety enforcement effort, benefiting all travelers. This automated system will enable more efficient and effective enforcement inspections and limit delays to safe carrier/operators. For credentialing, through WEBCAT, the participating CVO carriers will be able to submit applications to renew registrations and process oversize and overweight permits electronically to the state.

3.3.6 Traveler Safety and Infrastructure Security

Since the events of September 11th, 2001 governments and agencies within the U.S. have emphasized securing the safety of people and infrastructure. ADOT&PF is committed to these efforts and views technology as one method that can improve traveler safety and infrastructure security.

3.3.7 Transit Operations

Promoting the use of transit is key to reducing congestion and its impacts in Alaska urban areas. Transit management agencies in Alaska are primarily interested in ITS to improve their existing operations. By improving operations, transit management agencies hope to improve the efficiency of their operation, strengthen the public's perception of transit and increase ridership.

Transit Signal Priority Systems

Transit operations will become more reliable and efficient through the implementation of transit signal priority equipment installed on traffic signals and transit vehicles. Transit traffic signal priority systems will reduce transit delay by giving transit vehicles priority when they approach a signalized intersection. This reduces the total amount of time needed to travel existing routes which contributes to improved transit efficiency and reduces travel time. Reducing transit delay will also improve day-to-day transit operations, reducing vehicle wear and tear and fuel consumption.

Real-time Transit Vehicle Arrival Information and Notification

Public perception and use of transit will improve as transit agencies implement systems that estimate transit vehicle arrival times and convey this information to transit riders. DMS and announcement systems will provide real-time arrival information to users waiting for transit vehicles at bus stops while web and telephone information systems will provide this information to users who have yet to start their trip. Real-time transit vehicle arrival information will provide both en-route and pre-trip users the flexibility to adjust their plans and make more informed decisions based on real-time information.

3.4 The Vision

ADOT&PF will develop a comprehensive and coordinated approach to managing the statewide transportation network. The Department will emphasize the effective management of various deployed systems and equipment to address safety, congestion, and mobility challenges. The following narrative illustrates how these systems are intended to interact with staff and travelers.

In the future, activating the statewide ITS infrastructure could all start with the click of a mouse.

> *Steve, Susan, and Mike are old high school friends planning a trip together through Denali early in the spring season to avoid the crowds and take advantage of early season rates. Steve lives in Seattle, Susan in Juneau, and Mike in Fairbanks. All three agree to meet in Denali.*
>
> *Steve uses the Internet to make his travel arrangements. By visiting a single web site, he is able to create a complete multi-modal itinerary from Seattle to Denali. The website includes schedule, reservation and connection information for airlines serving the Seattle-Alaska market, the Alaska Marine Highway System and the Alaska Railroad, rental car information, and information on taxi and bus connections between all modes. Steve has selected an itinerary that includes a flight from Seattle to Anchorage and a rail leg from the new train station at the airport to Denali, where the group will meet. Steve found the hotel the group selected via the same website.*
>
> *Meanwhile in Juneau, Susan is looking forward to the opportunity to test out her new sports utility vehicle on the group's trip. Using her handheld personal digital assistant, she visited the same website that Steve used and selected a trip that includes a leg on the Alaska Marine Highway system from Juneau to Seward. From Seward, Susan will drive to the hotel in Denali. Susan also booked her return trip on the Alaska Marine Highway System. She plans to drive through Canada to Skagway on the return home and ferry the final leg home to Juneau.*
>
> *Steve just landed in Anchorage. He accesses real-time schedule information for the rail leg of his trip via a kiosk located at the airport. A landslide on the rail line is imminent (as detected by the detection system installed along the line by the rail system) and landslide mitigation efforts have caused delays on the system for the day. Rail system staff have entered the train*

delay information into their automated train dispatch system. The electronic information is directly pulled from the dispatch system and entered in the real-time schedule systems, which Steve accesses at the airport kiosk. His train to Denali is delayed by one hour. With that information in hand, Steve changes his train reservation to take the train from the downtown station, hops a bus to a restaurant in Anchorage, and enjoys a lunch before getting on his train. He found the information on the bus route and schedule, as well as the restaurant information at the same airport kiosk he used to change his train reservation.

