British Columbia - Washington State
Cross-Border ATIS Data Management System

Project Report

May 2007

CascadeGatewayData.com

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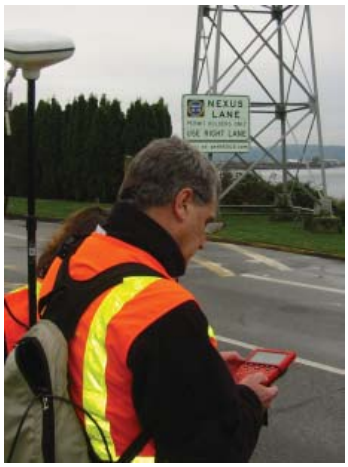
Executive summary

In 2004 The International Mobility and Trade Corridor Project (IMTC) agreed to endorse a binational project to create an archive of the data being collected by the Washington State Department of Transportation (WSDOT) and the British Columbia Ministry of Transportation (BC MoT) to calculate and deliver of dynamic border wait-time reports to drivers via variable message signs (VMS).



That same year, funding was assembled from Transport Canada, BC MoT, and WSDOT to create and operate the ATIS-Data Management System (DMS) archive.

Work on the project commenced in June of 2006. The project was managed by the Whatcom Council of Governments (WCOG), the lead agency of IMTC.

Project milestones included:

- Development of a schema-based standard for organizing the traffic data coming from the Washington and British Columbia systems.
- A GPS inventory of both the state's and province's ATIS system vehicle-detector locations and subsequent development of a cross-system translation table.
- Development of a database with capabilities including automated FTP uploads and interface with an end-user website.
- Development of an archive and data query website – www.CascadeGatewayData.com
- Automation of criteria-based e-mail alerts for U.S. and Canadian federal border inspection agencies.
- Parallel development with the U.S.-Canada Border Information Flow Architecture (BIFA).
- Significant progress towards binational arrangements for ATIS system maintenance.

Continued expansion of cross-border ATIS in the Cascade Gateway region is a high priority for the IMTC. Intended next-steps include instrumentation of other border-crossings in the region (Pacific Highway northbound, Lynden-Aldergrove, and Huntingdon-Sumas). Additionally, the provision of advanced information to commercial vehicle drivers is an IMTC priority. As these initiatives advance, the Data Management System (DMS) is set up to expand, archive these very rich data sources, and make them available to system managers and users.

Acknowledgements

The IMTC coalition has, over the last seven years, assembled several innovative, cross-border projects. This project had some new features. Funding was shared: 50 percent from Transport Canada, 25 percent from BC MoT, and 25 percent from the Washington State Department of Transportation Advanced Technology Branch (TRAC). BC MoT was the managing agency of the Transport Canada funding, WCOG was the managing agency of the WSDOT funding and, WCOG managed delivery of the project itself. The successful delivery of the CascadeGatewayData.com website is a product of many agencies' and individuals' efforts.

The IMTC coalition expressed an interest in archiving ATIS data when the systems were still in design. In 2004, then prospective funding agencies discussed an action plan with WCOG. Key individuals included:

Mimi Sukhdeo, Transport Canada
Pat Cruickshank, BC Ministry of Transportation
Ed McCormack, WSDOT Advanced Technology Branch (TRAC)
Simon Leung, BC Ministry of Transportation

The archive developer (responsible for the data schema, the database, and the website) was **Adam Sanderson** at TRAC. Adam's designing, programming, and developing work built on data-formatting work by **Michael Forbis** at WSDOT and the team of **IBI Group** led by **Homayoun Vahidi** in Vancouver. Cross-checking data-management strategies with system structures and ATIS hardware was covered by **Abid Sivic** at BC MoT and **Paul Neel** at WSDOT.

Melissa Miller at WCOG covered the project's relationship to the U.S.-Canada Border Information Flow Architecture; the research, map-checking, loop indexing, geographic positioning, and production of the translation table; and creation of the website's map-based loop interface. **Hugh Conroy** was project manager at WCOG.

The project also benefited from the convention of an advisory committee. The committee included:

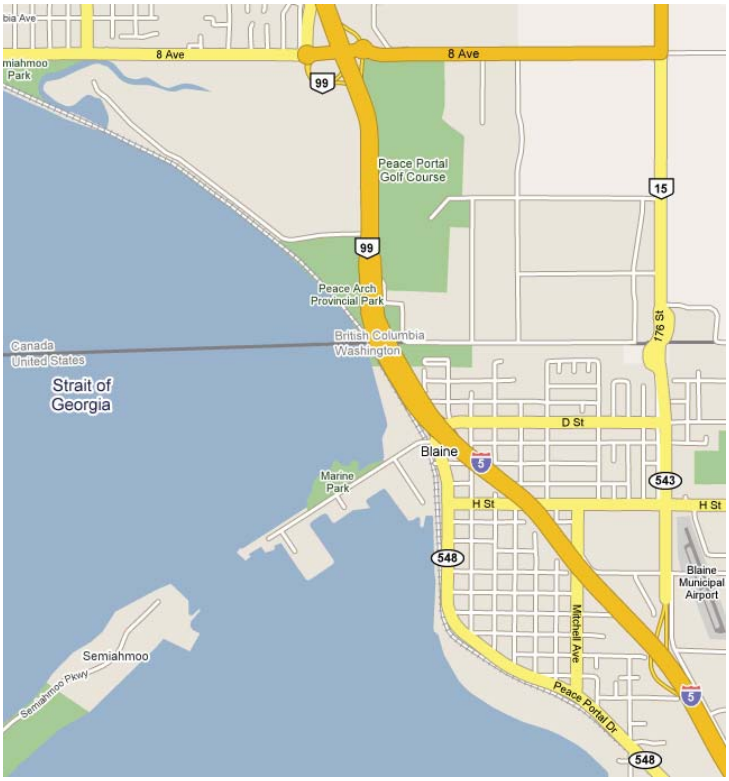
Mike Brower	U.S. Federal Highway Administration
Patrick Cruickshank	BC MoT
Douglas Gourlie	Canada Border Services Agency
Chris Hoff	Transport Canada
Edward McCormack	WA TRAC
Ed Miska	BC MoT
Mark Morse	WSDOT
Paul Neel	WSDOT
James Rector	U.S. Customs & Border Protection
Adam Sanderson	WA TRAC
Abid Sivic	BC MoT
Mimi Sukhdeo	Transport Canada
Homayoun Vahidi	IBI Group

Thanks is of course due to the IMTC coalition for endorsing this project and supporting the overall interagency dialogue this kind of project depends on.

Introduction

In 2003, both the British Columbia Ministry of Transportation (BC MoT) and Washington State Department of Transportation (WSDOT) installed advanced traveler information systems (ATIS) for cross-border drivers at the U.S.-Canada border-crossings at Peace Arch and Pacific Highway.

Figure 1: Map of Project Region



Credit: Google Maps

Coordination of the two ATIS projects through the International Mobility and Trade Corridor project (IMTC) resulted in systems that arranged for maximum cooperation of federal inspection agencies at the border, deployment of compatible technology, and standardized appearance of the information to the traveling public. Real-time system outputs can be viewed on the internet at http://www.wsdot.wa.gov/traffic/border/ for the WSDOT (northbound traffic) system and at http://www.th.gov.bc.ca/ATIS/index.htm for the BC MoT (southbound traffic) system (see **Figures 2 and 3**).

The ATIS Data Management System project

When the two cross-border ATIS systems went live there was a strong interest among IMTC participants in ensuring that the data collected to calculate wait-times was also archived for a variety of purposes. There was no archiving system in place.

Figure 2: Screenshot of the WSDOT Border Traffic Site

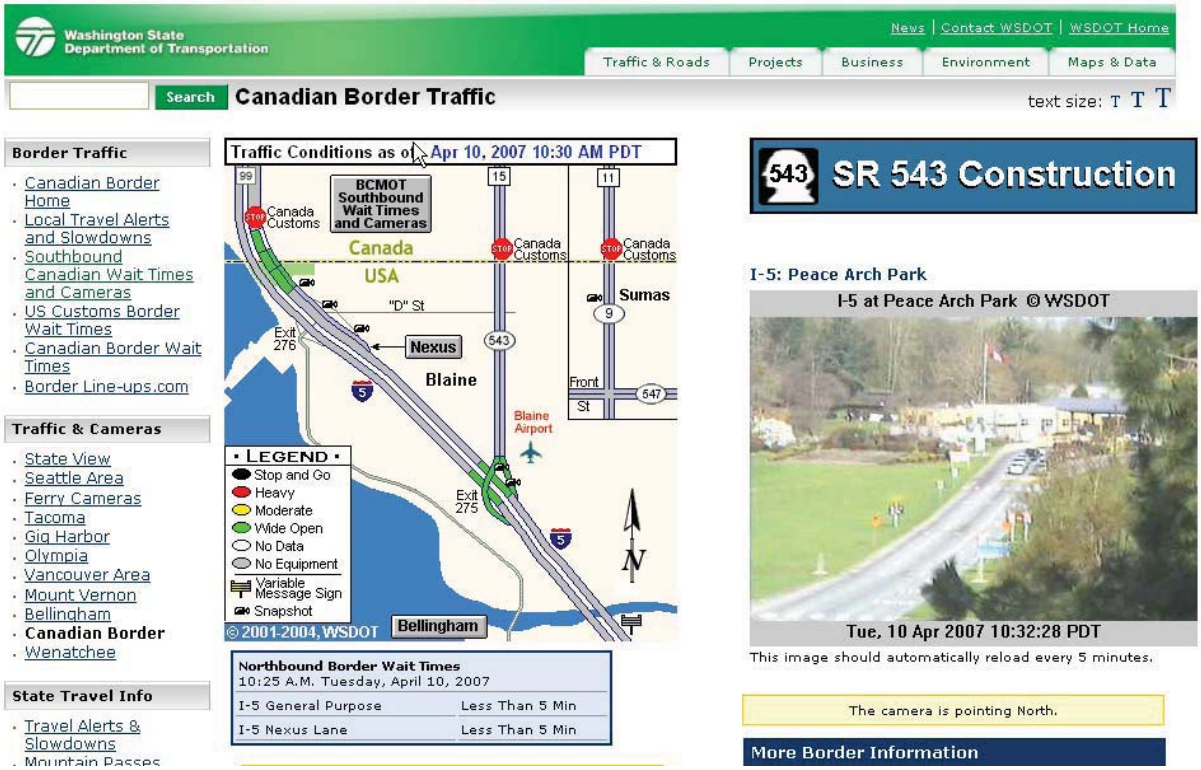
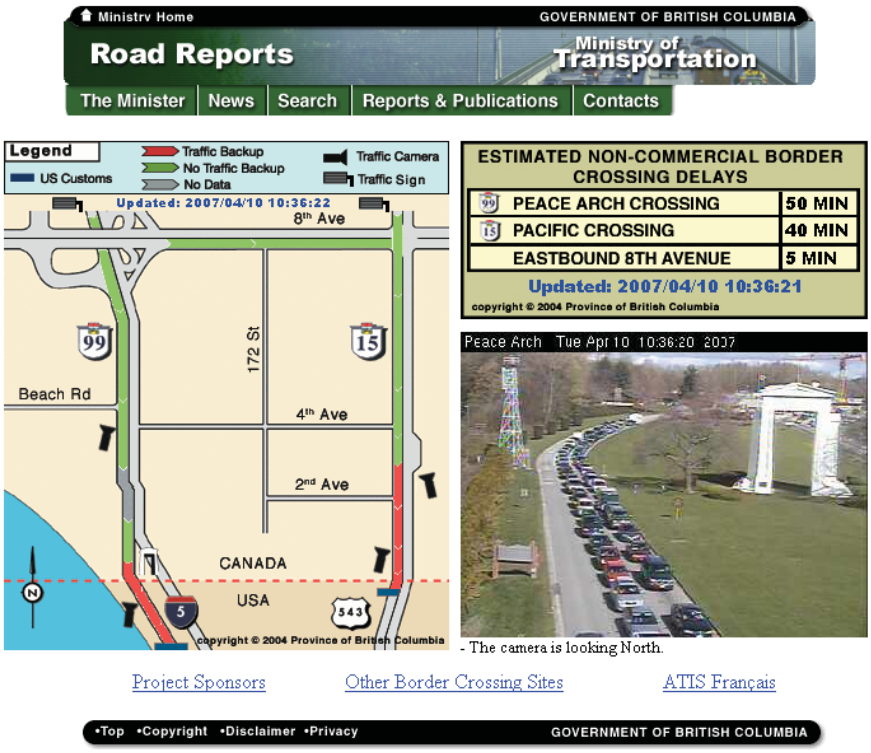


Figure 3: Screenshot of B.C. MOT Border Traffic Site



To address this need, a project scope and work plan (**Appendix A**) was developed by the Whatcom Council of Governments (WCOG), WSDOT, and BC MoT. Upon review, the project was formally adopted by the IMTC Core Group. In September 2004, a proposal (**Appendix B**) was submitted by BC MoT, with partners WCOG and WSDOT, for funding from Transport Canada's Deployment and Integration of Intelligent Transportation Systems program (DIITS) under its Strategic Highway Infrastructure Program (SHIP).

