

Memorandum 2:

Project Architecture

TO: Cross-Border ATIS Data Management System (ATIS-DMS) Advisory Committee
FROM: Whatcom Council of Governments (WCOG)
DATE: September 29, 2006
RE: Project architecture for review

1. Introduction

The ATIS-DMS project architecture is a plan for the cross-border exchange of data and information between two ITS systems; one in Whatcom County, Washington State, and the other in British Columbia.

This technical memorandum serves as the Advanced Traveler Information System Data Management System (ATIS-DMS) project architecture. The architecture has been developed in compliance with U.S. federal ITS regulations and can be incorporated into regional ITS architectures. It has also been designed to be incorporated into the Whatcom County Regional ITS Architecture and the British Columbia ITS Strategic Plan.

The purpose of this document is to map the electronic exchange of information that comprises the ATIS-DMS system and to record ATIS-DMS stakeholder agreements and adopted specifications.

2. The ATIS-DMS Project

This project archives data from the northbound advanced traveler information system (ATIS), owned and operated by WA State Department of Transportation (WSDOT), and the southbound ATIS system, owned by B.C. Ministry of Transportation (BC MoT). The archive is available to the public on the internet and provides both selectable raw data and standardized reports on vehicle counts, queue lengths, wait-times, and service rates for passenger vehicles crossing the two ports-of-entry between Blaine, Washington and Surrey, British Columbia.

3. Relation to Regional and National Architectures

This project architecture is a stand-alone architecture that will fit into the existing Whatcom County Regional ITS Architecture and can also be applied to the B.C. ITS Strategic Plan. It incorporates the specifications of the U.S. National Architecture version 5.1. Attention has been given to alignment with the Canadian Architecture, although terminology may be different.

4. The Project Region

The ATIS-DMS project incorporates in-road vehicle sensors (loop detectors) and variable message signs along the Interstate 5/B.C. Highway 99 and State Route 543/B.C. Highway 15 corridors. In addition, the system has been designed to seamlessly expand with the installation of additional loop detectors and traffic monitoring equipment at the other regional border crossings: State Route 539/B.C. Highway 13 (Lynden/Aldergrove Port-of-Entry) and State Route 9/B.C. Highway 11 (Sumas/Huntingdon Port-of-Entry).

This regional set of crossings is referred to as the Cascade Gateway.

5. Project Stakeholders

Project stakeholders have been identified as follows:

- **B.C. Ministry of Transportation (MoT)** – The provincial agency that is responsible for managing, operating, and maintaining province-owned transportation infrastructure. For this specific project, B.C. MoT has hired the consulting firm, IBI Group, to develop and maintain its ATIS software and hardware for the border crossings.
- **WA State Department of Transportation (WSDOT)** – WSDOT is responsible for managing, operating, and maintaining state-owned transportation infrastructure, as well as maintaining federally-designated highways. WSDOT develops its own software for ITS applications and manages its own ATIS system.
- **Canada Border Services Agency (CBSA)** – This federal agency enforces laws pertaining to the entry into Canada of people and goods. Operations include the processing of commercial goods, travelers, and conveyances, and identifying and interdicting high-risk individuals and goods. In addition, CBSA conducts intelligence to maintain border integrity and ensure national security.
- **U.S. Customs & Border Protection (CBP)** – This agency is part of the U.S. Department of Homeland Security and is responsible for managing the nation’s borders and ports-of-entry, preventing the passage of individuals or goods from entering the United States unlawfully.
- **Whatcom Council of Governments (WCOG)** – This regional agency is the federally-designated Metropolitan Planning Organization, a support agency for local governments in developing and administering transportation program activities. WCOG is also the Regional Transportation Planning Organization, a Washington State-designated organization which oversees regional transportation planning functions. WCOG is also the lead agency of the International Mobility & Trade Corridor Project (IMTC), a binational border planning forum that identifies and implements improvements to the Cascade Gateway cross-border transportation system.
- **Transport Canada** – This Canadian federal agency is responsible for setting policies, regulations and standards for Canada’s rail, marine, road, and air transportation systems. Transport Canada is a funding partner for the ATIS-DMS project.
- **Travelers** – This group of stakeholders includes all motorists and passengers traveling across the border. In the future, this group may also include commercial vehicle drivers

in relation to this project.

- **Archive Data Users** – These stakeholders include all organizations or individuals that access and use archived data from the ATIS-DMS system.