Susan enjoyed her ferry trip to Seward and is on the road to Denali. She notices that her engine temperature gauge is in the red zone and pulls over at the nearest roadside emergency call box. She knew that these call boxes would be located on her route, based on the information on the Internet and occasional roadside signing. She also remembers information about the new call boxes being reported on the local news in Juneau. She lifts the receiver, and information on her location is sent automatically to the Alaska State Trooper dispatch center. She speaks with a dispatcher, who sends a tow truck to her location.

Susan is towed back to Seward where the mechanic informs her that the water pump has gone out. The part must be ordered from Anchorage, and Susan must stay the night. She uses her personal digital assistant to access ADOT&PF's 511 Travel-in-the-know website (511.alaska.gov). From here she clicks on the Alaska Visitor Centers website (www.travelalaska.com), which includes links to Yellow Pages type information on hotels, campgrounds and restaurants and other visitor information including local events. She is able to make an on-line reservation at a nearby hotel, and decides to enjoy a local art show that evening.

Mike just left home in Fairbanks. The weather the night before had been cold and rainy. In the morning the weather cleared and the temperatures dropped below freezing, leaving patches of ice on Mike's lawn. Last night, ADOT&PF's road weather system provided road treatment crews with early information on potential icing – and crews were able to treat the critical bridge decks before any ice formed. The equipment used to treat the roads included on-board electronics that calibrate the application of the right amount of chemical and sand to meet the road surface condition needs. Automatic vehicle location systems mounted on the equipment also helped dispatchers manage the deployment effectively.

Mike is pleased to see that the principal roads are clear of ice, particularly the Johansen Expressway where he is traveling. Less than ¼ mile ahead of Mike, a driver crosses the centerline and crashes head-on with a large panel van that overturns and dumps its cargo of plumbing parts on the road. Mike manages to maneuver to the shoulder and is not involved. He phones 911 on his cell phone to report the crash as he checks to see if the people involved in the crash are injured. The 911 dispatch center staff are able to view the crash scene on their monitors, using images captured from an ADOT&PF video camera located on the Johansen Expressway. The dispatcher uses the video image and Mike's assessment to dispatch the proper emergency response staff and equipment to the scene. The dispatcher is able to note that more than one ambulance is needed, as well as a large tow truck or crane.

The 911 State Trooper dispatch center is equipped with a computer-aided dispatch system that includes automated vehicle location of all troopers in the field. The dispatcher is able to immediately route the closest available officer to the scene. This is much more time effective than the old method, which required troopers to use their radios to call in their locations when a call for help was placed over the radio.

ADOT&PF staff are also alerted about the crash, and view the scene on their monitors from the Fairbanks Regional ITS Operations Center. They begin their response by sending out a bulldozer to remove the plumbing parts from the road. They also, dispatch portable variable message signs and barricades to help manage the scene until the crash can be cleared. Operators at the center also activate the local highway advisory radio system, and post information on the statewide traffic and traveler information system advising of the nature and duration of the road blockage due to the crash. This information is accessible via 511, *the Internet, personal pagers, and at kiosks such as the one Steve used at the Anchorage airport.*

Police, medical response, and ADOT&PF are working together to manage all aspects of the crash scene. Medical response vehicles are equipped with video cameras and mobile data terminals. They are able to send real-time images and vitals to the local trauma center, where doctors advise the EMTs via radio on appropriate field treatment and prepare the hospital trauma unit with the proper staff and equipment to receive the patients. These actions shave vital minutes off the medical treatment response, greatly increasing crash survivability.

In the Alaska Range, there was a heavy snow. A rapid warming during the day caused snowmelt to swell rivers. At two locations along the Parks Highway, detection systems placed in rivers and streams sent alarms to the multi-agency Operations Center, warning of potential bridge scour. Bridge scour can cause undermining of a bridge's foundation, which may lead to structural problems and is costly to repair. Bridge maintenance staff are dispatched to the scene to place riprap and other materials to counter the effects of rising waters on the bridges.

Meanwhile, back at the ADOT & PF Operations Center, data on the day's operations are automatically sent to the State's data warehouse. The warehouse organizes and stores crash, traffic volume, maintenance activity, and other data critical to managing and operating the transportation system. The data are analyzed to ensure the efficient and effective delivery of transportation services throughout the State.

