Anchorage Regional ITS Architecture Update: Implementation Plan

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Revision History

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V 0.0	May 27, 2015	L. Jacobson	E. Ehlinger	Draft for internal review
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V 1.1	June 12, 2015	L. Jacobson		Revised to include bike detection strategy. TAC Approval
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1 Introduction

This report focuses on implementing Intelligent Transportation System (ITS) strategies that enhance travel safety and efficiency in the Municipality of Anchorage (MOA). The report fully considers the resources available to implement technologies, as well as existing and planned systems, to ensure the implementation is efficient and can be deployed and managed using available resources. .

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 apply a systems engineering approach to regional ITS planning and project development. At the project level, 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 project-level systems engineering approach must 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 project-level 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   What is the Purpose of the Implementation Plan?

The purpose of the Implementation Plan is to define a potential approach to deploying a set of strategies that are proposed for the MOA. It also provides suggested approaches to integrate ITS planning efforts with the overall transportation planning program in the Municipality.

This plan also meets federal ITS requirements to have an identified implementation plan.

2   Background

This document is a part of the update to the Anchorage Regional ITS Architecture (ARIA) for the MOA. The original ARIA was completed in 2003 and adopted in 2004. This update reflects changes since that time including:

- Technologies in place, deployed by the regional partners.
- Updates to the National ITS Architecture
- The regional stakeholder's understanding and assessment of the needs that can be met using ITS technology.
- The availability of a database tool to support documenting the regional ITS architecture – Turbo Architecture.

2.1   What is ITS?

Intelligent Transportation Systems (ITS) include advanced sensor, computer, electronic, and communication technologies integrated with the built transportation infrastructure, and deployed to improve overall transportation system operations and safety. Some examples of ITS already in place within the MOA include:

- Computerized traffic signals, including those that can be managed from an central computer platform;

- Traffic detectors and traffic cameras that provide real-time information to support operations;
- Public information websites such as the MOA's site showing the status of snow plow-out by sub-area; and
- Transit bus location and dispatch systems.

2.2 What is an ITS Architecture?

The term 'architecture', when applied to computerized systems and technology, is a model or framework used to describe these inherently complex systems. For ITS, architectures are focused on identifying the data flows between systems that may be owned and operated by different agencies or departments in support of transportation operations improvements. ITS architectures include:

- The requirements for defining the connections;
- Documenting the connections; and
- Documenting any supporting resources, such as interagency agreements, that will enable the architecture to be implemented as planned

2.3 Purpose and Objectives of the ARIA Update

The 2004 ARIA comprehensively documented the ITS goals and the potential regional ITS functions and connections between systems that could support those functions. The work included a broad base of stakeholders and potential system connections.

The focus of this ITS Architecture update is to:

- Improve the ability to access and understand the ITS Architecture
- Modify the ARIA to reflect any updates to systems deployed, as well as updating the regional partner's vision and goals for ITS over the 10-year timeframe of the update
- Make the ARIA easier to maintain by converting it to a Turbo Architecture file

The primary purpose of the ARIA itself is to document potential technology systems and agency/departmental connections that can improve the effective and safe delivery of transportation operations. By doing so, future systems that are implemented will be compatible with the identified data connections.

Additional objectives for the ARIA update are to integrate with regional planning processes, including the Anchorage Metropolitan Area Transportation Solutions (AMATS) regional transportation planning process and the AMATS Congestion Management Process. AMATS is a federally recognized Metropolitan Planning Organization (MPO).

Stakeholder involvement is another important objective for this project. Coordination of stakeholders improved the process in terms of idea exchange and understanding of the needs of each party.

2.4   Service Areas Included in the ARIA Update

A service area is a collection of systems, people and other infrastructure that deliver a set of ITS functions. The MOA ITS Architecture is described using the following service areas:

2.4.1   Archive Data Services

This service area is centered on collecting transportation data from various sources and archiving them for future use. Types of archive data could include traffic data, weather, emergency, transit, and etc. Geographic Information System (GIS) data is also an integral component of this service area as the Archive Data Services element would be communicating with a GIS data update provider.

2.4.2   Arterial Management

This service area supports arterial traffic management and focuses on the communication processes amongst center and field systems involved in arterial operations. This includes data flow amongst systems such as traffic cameras, traffic signal controllers, traffic signal preemption and priority systems, transit vehicular on-board systems, traffic detectors and other elements.