Along with secured funding availability from BC MoT and WSDOT, as well as with in-kind software-engineering arranged with the University of Washington's Transportation Center (TRAC), Transport Canada approved the request for financial contribution.

While funding became available in December 2004, commencement of the project had to wait until June 2005 in order to obtain revisions, review, and approval of funding agreements between WCOG and BC MoT.

This project was managed by the Whatcom Council of Governments.

Purpose of this document

The primary product of the ATIS-DMS project is the data archive itself and the internet-based system that avails this archive to users. The website is CascadeGatewayData.com.

This document offers an overview of how this project was conceived, how it was carried out, the products that have been delivered, lessons learned, and remaining opportunities for improvement.

Work elements

A detailed break-out of tasks and sub-tasks is listed in **Table 1**. Rather than expound on each task or subtask, this section will review the achievement of primary objectives. These are: understanding user needs, integrating data from two systems, developing a database and internet-based interface, and developing an automated report for Canadian and U.S. federal inspection agencies. Other work elements not directly related to capture and delivery of the data include portrayal of the ATIS-DMS system using the newly developed Border Information Flow Architecture (BIFA) and identification and resolution of cross-border institutional issues.

Table 1: Project Tasks and Subtasks

Task 1a: User Requirements
- Develop survey form
- Interviews
- Turbo Architecture
- Task memo
- User Requirements Documentation

Task 1b: Preliminary System Maintenance Planning
- Research & documentation of maintenance scenarios
- Task memo
- Concept of operations & Maintenance Document

Task 2: Data Standardization
- Comparison & evaluation of current output
- Determination of best, common resolution
- Task memo
- System Requirements and Design Document

Task 3: Database & Transfer
- From NB loops to storage
- From SB loops to storage
- DMS database setup
- DMS server setup
- From NB storage to DMS server
- From SB storage to DMS server
- Task memo
- Implementation Document

Task 4a: Internet Report Generator
- Develop list of reports
- Design web page(s)
- Canned reports
- Custom report tool(s)

Task 4b: System Testing
- In-house testing
- User beta testing
- Revisions
- Go live
- Task memo

Task 5: Inspection Agency Reporting
- Evaluation of interest and requirements
- Development of direct reporting
- Other installations or connections
- Task memo

Task 6: Institutional Issues
- Turbo Architecture
- Agreements
- Unanticipated issues
- BIFA write-up and documentation
- Task memo

Final Report - & plan for maintenance
- Report writing

Task 8: marketing the information
- Alert to stakeholder users
- Performance evaluation

Evaluating user requirements

To ensure that system-design and implementation was fully informed by the expectations of project supporters and the community of expected users, extensive outreach was conducted. A technical memo outlining this part of the project, including stakeholder surveys and summaries of user expectations is attached as **Appendix C**. An extracted list of current activities that interviewees reported they would support with data from the ATIS-DMS archive is inserted as **Table 2** below.

Table 2: Current Applications for Border Traffic Data

System or program evaluation
Operational modifications
Incident analyses (i.e. border closures)
Traffic management
Historical wait-times made available to the public
Traffic data collection
Policy making
Program evaluation
Business case development and cost-benefit analyses
Studies
Traffic and economic modeling efforts
Travel projections
Origin-destination analyses
Traveler and tourism information
Freight operations analysis
Land use and access planning
Service feasibility/market analysis for passenger rail
Port-of-entry facility expansion planning
Business planning
Measuring local system performance by national measures

Data integration

While the WSDOT border ATIS and the BC MoT border ATIS use similar equipment and similar methodologies to calculate wait times and deliver real-time border-delay information to drivers, the data products obtainable from each are not, in their raw form, compatible for blending.

After gaining assurances from both WSDOT and BC MoT that they were equally interested in developing a common data-export format, discussions were initiated among the key system operators to begin designing a data-batching and export procedure. This process was begun and completed using an Extensible Markup Language (XML) schema. A copy of the finalized schema is attached as **Appendix D**.

The schema helps the data transfer process in two ways: by clarifying the intention of the transferred data fields, and by defining an agreed upon structure for the XML

documents. The schema documents conventions associated with measurement units, lane numbering, and other issues such as time and date formatting. The structural portion of the schema identifies how the records are assembled, and defines the pieces of data which are required. This allows developers to ensure that the data they are sending conforms to what is expected.

GPS device inventory

Because the DMS archive is blending data produced by two separate systems, it was decided to develop and maintain a translation-table that provides WSDOT, BC MoT, and WCOG with a GPS-based identification of each loop-detector in the two systems along with the names assigned by each agency, lane characteristics, etc. The translation table is attached as **Appendix E**. Maps showing the location of the loop detectors are attached as **Appendix F**.

With the assistance of WSDOT Professional Land Surveyor Jim Van Parys, WCOG joined with WSDOT and BC MoT systems engineers to survey and record exact geographic coordinates of all traffic detectors (loops) used in the two, cross-border ATIS systems.

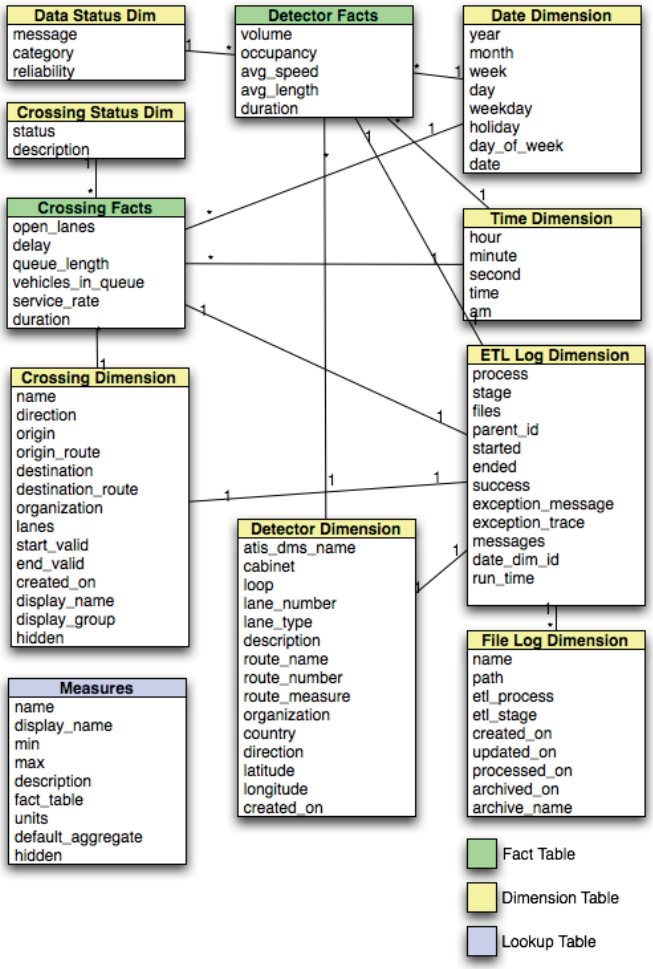
Figure 4: Collecting GPS Data for Loop Detectors

Database development

Since the DMS consists of fairly static data, which is continually being appended to, a data warehousing approach was taken for both the structure and the process.

The database is designed to fit a star schema. Facts or measurements lie in one set of tables and dimensional information or the context for those facts are in a separate set of tables. This structure allows the data to be easily queried, and provides a framework for the addition of future types of data (see **Figure 5**).

Figure 5: Database Overview



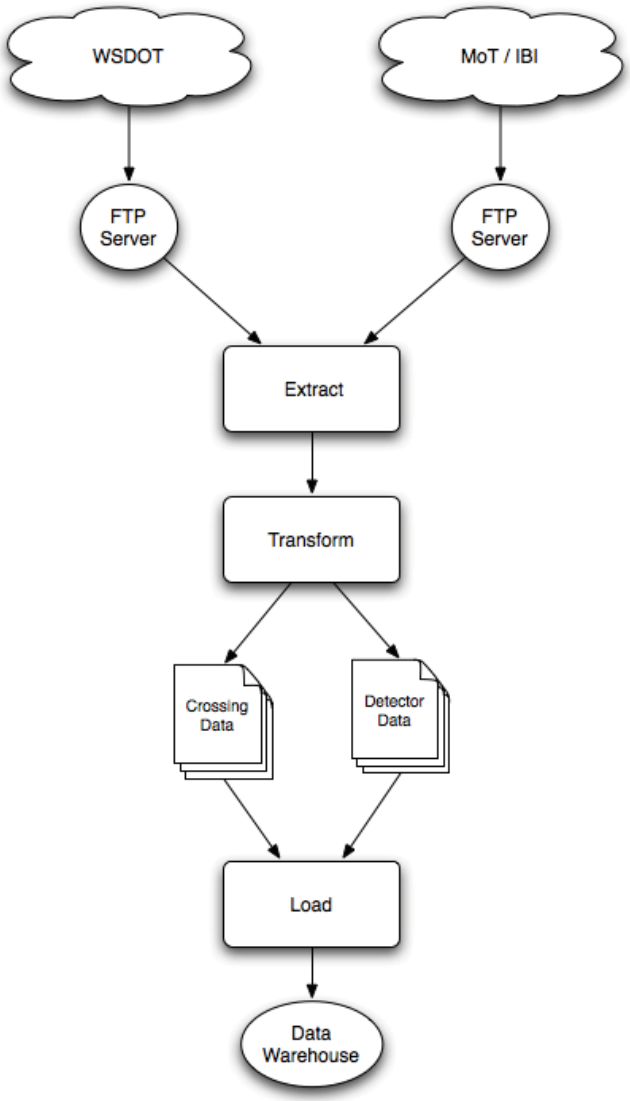
Chosen system, software, structure & platform

The ATIS-DMS system was built with flexibility and scalability in mind. The extract-transform-load (ETL) process and the front end web interface were built on top of "Ruby on Rails". This was all backed by a PostgreSQL database. The website is served up by an instance of Apache doing load balancing between multiple rails instances. Each of these components is loosely coupled and, as the need grows, may be easily split off to run on separate servers. Through this architecture the ATIS-DMS may be scaled to run on more computers as the amount of data managed increases.

Data acquisition

In order to update the database, an ETL process is used. With the data formatted per the XML schema, the ATIS-DMS server acquires the data over the internet using file transfer protocol (FTP). Batches of data are acquired by the server at least once every hour. Once the data has been extracted, it is transformed into an intermediary format that closely models the schema of the database, creating new references to crossings

Figure 6: Data Transfer Diagram



and detectors as needed. The transformed data is then loaded in bulk into the database. Each stage of this process is given a unique identifier that can be used to track where each piece of data comes from. Every file used in this process is then archived for data integrity checking (see **Figure 6**).

Challenges encountered

The ETL process needed to be built to survive a variety of possible faults and failures. Possible issues involve FTP servers becoming unavailable, loss of connection, and malformed data. If a file fails to be retrieved, the ETL process will simply attempt to access it during the next update cycle. Each agency has agreed to maintain their files for at least twenty-four hours on their respective FTP servers. This means that the ETL process will have an ample chance to retrieve missed files. Each incoming document is

processed in isolation, and each stage it passes through is logged. If a file is malformed, then it is set aside and the failure is logged.

Website development

The ATIS DMS website is a specialized product intended for a relatively small population of users. So, accommodating large volumes of simultaneous users (as is done with the agencies' real-time traveler information sites) was not a defining parameter. The website does contain several specialized functions that did require careful accommodation. These are explained below.

Interactive tools

The site allows users to logically navigate through the vast amount of available data. A basic drilldown approach has been taken. This approach allows a user to zoom in on specific information gaining more detail at each step.

Browsing interface

Data is divided primarily into year, month, and day summaries. At the year and month level, data is displayed in a calendar format to give context to information. This allows a user to identify trends in the data more easily. At the day level, data is portrayed as a series of line charts graphing the requested measurements. A user may also choose to view the data for a month by day of week. This allows the user to identify trends from a different perspective.

The browsing interface creates a flexible environment for inspecting the data. A variety of measurements beyond the default volume and delay may be added or removed from any data display. At each level of detail, one may choose to navigate to the next or previous time period. For instance at the day view, this allows one to check the relative differences between days. One may also select a new border crossing or loop detector to view while maintaining the same set of measurements and date.

Data export

Every level of the ATIS DMS interface allows export of the displayed data as a comma-separated values (CSV) file for use in external applications such as Excel or SPSS. If a user requires information that cannot be obtained through the interface, they may use a special advanced query interface. Advanced queries allow specification of date ranges, various groupings of data by time, date, direction, and location. The queried data may then be either previewed in HTML or exported to CSV for use in an external application.

Browser compatibility

The web interface has been developed and tested on a variety of web browsers so as to ensure that the site displays well on most applications. JavaScript is used sparingly,

and only required for the charts displayed for particular days. As the site is used more, and feedback is gathered, efforts to ensure that the site displays well on all common browsers will continue.

Website statistics

The website statistic tool Google Analytics has been incorporated into the site to allow website administrators to collect data on the number of visits to the site, which pages and features are most frequently used, and how website users are finding the website. A sample of the types of data reporting available with this tool is attached as **Appendix M**.