6. Market Packages

“Market package” is a term used to describe hardware or software products that are used to operate a specific ITS project. Market packages are defined in the U.S. National ITS Architecture and each market package is associated with a set of “elements” and “project areas” (described below).

The following market packages have been identified as being part of the ATIS-DMS project:

1. ATMS01: Network Surveillance

This market package includes traffic detectors, other surveillance equipment, the supporting field equipment, and fixed-point to fixed-point communications to transmit the collected data back to the Traffic Management Subsystem.

2. ATMS06: Traffic Information Dissemination

This market package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media, Transit Management, Emergency Management, and Information Service Providers.

3. ATMS09: Traffic Forecast and Demand Management

This market package includes advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecast of the roadway network performance. This includes the prediction of travel demand patterns to support better link travel time forecasts. The source data would come from the Traffic Management Subsystem itself as well as other traffic management centers and forecasted traffic loads derived from route plans supplied by the Information Service Provider Subsystem.

4. ATIS2: Interactive Traveler Information

This market package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that “push” a tailored stream of information to the traveler based on a submitted profile are supported.

5. AD1: ITS Data Mart

This market package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. It provides the basic data quality, data privacy, and meta data management common to all ITS archives and provides general query and report access to archive data users.

6. AD2: ITS Data Warehouse

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

7. AD3: ITS Virtual Data Warehouse

This market package provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse Market Package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

7 Operational Concept

The operational concept for the ATIS-DMS architecture captures each stakeholder's current and future roles and responsibilities in the implementation, operation, and maintenance of the project.

Based on the above market packages, selected to best represent the components used in the ATIS-DMS project, the following program areas have been identified as related to the roles and responsibilities of the project stakeholders:

1. Archived data systems for ATIS-DMS

Responsible stakeholder: Whatcom Council of Governments

Roles and responsibilities: Host, manage, and maintain the binational ATIS-DMS data archive.

2. Roadway system management for ATIS

Responsible stakeholders: WA State Department of Transportation (WSDOT), B.C. Ministry of Transportation (BC MoT)

Roles and responsibilities: WSDOT is responsible for the management and maintenance of the northbound border ATIS system. B.C. MoT is responsible for the management and maintenance of the southbound border ATIS system.

8 Agreements Between Organizations

For a multi-agency, multi-jurisdictional ITS project architecture, either informal or formal agreements may need to be established to define responsibilities, data sharing, and the interoperability of systems. For the ATIS-DMS project, much of this process has been accomplished through the project team, including participation from key stakeholders.

The following agreements have emerged from this project to define responsibilities and specific project requirements:

- **ATIS-DMS Funding Agreement** – This agreement is between Transport Canada, B.C. Ministry of Transportation, WA State Department of Transportation, and Whatcom Council of Governments to establish and maintain the ATIS-DMS binational border ATIS data archive. ****EXISTING****
- **ATIS-DMS Data Schema** – Document describing data transfer protocols and specifications between the B.C MoT and WSDOT ATIS systems and the ATIS-DMS archive. ****EXISTING****
- **ATIS System Maintenance Agreement** - Maintenance agreement between B.C. Ministry of Transportation and WA State Department of Transportation to share in the maintenance of each respective ATIS system. BC MoT will be responsible for maintaining all southbound ATIS system components; WSDOT will be responsible for maintaining all northbound ATIS system components. ****PLANNED AND PENDING ADDITIONAL DIALOGUE****

9 Identification of ITS Standards

ITS Standards are defined by the U.S. Department of Transportation as standardized communications between various ITS subsystems. They are designed to be applied to the specific architecture flows within an architecture (see the architecture flows in the appendix diagrams).

Standards are often determined through a meeting of all stakeholders. This was not completed as part of this architecture; however, two standards have been identified in the process of creating this architecture, and would be good candidates for future inclusion in later versions of the project architecture:

1. **ATIS General Use Group:** Advanced Traveler information Systems (ATIS) General Use Standards Group (SAE is the official standards development organization responsible for developing, publishing, and maintaining this standard).
2. **NTCIP C2C Group:** NTCIP Center-to-Center Standards Group (AASHTO, ITE, and NEMA are the standards development organizations responsible for developing, publishing, and maintaining this group of standards).
3. **TMDD:** This Traffic Management Data Dictionary (TMDD) standard is used for specifying the transfer of data from ATIS systems to the archive. It is under the ITE organization and has been developed with the NTCIP C2C Group.