2.4.3   Traveler Information

This service area provides two key functions – public traveler information and internal agency traveler information. On the general public side, it enables stakeholders to provide automated real-time or static public information regarding traffic conditions, events, emergencies, or construction via the internet and phone. On the internal agency side, the proposed system may be accessed by authorized users from the stakeholder agencies. The service area also provides remote access for authorized users to data that is only suitable for internal agency use, and for viewing CCTV, DMS, and other systems and equipment to support traffic and emergency operations.

2.4.4   Roadway Maintenance and Construction

This service area outlines the distribution of maintenance and construction data amongst applicable ITS elements in support of those operations. Weather, work zone, environmental conditions, and traffic images are some of the data flows exchanged within this service area. Information is also distributed to be archived for future use as well as to public/private information service providers (ISPs) for traveler use.

2.4.5 Transit Operations

The Transit Operations service area presents the external flows connecting to and from internal transit operations. Internal transit operations include flows amongst transit management centers, transit vehicles, field support, and demand response services. These internal flows aren't shown in the ARIA Update. In other words, only flows that are linked to transit related elements and subsystems outside of internal transit operations are highlighted. The exception to this is flows to and from transit service information providers such as transit agency websites.

3 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 help maximize the potential benefits in terms of safety, efficiency, and cost savings.

3.1 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.

3.1.1 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, especially with the Alaska DOT&PF because of the need to assure the Anchorage Regional ITS Architecture and the State's Alaska Iways Architecture are compatible and coordinated. Integration with ADOT&PF is specifically supported through the Turbo architecture database structure. The Turbo architecture database documents the ITS Architecture data flows and interfaces. Both the Alaska Statewide and MOA regional ITS architectures will reside in the same Turbo file, making it easy to verify compatibility and integration.

3.1.2 Technical Integration – Applicable Standards

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.

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 21st 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.

Applicable ITS Standards are included in the Turbo Architecture database. A report of the applicable standards can be printed from the Turbo Architecture file.

3.2   Integrating ITS with Regional Transportation Plans

A project related to the ARIA Update is the update of the Municipality's Congestion Management Process (CMP). These two efforts occurred concurrently, and the coordination of these two efforts produced a Strategic Integration Memo. The Strategic Integration Memo identifies how the architecture can be integrated with regional transportation plans. One of the important recommendations is to develop an operations/ITS plan. An Operations/ITS Plan is closely related to the ITS Architecture but provides a program of specific deployments, system integration strategies and institutional activities related to transportation operations and ITS. The level of detail in such a plan would be greater than the list of strategies included in this document. In addition, the projects defined in an Operations/ITS Plan can be fed directly into Metropolitan Transportation Plan (MTP) updates and updates to the Transportation Improvement Plan (TIP). While an Operations/ITS Plan is not a Federal or State requirement, many regional agencies have found such an effort to provide a number of benefits such as:

- Much like the ITS Architecture it helps bring a range of stakeholders together to discuss Operations/ITS issues. Law enforcement, emergency management and health care organizations are among the parties that may not ordinarily be active in transportation planning activities.

- It provides a forum and potential mechanism for coordination of Operations/ITS strategies between the DOTP&F and the Municipality. This includes both deployment of equipment and operating strategies.

- It provides a separate needs analysis related to Operations and ITS, and in particular can help identify strategies that may be used to defer the need for higher-cost capital projects.

- Operations and ITS do not usually have high visibility with decision makers or the public. The Operations/ITS Plan can provide quantitative estimates of benefit and cost that can be used to educate the public and decision makers about Operations and ITS.

3.3   Implementation Strategy

As mentioned previously, ITS cannot be implemented all at once. Various systems, both existing and new, can be implemented and integrated with other ITS elements over time. The following sectio provides an overview of how various ITS components in Anchorage may be implemented over time to maximize the benefits of each system. The section discusses implementation from the perspective of each service area, or function, that is enabled or enhanced by ITS deployment (e.g., snow and ice control).

NOTE: Project sequencing is for conceptual implementation only, and is not a ranking for program funding.

3.3.1   Near-Term (0-3 Years)

This section describes ITS deployments in the MOA within the next few years. 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.