Website user guide

To help new users gain familiarity with the CascadeGatewayData.com website, WCOG assembled a user guide. The user guide will be available on the website. It is attached as **Appendix G.**

Automatic reports for inspection agencies

Discussions with both U.S. and Canadian border inspection agencies confirmed that management at each port-of-entry is required to give ongoing vehicle wait-time measures to their respective headquarters. In addition, both agencies are required to file additional information explaining the cause of delays that exceed set performance-goals.

To help provide consistent and accurate information in support of these reporting requirements, U.S. Customs and Border Protection (CBP) and Canada Border Service Agency (CBSA) indicated that they would be interested in an automatic report that would be sent when the wait time exceeded a set threshold.

An e-mail function was developed that sends registered individuals an hourly report for the specified (location & direction) crossing whenever that user's specified wait-time has been exceeded. An example of both the account-setup screen and a report generated when conditions are met, are attached as **Appendix H**.

Compatibility with the U.S.-Canada Border Information Flow Architecture (BIFA)

Background on BIFA is attached as **Appendix I**.

The development of the ATIS Data Management System and the BIFA were almost concurrent. Knowing what the BIFA effort was setting out to accomplish, it was a stated goal of the DMS project proposal to use the BIFA template to 1) portray a project-architecture for the DMS project and 2) illustrate how the ATIS and the ATIS-DMS would be portrayed in a cross-border, regional ITS architecture.

WCOG is active on both the U.S. Canada Transportation Border Working Group (TBWG) and on the TBWG's BIFA Subcommittee. Through this involvement, we were able to participate in, and closely track BIFA development. As the BIFA product was finalized, documented, and additionally rendered in the Turbo Architecture database software format, WCOG obtained Turbo Architecture in order to maximize our application of BIFA to DMS.

DMS project architecture within the BIFA

The finalized project architecture was developed using Turbo Architecture and is compatible with the Whatcom County Regional Architecture, which is being developed using the BIFA template. However, the final project architecture did not use the BIFA template itself, due to the size of the BIFA template and the relatively limited-scope architecture for this project.

The project architecture is attached as **Appendix J**.

Cross-border institutional issues

Installing the hardware for the cross-border ATIS systems (2002-2004) required a lot of work obtaining permits and clearances from a variety of agencies and authorities. Given these previous experiences and the number of agencies involved with this project, resources were dedicated early to working on institutional issues.

The institutional issues that required attention for completion of this project included approval of cross-border funding agreements, agreement on data-standards between WA & BC, and, commanding the bulk of attention, identification of standard accommodations for maintenance of ATIS system hardware that crosses the border.

Cross-border funding agreements

In preparation for WA-BC cost-shared projects in 2002 and 2003, state and provincial attorneys approved and used a participation memorandum. It was assumed by parties to this project that the same form would be accepted. This was not the case. The legal office opted to write a new memorandum. This resulted in an unexpected delay of several months.

Data reporting standards

As mentioned earlier in this report, the ATIS DMS archive is built from data defined by an XML schema and transmitted via FTP. Before the schema could be agreed to, both BC MoT and WSDOT had to synchronize more basic things like device naming, labels for information, lane-numbering standards, etc. The application of an international standard was proposed by BC. Adherence to the Institute of Transportation Engineers' Traffic Management Data Dictionary (TMDD) was agreed to with some modification since TMDD did not have any specific treatment of border-crossings as a traffic environment.

Cross-border ITS systems maintenance

Early in the ATIS-DMS project, one of the controllers for the BC traffic stations at the border had an electrical malfunction and was damaged beyond repair. This was the first significant hardware maintenance issue since installation. And, because both the BC and WA border ATIS systems' hardware extends a moderate distance into the other country, this was the first time that the issue of worker-access had come up. For the near term, discussions with local United States and Canadian border officials have been successful in gaining worker-access for ITS system maintenance on a case-by-case basis. However, because the BC MoT and WSDOT, and CBP and CBSA expect that more such cross-border systems will be installed in the coming years, there is strong mutual interest in researching this issue more and soliciting a standardized, long-term accommodation.

As an intermediary step, BC MoT, WSDOT, and WCOG drafted a maintenance agreement **(Appendix K)** under which BC and WA assure each other that they will maintain their respective border ATIS systems (including portions that extend into the other country), coordinate with inspection agencies when the need to work near those facilities arises, and secure any needed permits from the international boundary commission.

At the time of this writing, an alternative maintenance approach is also being evaluated—one in which WSDOT would agree to conduct needed repairs on all system components in WA (including those owned by BC MoT) and visa versa.

Continued work on this issue has covered a few specific areas. First, WCOG conducted a series of conference calls with area management of WSDOT, BC MoT, US Customs and Border Protection, and Canada Border Services Agency. These discussions reviewed the type of access needed, produced the interim solution mentioned above, and concluded that documenting the situation for review by inspection agency headquarters was an appropriate next step. Copies of the aforementioned draft-agreement have been submitted for this purpose. A (currently draft) arrangement for cross-border maintenance is attached as **Appendix K.**

Secondly, research was conducted on how existing Canadian and U.S. federal law, as well as Washington state and British Columbia provincial laws, might already support accommodation of the needed access to cross-border ITS hardware by state and provincial work-forces. Supportive legislation exists. A report on the results of this research is attached as **Appendix L**.

Late changes to the system

With the CascadeGatewayData.com website completed, there was time for WCOG, WSDOT, BC MoT, TRAC, and system stakeholders to use the products and review results. Over the last couple of months, many small fixes have been completed by TRAC, developer of the software and database structure.

NEXUS, truck, and bus data

Both the northbound and southbound border ATIS systems have installed vehicle-detectors in the NEXUS lanes. However the NEXUS lane (expedited, pre-approved travelers) doesn't typically queue, and will certainly have a different delay-profile from the traffic using the regular, primary lanes. Therefore, both systems keep the NEXUS traffic separate from the ongoing counts and rates used to calculate real-time delay information (which wouldn't apply to a car arriving to use the NEXUS lane).

However, statistics compiled in the ATIS-DMS include summaries of total vehicle volume at the specific port-of-entry. For this measure, it is important to know what the overall-volume is as well as what the ratio of NEXUS to non-NEXUS traffic is. In response, changes were made to the system so that count data from specified, NEXUS-lane detectors are used to capture and compile the NEXUS-lane volumes so that overall volume numbers for the whole crossing are complete and available.

The southbound system at Pacific Highway also includes vehicle-detector stations in the truck-lanes and bus-lane. The primary purpose for the border-ATIS is to ensure that these volumes are subtracted from the overall volume so that only the passenger vehicles (car) count is used to calculate wait-times. However, these data may also have numerous uses for the ATIS-DMS stakeholders and so are separately compiled and availed on the CascadeGatewayData.com website.

Adjacent vehicle detector stations

WSDOT has additional detectors on northbound Interstate 5 very close to the border. These loops will be added to the ATIS system.

Weigh-In-Motion (WIM) devices

While both WSDOT and BC MoT have adopted weigh-in-motion (WIM) technology for portions of their commercial-vehicle-enforcement programs, there are installations of non-enforcement-grade WIM devices very close to the Pacific Highway port-of-entry.

On BC Highway 15, there is a piezo WIM device stretching across all lanes of traffic just south of 4th Ave.

This device captures base data on volume, weight, and vehicle classification. It was installed by Transport Canada for the 2006 National Roadside Survey. Ownership was subsequently transferred to BC MoT. BC MoT has agreed to avail this data for inclusion in the DMS. This change will occur as an enhancement in the near future.

WSDOT's Advanced Technology Branch also has a piezo WIM installed on U.S. Interstate 5, just south of the exit to SR 543 (access to the Pacific Highway truck border crossing). As cabling and electrification of this station is completed, data from this site will also be available to the DMS archive.

Summary

In 2004 The International Mobility and Trade Corridor Project (IMTC) agreed to endorse a binational project to create an archive of the data being collected by WSDOT and BC MoT to enable the delivery of dynamic border wait-time reports to variable message signs (VMS).

That same year, funding was assembled from Transport Canada, BC MoT, and WSDOT to create and operate the ATIS-Data Management System (DMS).

Work on the project commenced in June of 2006. The project was managed by the Whatcom Council of Governments (WCOG) the lead agency of IMTC.

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- Development of a schema-based standard for organizing the traffic data coming from the Washington and British Columbia systems.
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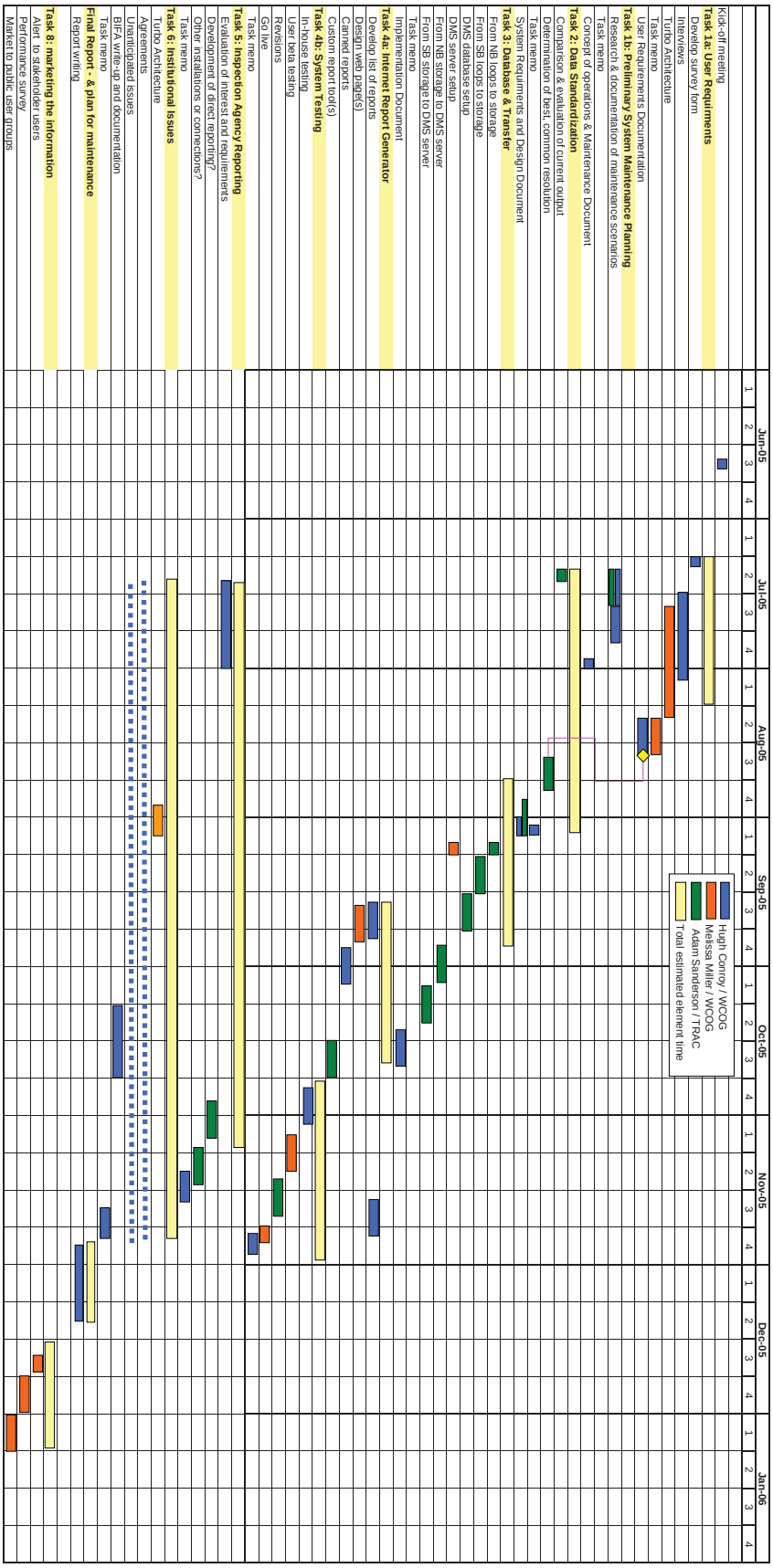
- Development of a database with capabilities including automated FTP uploads and interface with an end-user website.
- Website development – CascadeGatewayData.com
- Automatically generated e-mail alerts for U.S. and Canadian federal border inspection agencies.
- Parallel development with the U.S.-Canada Border Information Flow Architecture (BIFA).
- Significant progress towards binational arrangements for ATIS system maintenance.

Continued expansion of cross-border ATIS in the Cascade Gateway region is a high priority for the IMTC. Intended next-steps include instrumentation of other border-crossings in the region (Pacific Highway northbound, Lynden-Aldergrove, and Huntingdon-Sumas). Additionally, the provision of advanced information to commercial vehicle drivers is an IMTC priority. As these initiatives advance, the Data Management System (DMS) will be ready to archive and organize these new data sources.

Appendix A: Project Work Plan



1 Cascade Border ATIS Data Management System

This project is an integrated approach to deploy an Advanced Traveller Information System (ATIS) Data Management System to archive and disseminate traffic-flow information and data to agencies from both Canada and United States. This project involves software development (database management, web site development, etc.) and will include identification of user-needs and satisfaction of institutional requirements (i.e. data-sharing agreements, MOUs, etc.)