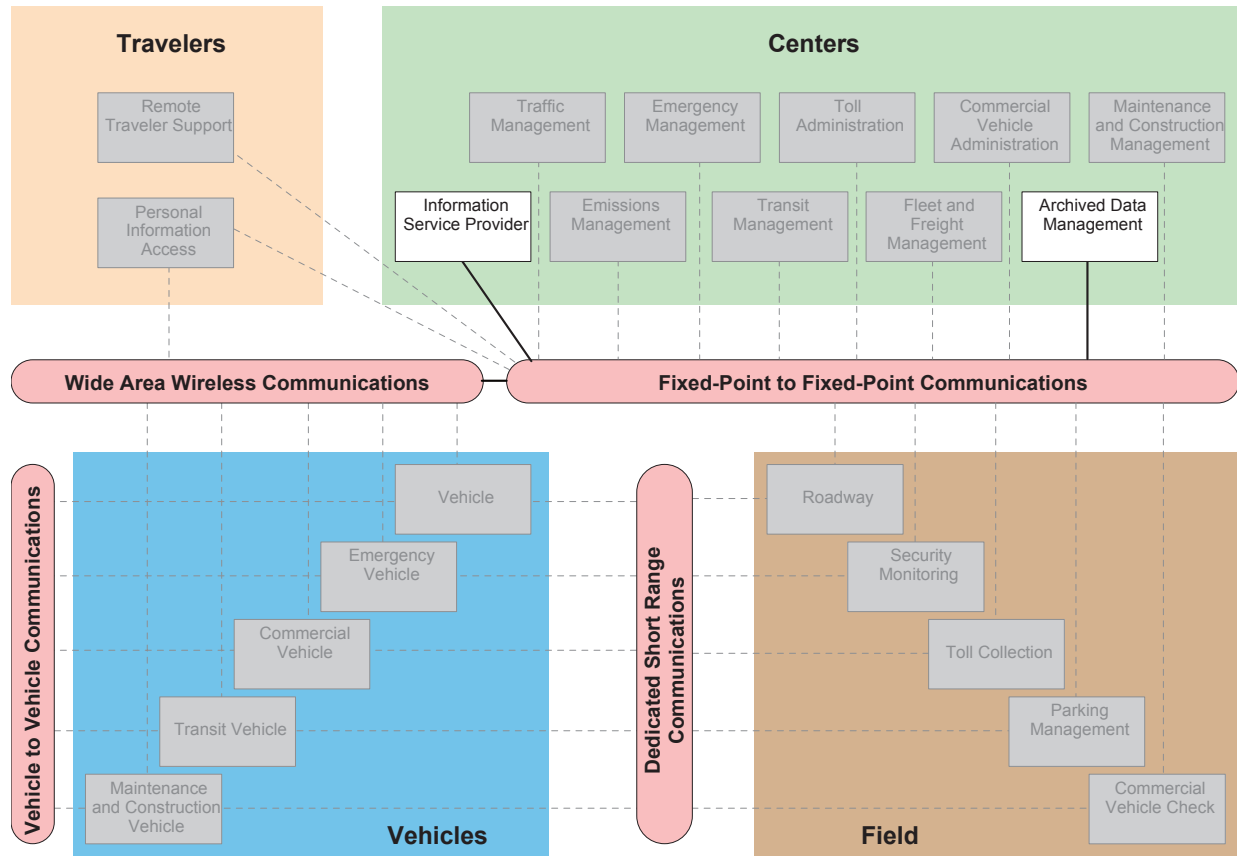
10 Projects Required for Implementation

All ITS activities needed for the original scope of this project have been completed and installed. Future improvements include the following components:

1. Completion of construction at the U.S. and Canadian Peace Arch ports-of-entry and resulting modifications of the existing ATIS systems (northbound and southbound).
2. Completion of construction on WA State Route 543 northbound, approaching the Pacific Highway crossing and the subsequent installation of loop detectors and other traffic-monitoring system equipment.
3. Expansion of system to include northbound and southbound passenger vehicle data from the Lynden/Aldergrove and Sumas/Huntingdon ports-of-entry.
4. Expansion of system to include both northbound and southbound commercial vehicle counts and wait-times at all three commercial ports-of-entry (Pacific Highway, Lynden/Aldergrove, and Sumas/Huntingdon).
5. Possible expansion of system to archive corridor travel-time data (i.e. Bellingham to downtown Vancouver).