Archive Data Services

Data Archive Investigation - Currently, agencies in the region maintain their own data repositories. This makes it convenient for internal operations in terms of accessing historic data within one's agency, but not as convenient for obtaining data from others. The aim of Data Archive service area is to support multi-agency data sharing. By creating a central Archive Data Services system that different agencies can contribute to, access to a more abundant amount of historic data becomes streamlined and readily attainable for the participating agencies. There is currently no consensus on the organization or management approach to a centralized data archive. The first step would be to conduct a study on the

specific needs for data archiving and how best to meet those needs. This study should consider various types of data to be archived, the priority for archiving each type, where such an archive would best fit among the regional agencies in terms of ownership and operations, and the potential policies and procedures connected ot the archive. (A second effort to implement the archive is suggested in the mid-term.)

Common Geographic Information System – The MOA currently has a common GIS platform. All departments and divisions have access to that platform. There will continue to be additional needs for GIS layers and applications. These efforts will follow the greatest needs of the departments and divisions.

Shared Traffic Database – Within the overall data archive, traffic data shared and easily retrieved traffic data was noted by many agencies as a need.. A initial focus of a regional data archive should be on implementing a shared database for traffic data.. This will reduce the burden on agencies to collect data or search for data that already exists somewhere within the Municipality. Part of this effort should also investigate geo-coding traffic data so it can be displayed on a GIS layer to graphically display the information.

Integration with ADOT&PF Traffic and Roadway Conditions Entry System – The existing condition entry system that ADOT&PF has connects directly to their 511 system and the information can be shared among a variety of agencies. Authorized personnel in the MOA such as police, fire, and traffic operators, can input and retrieve traffic information and roadway conditions directly into the statewide database. Personnel could enter and retrieve data through use of mobile devices as well. Once entered, the information is available for everyone to see simultaneously, reducing the time needed to report this information to individual agencies or to the public.

Arterial Management

Traffic Operations Center – There has been significant discussion about establishing a transportation operation center in the Anchorage area. There is currently a multi-agency group looking at what TOC functions are needed and how best to meet those needs. The group will also assess the configuration of the TOC, with options ranging from a brick and mortar building to a completely virtual TOC. When that work is completed, the recommendations will need to be implemented. There will likely be multiple projects starting in the near term and extending beyond to implement the recommendations.

Closed Circuit Television (CCTV) – CCTV provide agencies, operators and the public with real-time images of traffic, and incidents that occur on regional roadways. Anchorage Police Department Anchorage Fire Department have specifically voiced their interest in an expansion of camera coverage. Camera images could also help Maintenance staff in making decisions regarding their operations. 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. There are cameras currently in place within the Municipality. This effort would expand the coverage of cameras in the Municipality.

Traffic Signal Controller Upgrade – The existing traffic signal controllers are relatively old. The features and capabilities of the controllers are constrained because of this. There is a current effort to upgrade signal controllers. This effort will continue in the near-term.

Transit Signal Priority - The MOA and its Public Transportation Department has piloted Transit Signal Priority (TSP) systems on selected routes within the Municipality. Transit signal priority at additional locations will help 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. Transit Signal Priority may also assist with emergency response during disasters for evacuation, triage, etc. Further implementation of TSP is on-hold until the traffic signal controller upgrade project is complete. (This project is also included under transit operations.)

WiFi/Bluetooth Detection for Travel Time – WiFi and Bluetooth detectors can be used to determine travel times on the roadway network. This system could provide high quality travel time for the purpose

of modifying traffic signal timing, for performance monitoring,and to post travel times to the public on the web. This technology exists and is cost-effective to implement. A first step would be to design and implement a pilot study to determine how well it works to support traffic signal timing changes, and (if successful) how best to expand the system.

Bicycle Detection and Warnings: The adopted AMATS Bicycle Plan includes an Action Item Recommendation to consider visual or motion detection as options for detecting bicycles at signalized intersections where a high level of bicycle use exists or is anticipated. This strategy can include camera, radar, or other detection. The strategy can be used to detect bicycles as input to the traffic signal controller as well as providing warnings to drivers of motorized vehicles of the presence of bicyclists through means of dynamic message signs, or flashing warning signs.