The project will provide a new, powerful decision-making tool for motorists, building on the existing northbound ATIS system (along Washington State I-5 corridor) and southbound ATIS system (along BC Highway 99 and Highway 15 corridors). The ATIS Data Management System will make the most of an unprecedented opportunity to collect and apply an important data archive on cross-border travel demand and traffic flow. This project will be in full compliance with the ITS Plan for Canada, the BC ITS Strategic Plan and ITS architecture in U.S.

1.1 Background

Geographically, this project proposal pertains to two Canada-U.S. highway ports-of-entry (border crossings): the Peace Arch (Douglas, BC-Blaine, WA) border crossing and the Pacific Highway (Surrey, BC-Blaine, WA) border crossing. These two crossings are only separated by 1.6 kilometres. The Peace Arch and Pacific Highway are the 4th and 5th busiest passenger-vehicle crossings respectively on the Canada-US border. Pacific Highway is the 5th busiest truck crossing (Peace Arch is exclusively dedicated to passenger-vehicles by both countries). In the Pacific Region they are the two busiest border crossings, together processing 50 percent of cross-border passenger traffic and over 75 percent of cross-border truck traffic.

The Peace Arch and Pacific Highway crossings have a significant variation in travel demand by time of day and day of week. Although these border facilities are close together, there can be significant congestion at one crossing while minimal delay at the other. This situation could be minimized if motorists approaching these facilities had information as to which location has the shorter wait-time. This would enable drivers to choose the less-congested facility.

In the late 1990s, the Washington State Department of Transportation (WSDOT) began developing a system to do exactly that – measure wait times at the two crossings and deliver this information to motorists in advance of the decision point between the two routes. This system has been commonly referred to as the cross-border advanced traveller information system—ATIS. This project, for northbound travellers, is funded by the Washington State.

In 2000, with WSDOT's ATIS project in advanced stages of planning, the International Mobility and Trade Corridor Project[1] (IMTC) identified as a project priority the

[1] The International Mobility and Trade Corridor Project (IMTC) is a bi-national planning coalition focused on coordinating planning, funding, and project delivery of improvements to the regional, cross-border transportation and inspection systems. More information on IMTC is available at www.wcog.org/imtc.

development of a southbound cross-border ATIS to be installed by the British Columbia Ministry of Transportation (BC MoT). The shared objective of both systems is to increase productivity of the regional cross-border system by optimally distributing travel demand among the available inspection-agency resources at proximate crossing locations on this high-volume trade corridor. Commitment to a southbound ATIS system would not only double the regional system benefits but also ensure that this major international gateway is coherently served in both directions by a common system. These two deployments, both of which are today in final stages of deployment (BC MoT's southbound system went live on June 7), are described more below. For both WSDOT's and BC MoT's ATIS projects, the bi-national IMTC Project has played a key role in ensuring that 1) the two systems will generate matching output for motorists and 2) that the multitude of agencies with responsibility for border-crossing facilities (inspection, transportation, boundary authorities, parks, etc.) were informed of and permitted the installation and cross-border connections of the information-technology hardware that makes up the ATIS.

1.1.1 Northbound Cross-border ATIS - WSDOT

For northbound cross-border travelers, the traffic volumes and wait-times that must be calculated for the ATIS are those approaching the Canada Border Services Agency (CBSA) inspection facilities. The two U.S. highways approaching these crossings are U.S. Interstate I-5 for Peace Arch and Washington State Route (SR) 543 for Pacific Highway. SR 543 is a short route that connects to I-5 1.5 kilometres south of the border. WSDOT has installed a changeable message sign south of this interchange which will be used to inform northbound drivers of the relative border wait-times ahead.

As part of other related ITS projects in Washington State, WSDOT has also installed traffic cameras for these two crossings. They can be viewed online at http://www.wsdot.wa.gov/regions/northwest/traffic/BorderCams/

1.1.2 Southbound Cross-border ATIS – BC MoT

For southbound cross-border travellers, the traffic volumes and wait-times that must be calculated for the ATIS are those approaching the U.S. Customs and Border Protection (CBP) inspection facilities. The two Canadian highways approaching these crossings are BC Highway 99 for Peace Arch and BC Highway 15 for Pacific Highway. 1.6 kilometres north of the border, these two routes are connected by 8th Avenue in Surrey, B.C. In contrast to the northbound system, the route configuration for southbound ATIS has required BC MoT to install one changeable message sign on each approach route in advance of 8th Avenue. The BC MoT system also uses AVI pre-recorded telephone messages and an Internet website: http://www.th.gov.bc.ca/ATIS/index.htm

In recognizing the importance of the Border ATIS project, different levels of government from both sides of the border have jointly funded the southbound project, they are:

- Transport Canada (TC)
- Western Economic Diversification Canada (WED)
- Canada Border Services Agency (CBSA)
- U.S. Federal Highway Administration (FHWA)
- BC Ministry of Transportation (BC MOT)

1.1.3 History of Federal Funding

Due to the bi-national nature of this project and the coordinated, multi-agency funding partnership developed through the IMTC Project, $730,000 (CDN) of U.S. Federal Highway Administration (FHWA) funds were made available from the Coordinated Border Infrastructure Program. The overall cost of deployment for this project is estimated at $2.5 million. The following are the other Canadian Federal funding sources that are committed to the project:

- Transport Canada committed $300,000 towards the border ATIS project under the Strategic Highway Infrastructure Program (SHIP) – Border Crossing Transportation Initiatives (BCTI).
- Western Economic Diversification Canada committed $395,000 for the project
- Canadian Border Services Agency committed $170,000 for the project.

The Province of BC is responsible for the remaining cost of the project, estimated at approximately $904,000.

1.1.4 Summary of ATIS technology

Both the southbound and the northbound ATIS system are using the same method to calculate cross-border wait-times. Border waits start at the federal inspection primary booth where all auto travelers must stop and apply for admission to the country they are entering. Starting at this location and moving back along the border approach road, BC MoT and WSDOT have embedded induction loops in the roadway at appropriate intervals to a point beyond the end of peak-period backups. Loops are installed for each existing inspection booth and for each border-approach lane. Depending on the "footprint" of waiting vehicles at any given time, software has been written to use the loops to perform ongoing queuing analyses for each border crossing. The array of loops provides the system with an ongoing data stream including: the number of inspection booths open, the average inspection time, and the arrival rate of vehicles. The system in turn calculates information including: the estimated number of vehicles in the system (currently waiting to cross), and the estimated total time required for the next-arriving vehicle to cross all the way through (the information posted on the changeable message signs).

1.2 Problem Statement

In addition to providing a new, powerful decision-making tool for motorists, these ATIS systems provide an unprecedented opportunity to collect and manage an important data archive on cross-border travel demand and traffic flow. Ensuring that this opportunity is acted upon with a coordinated, bi-national, multi-agency program is the subject of the scope-of-work presented here. Based on discussions among involved agencies, it is anticipated that numerous agencies could use historical ATIS data to inform such activities as transportation system performance measurement and planning, trip planning, and improved operational modeling for border facilities. To build on the success of the two border ATIS systems, this project is an integrated approach to deploy an ATIS Data Management System with traffic flow information dissemination and data archive capabilities to be used by agencies from both countries.

1.3 Project Scope

The proposed ATIS Data Management System involves the development of a program for archiving and processing cross-border ATIS data. This project has been discussed within the IMTC coalition and has enjoyed support from road authorities, border agencies, local government, and other stakeholders from both countries. Subsequent to initial discussions, the IMTC Core group (the coalition's decision-making body) agreed to formally endorse the ATIS Data Management System initiative. Local project partners include BC Ministry of Transportation (BC MOT), Washington State Department of Transportation (WSDOT), and the Whatcom Council of Governments (WCOG). The project team is including this project in the proposal package for funding consideration by Transport Canada under the TC/BC Bilateral ITS General Deployment.

1.3.1 Project Objective and Scope

This project is the initial ITS deployment of the ATIS Data Management System. WCOG will host the ATIS data archive and the related IT on its server and website (www.wcog.org). The project is divided into six elements as detailed in the following sections. The on-going maintenance and operation of the system will be the responsibility of local agencies, and therefore not part of this scope.

Element 1: Identification of users, user-requirements, and architecture

With the expected data outputs of the ATIS system generally understood, this work-element will involve interviews with a comprehensive set of potential ATIS-data users to 1) discuss data needs, 2) identify and document which data needs can be met with ATIS data products, and 3) document required data resolutions and formats. Additionally, this work-element will include document-review and consultations to ensure that subsequent work on and delivery of the ATIS Data Management System is accordant with the ITS architectures of affected jurisdictions. This will include consultations with Transport Canada and the U.S. Federal Highway Administration regarding the development, under the auspices of the U.S.-Canada Transportation Border Working Group (TBWG), of the Border Information Flow Architecture (BIFA).

Element 2: Expedited software integration

While both the northbound and southbound systems are using the same hardware (loops, boxes, vms, etc.), the software and device-reporting routines being used are being/have been independently developed. This work-element involves development, and integration of matching reporting structure for the northbound system (WSDOT) as has been deployed for the southbound system (BC MoT). This work includes any software needed to generate a blended data-output from both systems.

Element 3: Database and data transfer development

With both systems able to produce matching output for each border-crossing (by direction), this work-element will develop the means by which daily data-flows from the ATIS are saved to a common repository. This is a two-step work-element. Element 3A will set up the database structure for archiving daily output. Element 3B will develop the means by which the daily-outputs are transferred to the common repository. This could

be done inexpensively with periodic downloads to CD ROM and delivery to WCOG or more seamlessly via the Internet. The later is preferred.

Element 4: Internet-based report generator

With a unified database of regional, bi-directional ATIS data archives in place, this work-element will develop an internet-based user interface that will allow users to extract information in report form—both static reports and reports based on custom queries. Access to types of data and level of detail may vary across different user-types (general public, agencies, etc.). Strong interest has already been noted from BC MoT and WSDOT in "cross-linking" resulting trip-planning tools on their respective trip-planning websites.

Element 5: Direct, inspection-agency reporting

There is potential that a dedicated line of access to the data would be of interest to inspection agencies for internet-based, real-time observation of queuing patterns, real-time reporting of wait-times, etc. This element would develop this functionality.

Element 6: Institutional issues

This element acknowledges that unforeseen, issues might arise and will need to be resolved. Based on past work between the above named agencies towards building the cross-border ATIS, the ATIS Data Management System initiative is likely to encounter the need for developing agreements for such activities as data-sharing, linking with existing, federal-level websites, etc.

1.4 Project Justification

1.4.1 Complement the Border ATIS Deployment Partnership

The project proposed here, the ATIS Data Management System, is a mechanism to complement the primary, real-time applications of the ATIS by archiving its data outputs for a variety of planning, analytical, modeling, and trip-planning applications. Like the ATIS being deployed for auto travellers at Peace Arch and Pacific Highway, there are other regional projects and initiatives that promise additional opportunities for derivative data archiving and development of information and analytic tools which could be added into the Data Management System. These regional projects include the following:

- **BC MOT:** Intended next-phase development of ATIS to provide wait-time calculations for commercial vehicles.
- **WSDOT:** The WSDOT Advanced Technology Branch has a proposal before US FHWA to develop commercial vehicle traveller-information tools though installation of additional, higher-functioning sensors and secondary applications of data from the CVISN network, weigh-in-motion devices, and electronic-container seal tracking systems. Development of these applications will involve Canadian partner agencies including BC Ministry of Transportation and Transport Canada.

1.4.2 Consequences of not proceeding

If the proposed border ATIS Data Management System is not implemented, it will negatively impact the effectiveness of the planning, performance measurement,

modeling, system operations, and trip-planning applications outlined above. To not capture this rich flow of data is to forgo the opportunity to end the region's reliance on costly, one-time border-data collection efforts currently used to collect these data.

1.5 Eligibility criteria

1.5.1 Demonstrate Consistency with the Canadian ITS Architecture

As part of the US-Canada Transportation Border Working Group (TBWG) – Border Information Flow Architecture Working Group (BIFAWG), this project has been identified as one of the regional initiatives intended to provide consistency and standardization on data management and information distribution in the region. Transport Canada and the U.S. Federal Highway Administration as well as roads and border agencies will be consulted regarding the development of this project under the auspices of the TBWG - BIFAWG.

The proposed project is linked to User Services, Sub-Services, and Market Packages as defined in the Canadian ITS Architecture, as follows:

Cascade Border ATIS Data Management System:

- Archived Data Management
  - AD2 Archived Data Warehouse
- Route Guidance and Navigation
  - ATIS6 Traffic Estimation and Prediction
- Incident Management
  - ATMS08 Incident Risk Prediction System
- Travel Demand Management
  - ATMS09 Predictive Demand Management

1.5.2 Demonstrate Consistency with the BC ITS Strategic Plan

The border ATIS Project is one of the projects identified in the BC ITS Strategic Plan (ATIS 6.3 Cross Border Traveller Information and INFW 18.2 Provincial Traffic Data Information System).