Our three travelers eventually meet in Denali, and enjoy a fantastic outdoor experience. On the first night of the trip, after Steve, Mike and Susan all told their individual travel war stories, they found it ironic that their trip to the wilderness was made safer and more convenient through the application of technology.

ADOT&PF also plans to improve the movement of goods and other freight throughout the State through the application of technology. The following narrative illustrates how this will happen.

George manages a small trucking company in Alaska. Administrative paperwork consumed a large part of his time—he had to file various forms for taxing and credentials, and maintain files while submittals and approvals lagged back and forth through the postal service. He also had to make multiple trips to the Division of Motor Vehicles to renew licenses – a repetitive process that often found him standing in line for long periods of time.

Intelligent Transportation Systems have greatly eased the burden on George and other trucking company managers. Instead of trips to the DMV, he now updates all vehicle registration information online, with the click of a mouse. He can also pay registration and other fees online by authorizing an electronic fund transfer. Furthermore, all pertinent information is maintained electronically, which eliminates the need for George to manage files of redundant paperwork. He now spends more time managing his fleet, training drivers, providing customer service, and developing new markets for his business.

The efficiency of truck dispatching is also supported by ITS. Pat, a dispatcher at the same trucking company, regularly checks the Internet for traffic and weather advisories and for restrictions on oversize and overweight vehicles. Today, she receives an advisory of road closures for trucks due to unstable pavement conditions. This knowledge helps her plan the day's work orders. In response to the travel advisory, Pat reroutes trucks and adjusts schedules to avoid the road closures

ADOT&PF technologies help truck operators in many ways. Mary, a driver for the trucking company, gets up-to-date traffic and incident information via her on-board computer. She can request route advisories so she can divert her route from construction delays, normal traffic tie-ups, and incidents.

Fleet efficiency also benefits from weigh-in-motion stations, because trucks no longer have to pull off and wait in line at manual weigh stations. Weighing trucks on scales hindered productivity and contributed to pollution as trucks idled in queue.

Also as Mary drives down the road, an overhead sign advises her to bypass the truck inspection station. A transponder mounted on her vehicle identifies her vehicle so systems can automatically check all registration and inspection data pertinent to her trip. Because her truck has recently been certified as acceptable, she is allowed to bypass inspection stations due to her flawless safety record. The same transponder makes crossing the border to and from Canada a breeze, as she can use the new electronic border crossing lanes without stopping.

Andy, another trucker, is not allowed to bypass the inspection station. When the weigh/inspection station queried the database with his transponder identification, a potential safety violation was noted. An overhead sign automatically directs him to pull into the station. There, troopers with handheld data terminals look up the truck's records from statewide and national safety databases, which indicate that the truck was cited for brake-wear violations last week. The trooper then notes that the brake problem has not been addressed, and pulls the truck out of service immediately. The new violation is noted and input, via the troopers' handheld terminal, into the statewide and national databases. These smart systems allow enforcement officials to focus only on violators, instead of stopping the whole population of vehicles to find the relatively few that are not in compliance.

ADOT&PF also plans to improve transit and traffic operations in cities throughout the State through the application of technology. The following narrative illustrates how this will happen.

It's 4:44 PM, Thursday March 25th. John, an emergency medical technician, is currently responding to a severe crash near the airport. Meanwhile, John's wife Sarah, a physical therapist, is working with a patient, Maria, at the Fairbanks Memorial Hospital. Today is John and Sarah's 5th wedding anniversary. To mark the special occasion, both John and Sarah have arranged their busy work schedules so they can have dinner with each other tonight. Although they'll probably never know it, John, Sarah and even Maria will reap the benefits of intelligent transportation systems deployed throughout the region.

En-route to the severe crash near the airport, John is informed by a dispatch operator that the driver of one vehicle may have had a heart attack triggering the multi-vehicle crash. Knowing that time is always critical in these situations, John is thankful that a couple of years earlier the City of Fairbanks and emergency management agencies had partnered to equip ambulances and traffic signal systems with emergency vehicle pre-emption systems. Now as John's ambulance approaches an equipped traffic signal, the receiver installed at the intersection receives a signal emitted by an emitter installed on John's vehicle. The controller at the intersection receives the signal from the receiver and pre-empts the traffic signal's current phase, giving John a green light so he can proceed through the intersection without slowing down. Over the years this technology has proven invaluable, not only in terms of more prompt medical treatment, but also in terms of safely traveling to and from the crash scene – a benefit that John is particularly thankful for. With the preemption system in place it only takes John 4 minutes to safely arrive at the crash scene. Without intelligent transportation systems like this, John's trip would have certainly taken several minutes longer.