Appendix A

Architecture Diagram 1: ATIS-DMS Subsystems

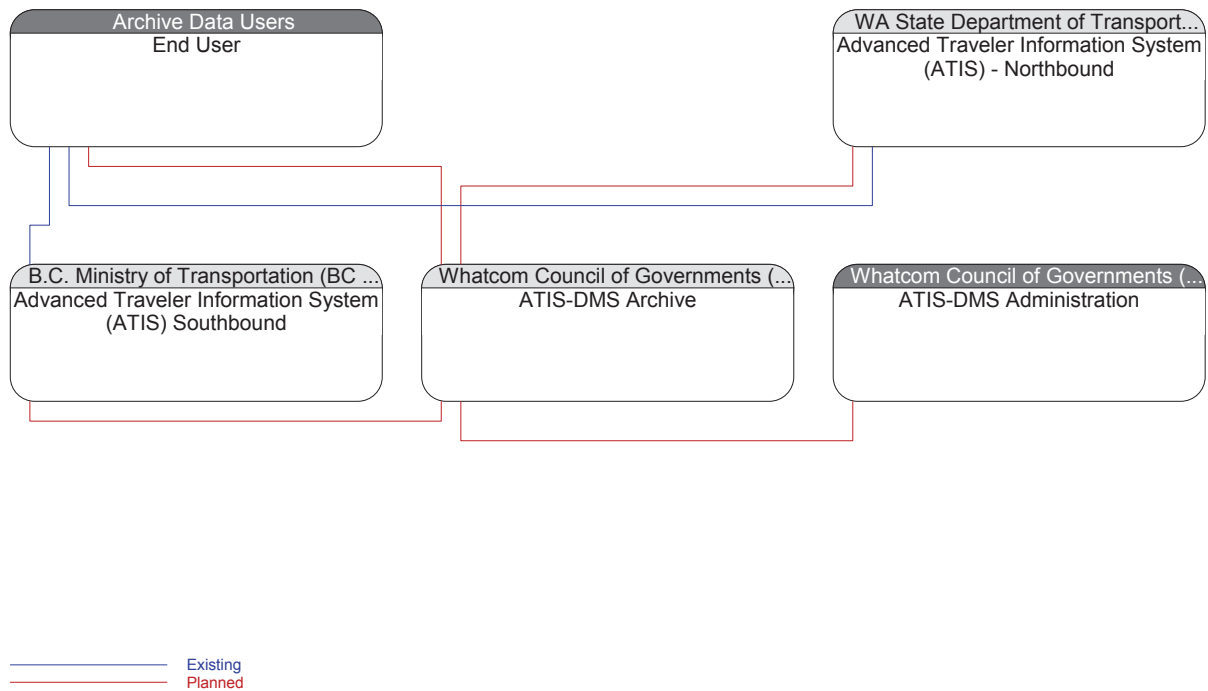


Note:

The centers incorporated in this architecture are highlighted in white. All other grayed out centers are not part of this specific project.