1.6 Other Supporting Factors

There are other factors in support of the proposed project. This section covers two key areas: Project Integration with Bi-National, Provincial and Regional Authorities, and Sustainable project.

1.6.1 Well-Conceived Project- Integrated with Bi-national, Provincial and Regional Authorities

The ATIS-DMS project was identified as a priority through the bi-national, multi-agency IMTC Project. Responding to initial drafts of the project-concept and positive indication of funding and resources from four agencies from both Canada and the U.S., the IMTC Core Group formally endorsed the DMS project in April 2004. Through this process with the IMTC forum, the DMS project has consensus support from over 15 transportation

and inspection agencies, and non-governmental organizations from the federal, provincial, state, and municipal level.

1.6.2 Sustainable Project

The cross border ATIS is now generating data and information that has, before, only been available from one-time data-collection efforts that are typically expensive and interruptive to inspection operations and traffic-flow. While travellers and border inspection agencies will realize the primary benefits of ATIS, the secondary benefits of making archived ATIS data available to multiple stakeholders from a well-designed database and reporting system will far exceed the costs of system development.

1.7 Project Costs

The following table summarizes the cost breakdown of the proposed ATIS Data Management System:

Budget for Cascade Border ATIS Data Management System

Task	Description	Estimated Cost (US$)	Estimated Cost (Can $)
Element 1	Identification of users, user-requirements and architecture	$10,000	$13,750
Element 2	Data standardization and integration	$40,000	$55,000
Element 3	Database and data transfer development	$35,000	$48,000
Element 4	Internet-based report generator	$30,000	$41,250
Element 5	Direct, inspection-agency reporting	$25,000	$34,350
Element 6	Institutional issues	$20,000	$27,500
TOTAL		**$160,000**	**$220,000**

This project involves stakeholder consultation, software development, and possible networking for specific user requirements. There should be minimal or no environmental impacts associated with the project. However, the project team is prepared to provide an environmental screening report if required.

This project only involves the initial capital investment for software development, database development, data-transfer systems, SQL server software, development of internet-based data query and report-generation tools, and administration of requisite agreements and inter-agency protocols. On-going maintenance and operation of the Data Management System (web site, data storage, reporting tools, data-transfer methods) will be the responsibility of the Whatcom Council of Governments.

This project involves hardware and software development of the Cascade Border ATIS Data Management System. The project does not involve any road constructions, therefore it is expected that no environmental impact or associated mitigation is required with the project. However, if an Environmental Assessment screening report is necessary, the project team will complete one in accordance with the Canadian Environmental Assessment Act.

1.8 Funding Strategy

The total estimated cost for this project is $220,000 Canadian ($160,000 US dollars). The BC Ministry of Transportation and the Washington State Department of Transportation (WSDOT) have each committed $55,000 Canadian funds (total $110,000) toward this project. This proposal is to seek the remaining $110,000 required funding from Transport Canada under the Provincial Bilateral ITS Deployment funding mechanism (as part of the Strategic Highway Infrastructure Program – Intelligent Transportation Systems).

1.8.1 Other resources

The Washington State Transportation Center (TRAC) at the University of Washington has also agreed to avail two months of staff-time to the DMS project. Available TRAC staff will include a software engineer with expertise in data collection from ITS devices, development of transportation databases, and design of internet-based data analysis and reporting tools.

1.8.2 Other Potential or Committed Federal Funding

Beyond the funding already identified for the development of reporting tools for federal inspection agencies, U.S. Customs and Border Protection (US CBP) and Canada Border Services Agency (CBSA) will be welcome to collaborate and/or provide additional funding for expansion of ATIS applications of interest to inspection agencies.

Additionally, data from the ATIS systems should prove extremely useful for continued development and use of border-station simulation models such as CBSA's Can Sim and the U.S. Border Station Partnership Council's Border Wizard simulation models. If integration of these tools with ATIS data sources proves desirable in the context of the ATIS DMS project, additional funding would be sought from other sources including Canadian and U.S. federal inspection agencies.

1.9 Project Deliverables and Timing

This project includes the following deliverables:

- Database
- Internet report generator
- Web links with funding agencies
- Task-related memoranda
- Final report

This project is anticipated to take 12 months to complete. The following is the proposed project timeline.

		2004									2005											2006		
		A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
Requisite external milestones																									
Completion of southbound ATIS				◆																					
Completion of northbound ATIS					◆																				
ATIS DMS project elements																									
1	User requirements								■	■	■														
2	Data standardization								■	■	■														
3	Database and data transfer											■	■	■											
4	Internet report generator														■	■	■	■							
5	Inspection agency reporting								■	■	■				■	■	■	■							
6	Institutional issues								■	■	■	■	■	■	■	■	■	■	■	■	■	■			

1.10 Conclusion

The border ATIS Data Management System will provide a mechanism for effective planning, performance measurement, modeling, system operations, and trip-planning applications. Through a common database and reporting system both British Columbia and Washington State will be able to analyze developing traffic patterns and use that information to work towards mutually beneficial traffic management across the border.

The ATIS Data Management System will also ensure that existing data resources are used to their fullest potential. It will enable the provision of useful information to transportation agencies, border inspection agencies and others. And, it will continue the advancement of agency partnerships and information sharing supported by the project proponents and by numerous policy initiatives including the IMTC Project, the U.S.-Canada Transportation Border Working Group (TBWG), the U.S.-Canada Smart Border Declaration, and each country's adopted ITS architecture.

1.11 Management Strategy

1.11.1 Border ATIS Data Management System

- This project is to be managed and delivered by the Whatcom Council of Governments/IMTC.
- It is proposed that a steering committee be established with representatives from BCMoT, CBSA (Canada Border Services Agency), TC, USCBP (US Customs and Border Protection), WsDoT, WCoG, etc. to ensure participation from border agencies, area stakeholders, and data users on the deployment process and the future utilization of the data system. Consultations with TC at the steering committee and inputs from FHWA would provide tie-in to the Border Information Flow Architecture under the auspices of the U.S.-Canada Transportation Border Working Group.

Excerpt of final, multi-project application submitted by BC MoT to Transport Canada, September, 2004

SCHEDULE B
PROJECT # 2001-XX

CASCADE BORDER ATIS DATA MANAGEMENT SYSTEM
BUDGET FORECAST

(in Canadian $)

(Fiscal year begins on April 1st and ends on March 31st)

	Fiscal year 2004-2005				Fiscal year 2005-2006								
	3rd quarter		4th quarter		1st quarter		2nd quarter		3rd quarter				
EXPENSES	Oct - Dec		Jan - Mar		Apr - June		July- Sept		Oct - Dec		Total		Total
	Cash	Inkind[1]	Cash	Inkind	Cash	Inkind	Cash	Inkind	Cash	Inkind	Cash	Inkind	Contribution
Salaries and benefits (WCOG)	$15,500		$13,800		$11,300		$12,400		$1,800		$54,800	$0	$54,800
Consultants	$37,600		$35,600		$28,800		$23,800		$0		$125,800	$0	$125,800
Material, software	$1,500		$3,100		$4,500		$4,200		$0		$13,300	$0	$13,300
Equipment	$1,100		$3,000		$4,400		$3,900		$0		$12,400	$0	$12,400
Communication costs (consultation with stakeholders/potential system users)	$3,100		$2,000		$700		$800		$300		$6,900	$0	$6,900
Other operating costs (i.e. travel, please specify)	$3,100		$2,000		$700		$800		$200		$6,800	$0	$6,800
Total expenditures	$61,900		$59,500		$50,400		$45,900		$2,300		$220,000	$0	$220,000
REVENUES[2]													
B.C. MoT (25%)	$15,500		$14,800		$12,600		$11,500		$600		$55,000	$0	$55,000
WSDOT ATB (25%)	$15,500		$14,800		$12,600		$11,500		$600		$55,000	$0	$55,000
											$0		$0
											$0		$0
Transport Canada (50%)	$30,900		$29,900		$25,200		$22,900		$1,100		$110,000	$0	$110,000
Total Revenue	$61,900		$59,500		$50,400		$45,900		$2,300		$220,000	$0	$220,000

[1] if in kind contribution not available quarterly please provide total amount

[2] please ensure that you have provided Transport Canada with all letters of commitment for partners contibuting to the project.

Memorandum 1:

Identification of users, user-requirements, and architecture

TO: Advanced Traveler Information Systems Data Management System (ATIS-DMS) Advisory Committee

FROM: Whatcom Council of Governments (WCOG)

DATE: September 9, 2005

RE: Element 1: Identification of users, user-requirements, and architecture

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This technical memorandum describes activities undertaken under element 1 of the Advanced Traveler Information System Data Management System (ATIS-DMS) project scope. The purpose of Element 1's activities has been to develop a comprehensive list of potential ATIS-DMS data users, determine users' needs from the system, and ensure that project products are accordant with the regional ITS architectures.

WCOG began work on Element 1 on June 28, 2005. On all tasks in this first element, WCOG worked closely with the ATIS-DMS project advisory committee to identify potential system users and develop the questionnaire.

1.0 Identification of users

WCOG and the ATIS-DMS advisory committee developed a list of agencies who would most likely use data outputs from ATIS-DMS and who could provide insight into what features and functions were desired. Respondents were also asked to provide additional contacts for further interviewing. Table 1 includes a list of everyone contacted and interviewed.

Potential users were defined as agencies who currently depend on cross-border data to perform required tasks, and agencies whose operations may benefit from additional cross-border traveler information and data.

2.0 User requirements

WCOG conducted 20-minute telephone interviews with all of the listed users. The goal of the interviews was to determine what cross-border data is being used now (and from what source); how the ATIS-DMS data would be used by the responding agency; what benefits or new data applications the ATIS-DMS outputs would provide for; and what format users wanted to see the ATIS-DMS products in.

Table 1 List of Users

Organization		Contact
Transport Canada		
	Pacific Region	Mimi Sukhdeo
	Headquarters Ottawa	Jonathan Sabean
U.S. Federal Highway Administration		
	WA State Division	Michael Brower
	Northern Border Coordinator	Alicia Nolan
	Statewide Planning	Roger Petzold
B.C. Ministry of Transportation		
	Planning	Patrick Cruickshank Andrew Hind
	Operations	Brigid Canil
WA State Department of Transportation		
	Local Area Office	Todd Harrison Tim Hostetler Roger Horton Mike Koidal
	Rail Office	Kirk Fredrickson
	ATIS System	Paul Neel Michael Forbis
Canada Border Services Agency		
	Port Director	Gail Stewart
	Facilities Planning	Georgina Turcotte David Derrick
U.S. Customs & Border Protection		
	Port Director	Jay Brandt James Rector
U.S. General Services Administration		
	Facilities Planning	Mark Howard
Greater Vancouver Transportation Authority		
	Planning	Mike Lai
	ITS	Keenan Kitasaka
Western Washington University		
	Border Policy Research Institute	Don Alper
	Economics	Hart Hodges Paul Storer
Visitor & Information Bureaus		
	Bellingham/Whatcom	John Cooper
	Tourism Vancouver	Sandi Louie
Municipalities		
	City of Surrey, B.C.	Ann Coffin
	City of Blaine, WA	Stephan Banham

A questionnaire was developed by WCOG in coordination with the ATIS-DMS advisory committee which consisted of the following questions:

1. What work of your department is guided by information about cross-border travel demand, changes in cross-border travel-time, or distribution of cross-border travel demand by hour-of-day or day-of-week?
2. What sources and formats of information does your department currently use for the purposes listed above?
3. Understanding the data elements being generated and calculated by the cross-border ATIS systems, it seems like, in general, the following raw data outputs could be processed to form information that your department uses or might consider using.
4. Would the use of any of the listed ATIS data be a preferred alternative to sources that you already use? Please specify.
5. Do you see opportunities for your department to make first-time use of data and information generated by the cross-border ATIS?
6. Would you be interested in commercial vehicle ATIS data?
7. For each of the data applications discussed above, what is the preferable medium for your use?
8. For each of the data applications discussed above, what is the preferable resolution of reporting?
9. For each of the data applications discussed above, what is the preferable frequency of reporting?
10. For each of the data applications discussed above, are there other cross-tabulations of interest?

Additional questions were asked of inspection agency representatives:

11. What real-time and historical data reporting enhancements would further operational objectives?
12. What types of direct network connections to the data and reporting would be of interest (as an alternative to availability on the internet or for real-time information not available on the existing WSDOT and B.C. Ministry of Transportation websites)?

2.1 Survey results

Responses to the above questions were compiled and sent to the WSDOT Advanced Technology Branch for consideration in ATIS-DMS product design. Responses are summarized and described in the following tables. The full text of answers is available in the Appendix.

Table 2 Stakeholder efforts currently using cross-border travel information

- System or program evaluation
- Operational modifications
- Incident analyses (i.e. border closures)
- Traffic management
- Historical wait-times made available to the public
- Traffic data collection
- Policy making
- Program evaluation
- Business case development and cost-benefit analyses
- Studies
- Traffic and economic modeling efforts
- Travel projections
- Origin-destination analyses
- Traveler and tourism information
- Freight operations analysis
- Land use and access planning
- Service feasibility/market analysis for passenger rail
- Port-of-entry facility expansion planning
- Business planning
- Measuring local system performance by national measures

Based on these responses, the ATIS-DMS system should provide users with the ability to access historic wait-time data, generate projections based on these data, and tie ATIS-DMS data results in with other data sources, such as origin-destination information, commodity data, etc.