It's now 4:48 PM, and John's wife Sarah has just finished the appointment with her patient. Since Sarah gets off work at 5:00, one hour earlier than John, she plans to go to their home before meeting John at an upscale downtown restaurant. Meanwhile, Sarah's patient Maria left the hospital and is walking toward her bus stop. When Maria arrives at the bus stop, she notices a variable message sign that displays estimated bus arrival times. Years back, transit vehicles were equipped with global positioning units (GPS) to automatically track the location of vehicles and to estimate arrival times. Unfortunately for Maria, and her ailing foot, the Red Line is running 9 minutes behind schedule today. Fortunately, for Maria, the hospital's lobby is nearby. Unable to stand for any significant length of time, Maria opts to *wait for the bus in one of the comfy chairs in the hospital's lobby. Although the weather is pleasant today, the hospital's lobby often serves as temporary shelter to transit users on days when weather conditions are unpleasant.*

While Maria waits for her bus, operators at the Metropolitan Area Commuter System (MACS) Transit Management Center are using transit vehicle location information collected by GPS units installed on MACS buses to manage their fleet of vehicles in real-time, and to make better operational decisions. When transit delays are considered excessive, operators often shift buses from other routes or elect to operate additional buses to improve the reliability of transit schedules. In Maria's case, the delay on the red line is not considered significant, and operators proceed with their duties without taking any action. Knowing that her bus is estimated to arrive at 4:57 PM, Maria leaves the hospital lobby at 4:55 and proceeds to the bus stop where she boards her bus.

Back at the hospital, Sarah departs the hospital parking lot at 5:14 PM and heads for home using her usual route – Airport Way. At the same time John arrives at the hospital and immediately receives another call for assistance – this time a minor injury crash on Airport Way. Earlier a car hit a traffic signal pole, cutting power to the signal. By the time Sarah approaches the affected intersection operators in the Integrated Transportation Operations and Communications Center have already taken measures to reduce congestion near the intersection. Thankfully, Sarah is only delayed a few minutes, and arrives home with no further delay.

Earlier, the software used to control the city's network of traffic signals detected the loss of power to the traffic signal and triggered an audible warning. An operator in the Integrated Transportation Operations and Communications Center heard the warning and then proceeded to verify the crash by manually controlling a CCTV camera posted on a traffic signal at an intersection located immediately upstream of where the accident occurred. While the operator was verifying the crash and assessing damage to the traffic signal, he called the appropriate emergency response agency and proceeded to give the emergency management operator details pertaining to the crash. At the same time another operator in the Integrated Transportation Operations and Communications Center began to manually override the traffic control system to adjust traffic signal timing plans so traffic can flow more freely around the affected intersection.

Across town, Sarah's patient Maria has just exited her bus. Thanks to transit signal priority systems, her commute to and from her weekly appointments at the hospital take less time than they had when Maria first started going to the hospital a few years back. Transit signal priority systems, similar to those deployed on John's emergency vehicle, hold the green traffic signal indication which reduces the frequency in which transit vehicles must stop.

Although she doesn't know it, Maria's commute has also benefited from other ITS-related improvements. For instance, last year the City of Fairbanks started pulling traffic detector data from loops installed at existing detector stations. The collected traffic detector data is combined with data from permanent traffic recorders. Both types of data are stored in a central database and used by transportation planners and regional transportation agencies to determine and prioritize transportation system improvements. This data is also used by traffic engineers to better time traffic signals throughout the area. Earlier this year, traffic signals along the route Maria takes to and from the hospital were retimed to improve traffic flow and progression, which has contributed to Maria's overall travel time savings.

It's now 5:58 PM and Sarah has just walked into the restaurant where she meets John. Although Sarah was afraid that the earlier crash on Airport Way was going to make her late getting home, the delay she incurred was much less than she expected. Thanks to ITS, Sarah had enough time to freshen up, feed her dog, make some calls and still meet her husband on-time at the restaurant. In fact, over the last hour and half, ITS has helped John, Sarah and Maria, reach their destinations safely and without frustration.