Appendix A

Architecture Diagram 2: ATIS-DMS Interconnects

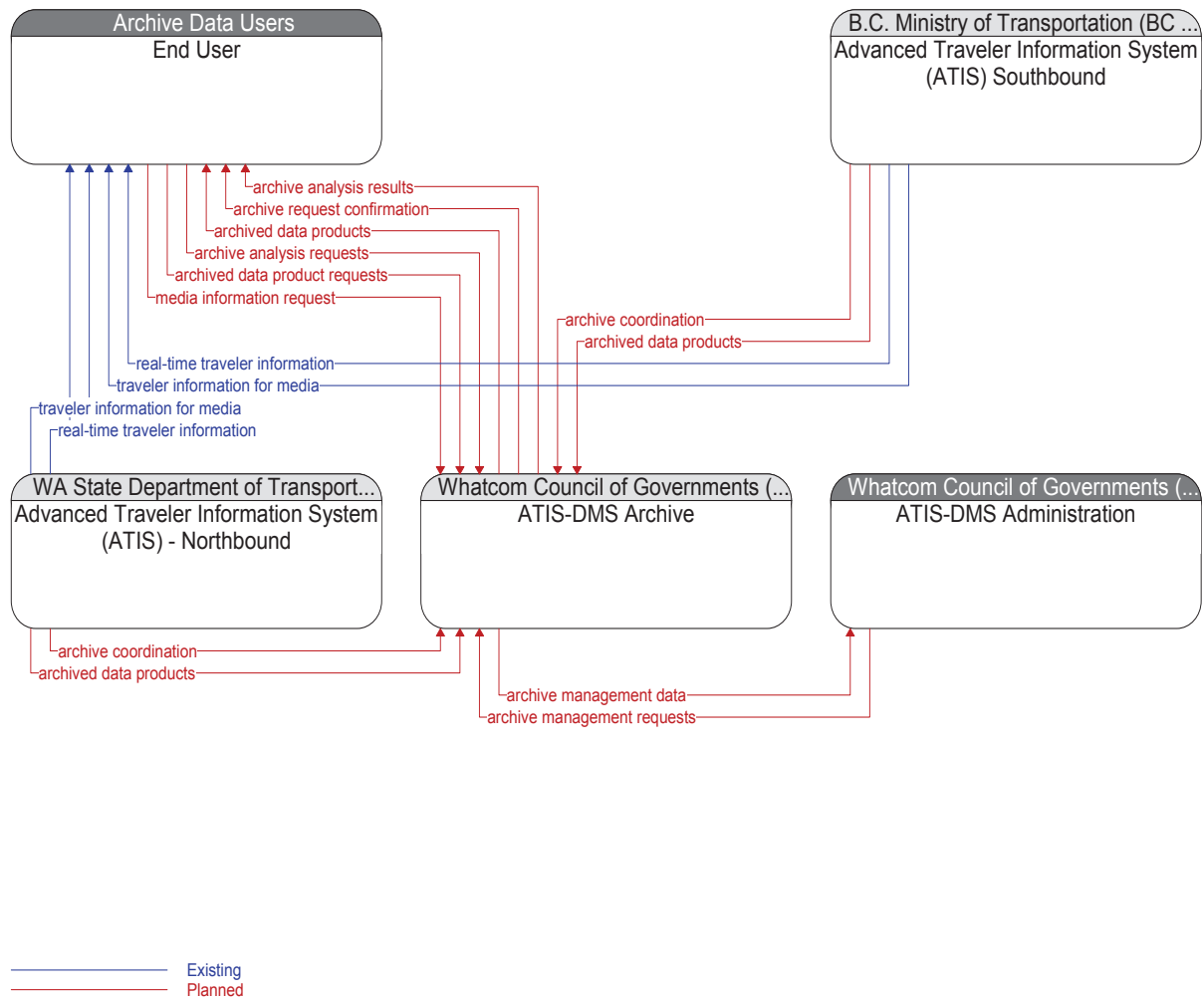


Note:

Gray stakeholders represent elements with a defined function within the architecture. Black stakeholders represent elements without a defined function.

Appendix A

Architecture Diagram 3: ATIS-DMS Architecture Flows



Note:

Gray stakeholders represent elements with a defined function within the architecture. Black stakeholders represent elements without a defined function.

Appendix B

Element Inventory

The following list shows the five identified **elements** (a system, a center, and/or one or more entities that are assigned to a stakeholder) in the ATIS-DMS architecture and their associated stakeholder agency and **entities** (either one of the 22 subsystems or 73 terminators defined in the U.S. National Architecture).

Updated September 20, 2006.

Advanced Traveler Information System (ATIS) - Northbound *Status:* Existing

Description: Northbound ATIS system designed to collect border wait times and provide camera images. This system provides real-time information via the internet and on variable message signs.

Associated Stakeholder: WA State Department of Transportation (WSDOT)

Mapped to the Following Entities: Archived Data Management Subsystem; Information Service Provider

Advanced Traveler Information System (ATIS) Southbound *Status:* Existing

Description: Southbound ATIS system designed to collect border wait times and provide camera images. This system provides real-time information via the internet and on variable message signs.

Associated Stakeholder: B.C. Ministry of Transportation (BC MoT)

Mapped to the Following Entities: Archived Data Management Subsystem; Information Service Provider

ATIS-DMS Administration *Status:* Planned

Associated Stakeholder: Whatcom Council of Governments (WCOG)

Mapped to Entity: Archived Data Administrator

ATIS-DMS Archive *Status:* Planned

Description: Archive of data collected from the northbound and southbound border ATIS systems in the Cascade Gateway

Associated Stakeholder: Whatcom Council of Governments (WCOG)

Mapped to the Following Entities: Archived Data Management Subsystem; Archived Data User Systems; Information Service Provider

End User *Status:* Planned

Description: End user who will use the data from the real-time systems or the archive system; includes inspection agencies, traveling public, and media.

Associated Stakeholder: Archive Data Users

Mapped to the Following Entities: Archived Data User Systems; Driver; Enforcement Agency; Media