Table 3 Current data sources

- Traffic loops, traffic counters, and count stations
- Speed meters
- WA State Patrol (for incidents)
- Regional studies
- Origin-destination surveys
- Observation and anecdotes
- CVISN
- Statistics Canada
- U.S. Customs & Border Protection
- U.S. Bureau of Transportation Statistics
- Existing ATIS websites from WSDOT and B.C. Ministry of Transportation
- Amtrak ticketing database

Numerous respondents noted that current data sources do not provide the kind of data they need. Tourism industry professionals commented that most of the information they provide to the traveling public is based on past experience. Transportation agency representatives commented that in the past, wait-time information was based purely on visual assessment by inspection agency staff.

Table 4 Desired outputs

- Car and truck counts (by port-of-entry and direction by time increment)
- Queue length (in feet by port-of-entry and direction by time increment)
- Vehicle at-border wait times (by port-of-entry and direction by time increment)
- Number of primary booths open (by port-of-entry and direction by time increment)
- Accumulated delay (annual hours of delay, average lengths, average vehicle counts, etc.)
- Peak travel time volumes
- Total trip travel time (to identify where the delay occurs, if not at the border)
- Lane utilization (i.e. NEXUS versus non-NEXUS traffic/ FAST versus non-FAST traffic)
- Comparison of data elements above with external factors

In addition to the data outputs requested above, other data elements were asked for but are currently unavailable from the existing ATIS deployments. These include: vehicle classification (although this could potentially come from weigh-in-motion deployments), commodity types, and traveler counts and characteristics.

Respondents were asked whether or not they would use the above outputs in place of existing data sources. Of the eighteen responses received, 89 percent of stakeholders said they would use the ATIS-DMS data over existing sources, predominantly because the existing data sources did not provide the information they were seeking.

Respondents were also asked whether they would make first-time use of information from the ATIS. 84 percent of stakeholders said they would. The other 16 percent responded that they may possibly uses for new information. Suggested first-time uses of the data included:

- The development of neural networks to predict traffic patterns based on how current patterns correlated with archived patterns under the same conditions
- Allow tourism centers to provide travelers with border wait predictions
- Allow transportation agencies to make sub-area traffic planning adjustments based on projections
- The evaluation of system resources based on queue length, processing time, and travel delay
- Ability to model real-time, reactive traffic management.
- Analyze the ATIS system itself, and whether traveler information effectively distributes traffic evenly between crossings
- Provide data for specific events and incidents

- Evaluate how investments improve traffic efficiency
- Respond more quickly to investment opportunities
- Evaluate maintenance programs (such as snow and ice removal).
- Could use to compare wait-times with passenger train statistics.

Respondents were asked whether or not there was an interest in commercial vehicle ATIS data. 72 percent of respondents expressed interest in commercial vehicle data in addition to passenger vehicle data.

Table 5 Preferred medium

- Internet access (static) – regularly updated reports available online
- Internet access (dynamic) – customizable tool to specify dates, modes, locations, etc. and generate a report
- Electronic (PDF, e-mail, other)

There was almost no interest in printed reports. Most wanted to be able to download summaries, or customize data requests using an internet tool. There was also interest in setting up regularly e-mailed reports at a specified frequency.

Several existing data tools were listed as examples, including the WCOG IMTC Cross-Border Travel Study Custom Query Tool and the B.C. Ministry of Transportation B.C. count data tool.

Other features requested by stakeholders include:

- Preset reports that could be automatically e-mailed to users at a specified frequency of reporting (i.e. monthly)
- Regularly posted reports on the internet in PDF or other usable format that could be accessed upon need (i.e. "canned reports")
- Data available in a database format (i.e. Microsoft Access, Oracle) and in a spreadsheet format (i.e. Microsoft Excel)

Table 6 Preferred resolution

- Hourly (32%)
- Weekly (19%)
- Monthly (13%)
- 10 – 30 Minutes (13%)
- Daily (10%)
- 20 Second (6%)
- Annual (3%)
- Peak Travel (3%)

Most respondents wanted the data to be broken into hourly, weekly, and monthly reports. Those requesting data at smaller resolutions (i.e. twenty second data) were more interested in preserving the data at the smallest increment, with the ability to aggregate results into more usable time segments.

Table 7 Preferred frequency of reporting

- Monthly (42%)
- Quarterly (15%)
- Daily (12%)
- Weekly (8%)
- Annually (8%)
- 6 Months (4%)
- Hourly (4%)
- Peak Hourly (4%)
- Special Events (4%)

Almost half of the stakeholders who responded to this question wanted to receive reports on a monthly basis. About 15 percent of the stakeholders wanted the data on a seasonal or quarterly basis. And 12 percent of respondents wanted data to be sent to them or available the next day.

Several stakeholders also expressed interest in trend data.

Table 8 Other cross-tabulations

- Weekday/weekend day
- Direction
- Crossing location
- Lane utilization with external factors
- Seasonal factors and peaking characteristics
- Integration of historical data with real-time data for projections
- Import/export data
- E-seal data
- Cross-referencing weigh-in-motion system data
- Exchange rate
- Price of gas
- Security level
- Trip purpose

Several external factors were mentioned by stakeholders (i.e. border security level, currency exchange rate, construction at the border, etc.). One suggestion was to have several fields in the ATIS-DMS database that would be placeholders for future expansion of the data, allowing the system to pull in these external data if and when they are available.

The weekday/weekend day, direction, crossing location, special events, and lane utilization cross-tabulations are all possible in the existing design for the future northbound and southbound ATIS systems. The other cross-tabulations require data sets outside of the designed ATIS system.

2.2 Inspection agency requirements

WCOG interviewed representatives from Canada Border Services Agency (CBSA) and the U.S. Customs & Border Protection (CBP) in person to discuss specific inspection agency requirements and application opportunities.

Customs & Border Protection (CBP)

CBP currently collects traffic volumes from the primary booth radiation portal monitors and from license plate readers.

Although CBP expressed no interest in a real-time data flow, as they use the B.C. Ministry of Transportation site to report wait times, there was some interest in hourly numbers. CBP is required to send an e-mail to headquarters every hour with the current wait-time. If the wait-time is over sixty minutes, a brief explanation must also be attached.

One idea suggested was a real-time report that would send an e-mail with the average wait-time every hour (and also list, on the same form, the hourly averages for the rest of the twenty-four hour period).

CBP is interested in both static reports and an online dynamic query tool, similar to those discussed by other stakeholders.

Canada Border Services Agency (CBSA)

CBSA is interested in any data available to better serve their mandate. CBSA has wait-time standards that require reporting of average wait times and explanations when standards are not met.

CBSA records traffic volumes and auto passenger residence, trip length, and vehicle occupancy. License plate readers also provide certain aggregate data.

CBSA expressed interest in hourly wait-time reports only. This could include the percentage of time that performance objectives are met, along with summary statistics on NEXUS operations and performance.

CBSA is interested in both static reports and an online dynamic query tool, similar to those discussed by other stakeholders.

WCOG suggested correlating southbound and northbound traffic volumes on a daily basis to look at patterns. CBSA commented that this may be interesting but is not a priority. However, knowing when the peaks occur can influence how CBSA schedules shifts.

3.0 ATIS-DMS in regional architectures

An Intelligent Transportation Systems (ITS) architecture defines how all of the transportation information technology used in a region may be coordinated. The northbound and southbound ATIS systems are already part of the B.C. ITS Architecture and the Whatcom County Regional ITS architecture, and are also listed in the Border Information Flow Architecture being developed by the U.S. and Canadian Transportation Border Working Group (TBWG).

The ATIS-DMS complement to the ATIS projects has not yet been added to these regional architectures, and will need to be included. WCOG is overseeing an effort to update and convert the existing Whatcom County Regional ITS Architecture into Turbo Architecture, an interactive software program that aids transportation planners and system integrators in the development and maintenance of regional and project-specific ITS architectures.

ATIS-DMS project team members in B.C. will work with the ITS Corporation in B.C. to include the ATIS-DMS project in the B.C. Provincial ITS Vision and Strategic Plan.

WCOG is also a participating agency on the TBWG Border Information Flow Architecture working group and will coordinate the project inclusion in the national architecture.

Appendix: Survey Responses

Question	Response	Name	Organization
1. What work in your department is guided by information about cross-border travel?			
	- Share information with the public - Evaluate systems for operational modifications, expansion, etc.	Brigid Canil	B.C. MoT
	- Analyze events, i.e. border closures - Develop operational strategies for known future events. - Upstream traffic management. - Availing historical wait-times to the public and others. - (Other WSDOT offices' uses include traffic office, freight mobility, economic development issues.)	Michael Forbis & Morgan Balogh	WSDOT
	- Policy making - Program evaluation	Jonathan Sabean	Transport Canada
	- Planning studies: congestion, travel volumes, forecasting - Programming: cost-benefit analysis - Making business cases for better service response based on estimated time-costs for individual travel	Pat Cruickshank	BC MoT
	- Traffic volume, classification - Collision data - Also track separately traffic volumes that come in from beyond WA's borders with OR and ID and ferries.	Roger Horton	WSDOT
	- Design of city street improvements - Ramps, APDR work - Information to business who are affected by cross-border travel.	Steve Banham	City of Blaine
	- BPRI currently has a project modeling cross-border travel demand as a function of numerous independent varialbles (exchange rate, wait times, price differentials (cigarettes, clothing, etc.). - Other projects include looking at projections of traffic flows including future patterns associated with special events like the 2010 Olympics and the afternmath. - Also, how border delays related to security measures are related to the volume and nature of cross-border trade flows.	Donald Alper	Western WA University
	- Developing information for drivers, travelers, and other system users: Traveler information, determination of level-of-service	Keenan Kitasaka	GVTA

Question	Response	Name	Organization
1. What work in your department is guided by information about cross-border travel?			
	- One of six FHWA strategic goal areas is titled "Global Connectivity." The strategic objective is to "sustain the economic efficiency of goods movement on the surface transportation system" and it is supported by three strategies: to address state and local users needs (e.g., data, professional capacity building) relative to the challenges of moving freight and passengers more efficiently through our transportation network; to improve U.S. land border crossing efficiency for both passengers and freight; and to improve safety, efficiency, and U. S. trade and business opportunities goals through international road partnerships. - Ultimately, we are interested in travel times on significant freight corridors and delay times for commercial vehicles, pedestrians, bicyclists and passenger vehicles processed at NHS border crossings.	Mike Brower	FHWA
	- Planning for our Douglas community - access to Hwy 15 and 8th Avenue, signalization, etc. However, most of the ATIS data relates to the Provincial road network. Only relates to Surrey when it effects the border community. - Also data useful for dealing with citizen and business complaints to the City of Surrey regarding border back-ups - Analysis of access	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	- Main goal is to communicate to the traveling public information about crossing the border. Projections of what to expect when crossing the border, including wait times and processes. Information is now based on personal experiences, past experiences, and radio reports, although these are often off. Having archived information would be helpful, especially for travelers planning to cross the border around peak travel times such as holidays and special events.	John Cooper	Bellingham/ Whatcom Visitors Bureau
	- This office doesn't collect highway information. Collect cross-border rail passenger ridership information and train delay data.	Kirk Fredrickson	WSDOT
	- Use data for current State Route Projects (i.e. all components of SR 539 improved access, improved I-5/SR 539 access, etc.). Data for developing current numbers and, more importantly, projections. Project-specific need. - There is also a need from the public user perspective. Currently use real-time data but archived data could be used to inform travelling public.	Tim Hostetler	WSDOT
	- Use data for planning the growth of facilities.	Mark Howard	U.S. GSA

Question	Response	Name	Organization
1. What work in your department is guided by information about cross-border travel?			
	- Use cross-border data as input into our regional transportation planning model. These data serve as external inputs for calibrating the model. They are also used to develop future projections. Useful cross-border data include volume counts, vehicle classifications, and commodity data for goods movements.	Mike Lai	GVTA
	- Mostly use word-of-mouth and traveler surveys at the Peace Arch traveler information center to find out how long it is taking people to cross the border, and other border-related travel information. There have been a lot of questions, especially over the last few years, about requirements and expectations for cross-border travel. There are also a lot of questions from convention travelers about bringing business-related goods into Canada.	Sandra Louie	Tourism Vancouver
	- Measuring cross-border traffic characteritics against national-level performance measures; reduced travel time through borders	Alicia Nolan	FHWA
	- Currently use data to determine existing traffic conditions and conduct future traffic pattern analyses, including origin-destination and corridor volume counts. Data is used to evaluate and justify infrastructure planning and improvements.	Mimi Sukhdeo	Transport Canada
	- For border related performance measures, freight and passenger, use this kind of data to measure delay at borders, travel time, and reliability. - Use data like this to develop baselines. - Assess the impact of programs (i.e. electronic manifest)	Roger Petzold	FHWA
	- Planning - Traffic operations - Evaluation of project needs and related and topical considerations - Project scoping & design - Annual publication of volume charts - Construction traffic management strategies and contracting strategies	Todd Harrison	WSDOT
2. What sources of information does your department currently use for the purposes above?			
	- Count stations, speed meters	Brigid Canil	B.C. MoT
	- Information from State Patrol (on incidents).	Michael Forbis & Morgan Balogh	WSDOT
	- Aggregate numbers, mostly annual, from TC's Economic Analysis branch and from Statistics Canada. - Provincial studies. - There is very little data useful for measurement of program benefits.	Jonathan Sabean	Transport Canada