Traveler Information

Highway-Rail Intersection (HRI) Warning Systems – It is envisioned that the MOA will implement HRI Warning systems located near highway-rail intersections. This will improve driver awareness of on-coming trains and improve safety at HRIs. Railroad information collected from the Alaska Railroad Corporation (ARRC) wayside equipment and detectors would provide the needed data for this feature. Advanced train detection could collect data such as train speed, location, arrival times, and crossing delays. By collecting and distributing this information to travelers and agencies, motorists could choose their routes and times of travel to minimize delays caused by rail crossings. Dynamic message signs will be the primary mechanism for providing this information, although it could also be displayed on a traveler information website and through smartphone apps.

Traveler Information Website – There are several real-time data sources either available or proposed that would be valuable to display on a traveler information website. CCTV camera images are some of the most popular types of traveler information. The existing and any planned CCTV images, either full motion or stills, could be displayed. In addition, information on travel times from the wifi/Bluetooth detectors could also be displayed. Information on incidents, planned construction closures, or special events that affect traffic could also be included. As additional real-time or planned data was available, it could be added to the website.

Roadway Maintenance and Construction

Signal Priority for Maintenance Vehicles - Transit vehicles have the ability to request priority at traffic signals using on-board systems. Allowing maintenance vehicles such as snow plows the same ability allows for maintenance work to be completed more quickly and therefore cause fewer disruptions to traffic flow. This is particularly important for snow plows to allow them to proceed on their routes as expeditiously as possible. The usage of signal priority systems could also include automatic vehicle location (AVL) capabilities and turn-signal linkage.

RWIS Data Sharing – Alaska DOT&PF currently operates road weather information systems (RWIS) in the MOA and the surrounding area. A mechanism to share this information with Maintenance staff within the MOA would help in determining the most effective winter maintenance actions.

Transit Operations

Transit Technology Refresh – MOA Public Transportation has a number of systems on-board their coaches and in their operations center (over 50 pieces of software and all the major transit management functions). Many of these are nearing the end of their useful life. There will need to be a series of project to refresh the technologies of these systems. These refresh projects may start in the near term, but will likely spread through at least the medium term as well.

Multi-modal Trip Planner – Public Transportation has funding for a multi-modal trip planner that will include smartphone applications. The data will be consolidated and available for other organizations to use for their planning purposes.

Transit Signal Priority - The MOA and its Public Transportation Department has implemented Transit Signal Priority (TSP) systems on a couple of routes within the Municipality. Transit signal priority at additional locations 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. Transit Signal Priority will also assist with emergency response during disasters for evacuation, triage, etc. Further implementation of TSP is on-hold until the traffic signal controller upgrade project is complete. (This project is also included under arterial management.)

Fare Payment – Customers and the Public Transportation Department would like to provide a mechanism for customers to recharge their transit accounts on-line and/or through a smartphone app. A project to investigate the best mechanisms for Anchorage would be a first step followed by an implementation project.

3.3.2 Medium-Term (3-5 Years)

This section describes implementation of ITS that is envisioned in the MOA within the three to five year timeframe. These deployments are envisioned in the medium term either because enabling technologies are needed or the level of integration that would be required makes it necessary for other projects to precede them.

Archive Data Services

Data Archive Implementation – This effort will implement the outcome of the data archive investigation suggested in the near-term.

Traveler Information

Parking Management – The MOA is planning to implement a new parking management system. This system will be able to provide parking occupancy and availability information so travelers will know where parking spaces are available. It will also include wayfinding features to provide travelers with information on how to get to the available spaces. This project is in mid-term because the parking revenue control system has to be updated first. It is envisioned that information will be displayed on signs along the streets and on a traveler information website.

Advanced Highway-Rail Intersection (HRI) Warning Systems – It is envisioned that the MOA will integrate positive train control with HRI Warning systems located near highway-rail intersections. This will improve knowledge of on-coming trains and improve safety at HRIs.

Transit Operations

Intelligent Transit Stops – Ranges from kiosks, which show static transit schedules, to real-time information on schedules, locations of transit vehicles, arrival time of the vehicle, and alternative routes and modes. This is shown in the mid-term because Public Transportation will be tied up with existing projects and determining their technology refresh in the near term.

3.3.3 Long-Term (5-10 Years)

There will likely be projects that will fall into the long-term horizon. However, that will primarily be for funding and cash flow purposes. There are no technology implementation reasons to wait to implement any of the projects identified.