Question	Response	Name	Organization
2. What sources of information does your department currently use for the purposes above?			
	- Traffic loops: permanent & temporary - O&D surveys, personal observation - Commercial surveys, feedback from operators	Pat Cruickshank	B.C. MoT
	- Share information with the public - Automate data collection sites - Some data from CVISN	Roger Horton	WSDOT
	- Share information with the public - DOT loop counters - Reports from WCOG on inspection agency traffic volumes.	Steve Banham	City of Blaine
	- Surveys - Specialized transportation and trade data	Donald Alper	Western WA University
	- N/A	Keenan Kitasaka	GVTA
	- Share information with the public - FHWA has developed a Freight Analysis Framework to provide various freight flow maps for states, modes, and gateways using information available from the Bureau of Transportation Statistics. (FAF data is available at: http://www.ops.fhwa.dot.gov/freight/freight_analysis/index.htm) - However, FHWA also knows that it does not have readily available resources for the travel times on significant freight corridors or for delay times at the border crossings. We are working with the American Transportation Research Institute (ATRI) to develop such resources, but they have been slow in coming.	Mike Brower	FHWA
	- Share information with the public - Report from DelCan on queue lengths over time. This report was the basis for permitting and development in the Douglas community. - Limited future use of ATIS data. - Setting signals	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	- Currently use past personal experience. Also information from the WSDOT and MOT websites, especially border cameras.	John Cooper	Bellingham/ Whatcom Visitors Bureau
	- Amtrak ticketing database and train operating systems.	Kirk Fredrickson	WSDOT
	- Data from WCOG, WSDOT-commissioned studies (i.e. Mirai and Associates study for SR539/I-5 project).	Tim Hostetler	WSDOT
	- US CBP data. Use peak hourly counts and monthly traffic volumes.	Mark Howard	U.S. GSA

Question	Response	Name	Organization
2. What sources of information does your department currently use for the purposes above?			
	- Use prior studies done along the border by other agencies (i.e. Transport Canada's National Roadside Survey). Also collecte data through TransLink's own regional screenline counts and trip diary surveys.	Mike Lai	GVTA
	- Surveys of travelers who visit the information centers.	Sandra Louie	Tourism Vancouver
	- FHWA is still evaluating automated sources and some one-time studies.	Alicia Nolan	FHWA
	- Posted hourly wait-times from CBP and CBSA. One-time studies at FHWA.	Roger Petzold	FHWA
	- Either Transport Canada hires a consultant to collect data for a project-specific purpose in an ad hoc study, or uses existing sources such as the 2000 IMTC Cross-Border Trade & Travel Study, the TransLink Regional Emme/2 model, B.C. Ministry and municipal traffic data, etc.	Mimi Sukhdeo	Transport Canada
	- Monthly data from CBP & CBSA via WCOG - DOT traffic counters	Todd Harrison	WSDOT
3. What raw data outputs could be processed to form information your department might use?			
	☒ Car counts (and truck counts) [1] ☒ Queue length (in feet) [2]	Brigid Canil	B.C. MoT
	☒ Car counts (and truck counts)	Michael Forbis & Morgan Balogh	WSDOT
	☒ Car counts (and truck counts) ☒ Queue length (in feet) ☒ Vehicle at-border wait-time [3]	Jonathan Sabean	Transport Canada
	☒ Car counts (and truck counts) ☒ Queue length (in feet) ☒ Vehicle at-border wait-time ☒ **Other**: vehicle classification	Pat Cruickshank	B.C. MoT
	☒ Car counts (and truck counts) ☒ **Other**: vehicle classification using WIM data	Roger Horton	WSDOT
	☒ Car counts (and truck counts) ☒ Queue length (in feet)	Steve Banham	City of Blaine

[1] Full text: Car counts (and truck counts) (upon arrival at end-of-queue) by port-of-entry and direction by time increment)15 minutes, hour, day, week, etc.)

[2] Full text: Queue length (in feet) by port-of-entry and direction by time increment (same as above)

[3] Full text: Vehicle at-border wait-time by port-of-entry by direction by time increment (5 minutes, 15 minutes, hour, etc.)

Question	Response	Name	Organization
3. What raw data outputs could be processed to form information your department might use?			
	☒ Car counts (and truck counts) ☒ Vehicle at-border wait-time	Donald Alper	Western WA University
	☒ Car counts (and truck counts) ☒ Vehicle at-border wait-time	Keenan Kitasaka	GVTA
	☒ Car counts (and truck counts) ☒ Queue length (in feet) ☒ Vehicle at-border wait-time ☒ **Other**: Accumulated times to give annual hours of delay, average lengths of delay, annual numbers of vehicles, etc.	Mike Brower	FHWA
	☒ Car counts (and truck counts) ☒ Queue length (in metres) ☒ Vehicle at-border wait-time ☒ Number of primary booths open [4]	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	☒ Car counts (and truck counts) ☒ Queue length (in feet) ☒ Vehicle at-border wait-time	John Cooper	Bellingham/ Whatcom Visitors Bureau
	☒ Car counts (and truck counts) ☒ Queue length (in feet) ☒ Vehicle at-border wait-time	Kirk Fredrickson	WSDOT
	☒ Car counts (and truck counts) ☒ Vehicle at-border wait-time ☒ Number of primary booths open ☒ **Other**: Not possible with ATIS, but interested in commodity data	Tim Hostetler	WSDOT
	☒ Car counts (and truck counts) ☒ **Other**: Peak volumes for Border Wizard	Mark Howard	U.S. GSA
	☒ Car counts (and truck counts) ☒ Queue length (in feet) ☒ Vehicle at-border wait-time ☒ **Other**: Use queue length as a proxy for delay	Mike Lai	GVTA

[4] Full text: Number of primary booths open by port-of-entry by direction by time increment (5 minutes, hour, etc.)

Question	Response	Name	Organization
3. What raw data outputs could be processed to form information your department might use?			
	☒ Car counts (and truck counts) ☒ Vehicle at-border wait-time ☒ **Other**: Any information on # of passport-holders also of interest.	Sandra Louie	Tourism Vancouver
	☒ Car counts (and truck counts) ☒ Vehicle at-border wait-time ☒ Number of primary booths open	Alicia Nolan	FHWA
	☒ Vehicle at-border wait-time ☒ **Other**: Total travel time through as part of the journey—to identify where the delay is.	Roger Petzold	FHWA
	☒ Car counts (and truck counts) ☒ Queue length (in feet) ☒ Vehicle at-border wait-time ☒ Number of primary booths open ☒ **Other**: Also interested in lane utilization (i.e. NEXUS vs. non-NEXUS traffic, FAST vs. non-FAST traffic), and external factors (see #10).	Mimi Sukhdeo	Transport Canada
	☒ Car counts (and truck counts) ☒ Queue length (in feet) ☒ Vehicle at-border wait-time ☒ Number of primary booths open	Todd Harrison	WSDOT
4. Would any of the listed ATIS data be a preferred alternative to sources you already use?			
	Yes	Brigid Canil	B.C. MoT
	N/A	Michael Forbis & Morgan Balogh	WSDOT
	Yes, especially given the common understanding of the method of data collection and the fact that it's an ongoing data stream rather than a non-automated, one-time effort.	Jonathan Sabean	Transport Canada
	Yes, as a supplement to existing sources	Pat Cruickshank	B.C. MoT
	Yes, the data office is always interested in new sources of data.	Roger Horton	WSDOT
	Yes	Steve Banham	City of Blaine
	Yes - the data that would be furnished by the ATIS would be specific to those crossings, and much more reliable. Our primary concern would be that it is localized information and may not fit into a bigger national picture of whatever scheme/format FHWA might ultimately develop for the northern boundary.	Mike Brower	FHWA

Question	Response	Name	Organization
4. Would any of the listed ATIS data be a preferred alternative to sources you already use?			
	Yes - whatever the most reliable data is we're interested in. But Surrey will have specific project data needs, not general data needs.	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	Yes.	John Cooper	Bellingham/Whatcom Visitors Bureau
	Yes - currently don't use any cross-border travel data for the Peace Arch, but would if such a data source was available.	Kirk Fredrickson	WSDOT
	Yes. This data would be the best available, so would be used.	Tim Hostetler	WSDOT
	No	Mark Howard	U.S. GSA
	Yes - it would definitely be used as supplementary data to what currently exists.	Mike Lai	GVTA
	Yes - this would be a more acurate source of information.	Sandra Louie	Tourism Vancouver
	There is not a decided current source now.	Alicia Nolan	FHWA
	Yes	Roger Petzold	FHWA
	Yes, since ad hoc study data provides only a snapshot of the travel flows for a predefined month or season, and is subject to abnormal traffic patterns due to incidents or special events. Most studies collect data for a small time period, a few days to a few weeks. The IMTC ATIS-DMS data source will be more robust and therefore more reliable.	Mimi Sukhdeo	Transport Canada
	Yes	Todd Harrison	WSDOT
5. Do you see opportunities for your department to make first-time use of data and information from ATIS?			
	Yes. Interested in the northbound information on commercial vehicles entering Canada.	Brigid Canil	B.C. MoT
	Improve analytical ability by integrating real-time data with historical data.	Michael Forbis & Morgan Balogh	WSDOT
	Sees applications for modeling in real-time, reactive traffic management. Also help others make better business cases for system improvements.	Jonathan Sabean	Transport Canada
	Potential to avail this information to commercial carriers—when all four crossings are covered	Pat Cruickshank	B.C. MoT
	Yes. Good queuing information relative to time of day for traffic operations and planning.	Steve Banham	City of Blaine
	Use the historical data to analyze performance of the ATIS system itself. Does traffic tend to distriubte more evenly between the two crossings when a relative difference in waitime is posted up stream?	Donald Alper	Western WA University

Question	Response	Name	Organization
5. Do you see opportunities for your department to make first-time use of data and information from ATIS?			
	Development of neural networks to predict traffic patterns based on how current patterns correlate with archived patterns under the same conditions.	Keenan Kitasaka	GVTA
	For the immediate future the information provided by this system would be our sole source of site specific data and could be used to establish baseline performance measures. Sharing this information nationally could help it to become "the model" for the rest of the nation. Nothing like being the first to offer up such a data system. Early sharing of our efforts with FHWA-HQ would garner some interest on their part, and possibly support requests for any foreseen financial or manpower needs.	Mike Brower	FHWA
	No	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	Yes. Will use this information for our travelers and link info to our website. Also beneficial for staff in the visitors center to provide acurate information. This information can also be tied into the kiosk project ("Here's Info"). These kiosks are throughout Whatcom County and the Lower Mainland, mostly in hotels, and provide visitor information. Anything that can be tied into this system would be useful. Maybe a regularly downloadable PDF file or a link to an active site. A specific report for this kiosk system? (John will send a link to the kiosk person).	John Cooper	Bellingham/ Whatcom Visitors Bureau
	Yes, could be used for future planning as well as for project-specific planning. For example, WSDOT could make plan adjustments based on cross-border traffic projections that it now cannot make (i.e. if data shows a larger number of travelers taking SR9, could redevlop emphasis on other routes to this, i.e. SR542 at Neugent's Corner, etc.). These are sub-area adjustments that aren't made now due to a lack of data, but if more acurate data was had, we could make more detailed plans based on projections.	Tim Hostetler	WSDOT
	Possibly.	Mark Howard	U.S. GSA
	Definitely. Could be used for existing projects, such as updating, calibrating and validating the model. Could have future uses for the launch of the long-range transportation plan for the region, as well as data for the goods movement planning process.	Mike Lai	GVTA
	Possibly.	Sandra Louie	Tourism Vancouver
	Evaluation of processing resources along with identification of peak traffic times and average-daily travel.	Alicia Nolan	FHWA

Question	Response	Name	Organization
5. Do you see opportunities for your department to make first-time use of data and information from ATIS?			
	Would be able to respond to requests for status of border traffic connected to specific events (i.e. London subway bombings and corresponding security-level change for transit systems.) Better traffic numbers might improve the dialogue between CBP and local communities—because wait times are down but there's not a reliable way to capture and share that information with the public. Better analysis of temporal travel patterns.	Roger Petzold	FHWA
	Yes, in two ways: 1) Can do comparisons of investments and the flow of traffic. Good volume and wait-time data will allow for a more substantial evaluation of how funded programs are improving traffic efficiency, and allows for another evaluation tool to consider the success of a program (such as SHIP). 2) The data will provide a way for Transport Canada to monitor and understand the dynamic at the border, idenfity the needs of infrastructure improvements and justify for future funding for projects using historical data. When an investment opportunity arises, there can be hard evidence to support a request for improvements. This will be helpful for all IMTC agencies at the project management level. Agencies can respond immediately to opportunities as the historical data are readily available in the ATIS-DMS. Right now, agencies rely on experience and "gut feeling" to determine if a project is a good idea. It is then followed by analyses, data gathering, and its justification in a business case. This process takes a long time and by the time funding may be secured, the problem could be worse. Having advanced data allows for agencies to respond to border needs immediately.	Mimi Sukhdeo	Transport Canada
	Evaluating maintenance programs. Snow and Ice, etc. Also use in budgeting and cost-benefit analyses. Security, incident response, and vulnerability planning.	Todd Harrison	WSDOT
	Could use this data for marketing purposes to support increased train ridership, as well as for department performance measures. Could also be used to educate the public on cross-border travel realities.	Kirk Fredrickson	WSDOT
6. Interested in commercial vehicle ATIS data?			
	Yes	Brigid Canil	B.C. MoT
	N/A	Michael Forbis & Morgan Balogh	WSDOT
	Yes - Recording wait times, and program evaluation.	Jonathan Sabean	Transport Canada

Question	Response	Name	Organization
6. Interested in commercial vehicle ATIS data?			
	Yes - Wait times and also analysis by category of commercial vehicle. Important data to tie analysis to broader economic impacts.	Pat Cruickshank	B.C. MoT
	Yes, there is the truck route through Blaine	Steve Banham	City of Blaine
	Yes, TransLink's regional ATIS will include commercial system information services.	Keenan Kitasaka	GVTA
	Yes - Commercial movements are vitally important to FHWA interests, especially with regard to the delays they encounter at the border. All data relating to their numbers, delays, etc. would be of interest.	Mike Brower	FHWA
	Not for Surrey. There may be interest at the Province, or TransLink, as part of their comemrcial vehicle strategic planning process.	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	No interest.	John Cooper	Bellingham/ Whatcom Visitors Bureau
	Not a primary issue for the passenger rail office, as the freight rail component is being moved to another office. However, having the commercial vehicle data could help us better understand trade flows and how diversions to freight rail could impact Amtrak Cascades on-time performance.	Kirk Fredrickson	WSDOT
	Yes	Tim Hostetler	WSDOT
	Possibly. More of an operational consideration, and may drive what CBP needs.	Mark Howard	U.S. GSA
	Yes - for the goods movement planning process for the GVRD.	Mike Lai	GVTA
	Not at this point.	Sandra Louie	Tourism Vancouver
	Yes - FHWA is more interested in the commercial-vehicle and delay issues.	Alicia Nolan	FHWA
	Yes - Interest in total trip time along with O&D	Roger Petzold	FHWA
	Yes	Mimi Sukhdeo	Transport Canada
	Yes, would be good to speak with Barb Ivanov on this.	Todd Harrison	WSDOT
7. What is the preferable medium for you to use?			
	☒ Internet access (dynamic) – Could be similar to the intranet service that is used to access BC count data for BC MoT today.	Brigid Canil	B.C. MoT
	☒ Internet access (dynamic) ☒ **Other**: Maximum flexibility is always good.	Jonathan Sabean	Transport Canada

Question	Response	Name	Organization
7. What is the preferable medium for you to use?			
	☒ Electronic (PDF, e-mail, other) ☒ Internet access (dynamic) - Via internet from a server that is accessed actively by individuals pulling off the data they need for a given application and also automatically by external systems that could pull off preset reports and route them to an agency user—a standing order for data periodically routed via an IP based on set security, etc.	Pat Cruickshank	B.C. MoT
	☒ Electronic (PDF, e-mail, other) ☒ **Other**: The data office usually works with set format reports, so dynamic querying probably isn't a high priority.	Roger Horton	WSDOT
	☒ Electronic (PDF, e-mail, other) ☒ Internet access (dynamic) – Posted reports that we could pull down would be good	Steve Banham	City of Blaine
	☒ Electronic (PDF, e-mail, other) ☒ Internet access (dynamic) ☒ **Other**: For feedback on these questions, should talk with others listed at the end of the questionnaire.	Donald Alper	Western WA University
	☒ Electronic (PDF, e-mail, other) ☒ Internet access (dynamic) ☒ **Other**: Preference for the system to transmit, on an agreed-to frequency, a set array of information in a format that can be displayed.	Keenan Kitasaka	GVTA
	☒ All	Mike Brower	FHWA
	☒ Electronic (PDF, e-mail, other) ☒ Internet access (dynamic)	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	☒ Electronic (PDF, e-mail, other) ☒ Internet access (dynamic)	John Cooper	Bellingham/ Whatcom Visitors Bureau
	☒ All ☒ **Other**: System similar to online cross-border custom query tool useful, in addition to quick reports.	Kirk Fredrickson	WSDOT
	☒ Internet access (dynamic) ☒ **Other**: Interested in data in a database format, mayne regularly e-mailed or available on a website. Also information about lane usage (i.e. nexus usage)	Tim Hostetler	WSDOT
	☒ Electronic (PDF, e-mail, other)	Mark Howard	U.S. GSA

Question	Response	Name	Organization
7. What is the preferable medium for you to use?			
	☒ Electronic (PDF, e-mail, other) ☒ **Other**: Ability to massage data - excel spreadsheet, or database format.	Mike Lai	GVTA
	☒ Electronic (PDF, e-mail, other) ☒ Internet access (dynamic) ☒ **Other**: Internet tool that allows user to specify dates.	Sandra Louie	Tourism Vancouver
	☒ Electronic (PDF, e-mail, other) ☒ Internet access (dynamic)	Alicia Nolan	FHWA
	☒ Electronic (PDF, e-mail, other) (oracle or Access database) ☒ Internet access (dynamic)	Roger Petzold	FHWA
	☒ All ☒ **Other**: Online should have both a query tool for power users and canned reports for quick use. Also, routine e-mails on a distribution list when certain customized reports are ready for download	Mimi Sukhdeo	Transport Canada
	☒ Electronic (PDF, e-mail, other) ☒ Internet access (dynamic) – Dynamic access would be one interest: query results that are dumpable to a spreadsheet. Also interested secure access for agencies.	Todd Harrison	WSDOT
8. What is the preferable resolution of reporting?			
	☒ Hourly - Is what current reporting is summarized to. But their background data is stored in 15 minute blocks. 15-minute is probably the highest resolution they would ever need.	Brigid Canil	B.C. MoT
	☒ 20 Seconds - we tend to aggregate data at 20 seconds and in 5-minute blocks	Michael Forbis & Morgan Balogh	WSDOT
	☒ Hourly - probably the highest resolution the TC ITS office would use. But maximum flexibility is still the approach that's of most interest. And, for a trip-planning application, it would be very useful for the driver to have access to both the current border traffic condition and a comparison to the historical "norm" for the subject trip period.	Jonathan Sabean	Transport Canada
	Per above, a variety of resolutions [assuming 20 second resolution is of interest].	Pat Cruickshank	B.C. MoT
	☒ Hourly	Roger Horton	WSDOT
	☒ Hourly	Steve Banham	City of Blaine
	☒ Between 30 & 10 minutes fifteen minutes	Keenan Kitasaka	GVTA

Question	Response	Name	Organization
8. What is the preferable resolution of reporting?			
	☒ Annual ☒ Monthly	Mike Brower	FHWA
	☒ Hourly ☒ Weekly ☒ Monthly	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	☒ Weekly	John Cooper	Bellingham/ Whatcom Visitors Bureau
	☒ Daily ☒ Weekly	Kirk Fredrickson	WSDOT
	☒ Hourly	Tim Hostetler	WSDOT
	☒ Hourly ☒ Peak travel hours	Mark Howard	U.S. GSA
	☒ Between 30 & 10 minutes	Mike Lai	GVTA
	☒ Weekly ☒ Monthly	Sandra Louie	Tourism Vancouver
	☒ Hourly ☒ Daily ☒ Weekly ☒ Monthly	Alicia Nolan	FHWA
	☒ Hourly ☒ Daily	Roger Petzold	FHWA
	☒ Hourly ☒ Between 30 & 10 minutes	Mimi Sukhdeo	Transport Canada
	☒ Hourly - most typical resolution used. Others may want it more resolute.	Todd Harrison	WSDOT
9. What is the preferable frequency of reporting?			
	☒ Ongoing	Michael Forbis & Morgan Balogh	WSDOT
	☒ Monthly ☒ Every six months	Jonathan Sabean	Transport Canada
	☒ Hourly – for analysis of an incident ☒ Daily – for analysis of an incident ☒ Weekly – most often	Pat Cruickshank	B.C. MoT
	☒ Monthly	Roger Horton	WSDOT

Question	Response	Name	Organization
9. What is the preferable frequency of reporting?			
	☒ Weekly - usually look at monthly but weekly would be useful.	Steve Banham	City of Blaine
	☒Daily - for trip planning information applications, the data should be as current as possible	Keenan Kitasaka	GVTA
	☒ Monthly ☒ **Other**: Trend data	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	☒ Monthly - is most feasible for staffing. Link to an active website on their website, and a link to a pdf file that is updated automatically on a regular basis.	John Cooper	Bellingham/ Whatcom Visitors Bureau
	☒ Monthly ☒ **Other**: Quarterly as well.	Kirk Fredrickson	WSDOT
	☒ Monthly ☒ **Other**: Seasonal data	Tim Hostetler	WSDOT
	☒ Monthly ☒ **Other**: Peak Hourly	Mark Howard	U.S. GSA
	☒ Annual ☒ **Other**: Interested in trends	Mike Lai	GVTA
	☒ Monthly ☒ **Other**: Special events; also quarterly	Sandra Louie	Tourism Vancouver
	☒ Monthly ☒ **Other**: The division offices may want a more current view.	Alicia Nolan	FHWA
	☒ Monthly	Roger Petzold	FHWA
	☒ Annual ☒ Monthly ☒ **Other**: Seasonal	Mimi Sukhdeo	Transport Canada
	☒ Daily - yesterday's data by the end of today	Todd Harrison	WSDOT
10. Are there other cross-tabulations of interest?			
	☒ **Other**: integrate historical data with real-time data	Michael Forbis & Morgan Balogh	WSDOT
	☒ **Other**: import-export data, Olympics 2010	Jonathan Sabean	Transport Canada
	☒ **Other**: An interest in capability of cross-referencing with WIM data (i.e. analyzing truck-traffic split between 8th Ave and Hwy 15).	Pat Cruickshank	B.C. MoT
	☒ **Other**: exchange rate, seasonal factors.	Steve Banham	City of Blaine

Question	Response	Name	Organization
10. Are there other cross-tabulations of interest?			
	☒ **Other**: Look at wait-time/queue length/booths open	Ann Coffin, Jamie Boan, Mira Petrovich	City of Surrey
	☒ Week-day / Weekend-day ☒ Direction ☒ **Other**: Good to also include external factors such as gas prices and exchange rate.	Kirk Fredrickson	WSDOT
	☒ Week-day / Weekend-day ☒ **Other**: Interested in external factor cross-tabs, such as trip purpose (i.e. work-related trips, relationship with other modes, etc)	Tim Hostetler	WSDOT
	☒ Week-day / Weekend-day ☒ Direction ☒ Crossing location ☒ **Other**: any that help to depict the changing operations at the border	Mike Brower	FHWA
	☒ Week-day / Weekend-day ☒ Crossing location	Mark Howard	U.S. GSA
	☒ Week-day / Weekend-day ☒ Direction ☒ **Other**: Seasonal data - peaking characteristics	Mike Lai	GVTA
	☒ Week-day / Weekend-day ☒ Direction ☒ Crossing location ☒ **Other**: mainly Peace Arch and truck crossings.	Sandra Louie	Tourism Vancouver
	☒ **Other**: spike events, holidays	Alicia Nolan	FHWA
	☒ **Other**: e-seals ☒ **Other**: Understanding shifting marine traffic	Roger Petzold	FHWA

Question	Response	Name	Organization
10. Are there other cross-tabulations of interest?			
	☒ Week-day / Weekend-day	Mimi Sukhdeo	Transport Canada
	☒ Direction		
	☒ Crossing location		
	☒ Various ratio analyses		
	☒ Variation with other time-series data?		
	☒ **Other**: lane utilization and EXTERNAL FACTORs (i.e. border security level, impact of currency exchange, gas prices, construction at the border, etc.). Have three fields or so in the database for future expansion of being able to pull in external data to compare using the query tool. Then you can theoretically isolate different environment and analysis a subset of database separately. For example, weekday average wait time tabulated for a certain season AND an external factor such as security level or construction can be examined separately.		
	☒ **Other**	Todd Harrison	WSDOT

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    <vds-id>15401</vds-id>
    <description>S/B Route 15 FAST ONLY, CC15-01, VDS15-
      01B</description>
  - <lane-data>
    - <lane-data-item>
        <lane-number>1</lane-number>
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        <occupancy>16</occupancy>
        <lane-vehicle-speed>21</lane-vehicle-speed>
        <avg-vehicle-length>170</avg-vehicle-length>
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  </detector-report>
- <detector-report>
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      02</description>
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        <lane-vehicle-speed>22</lane-vehicle-speed>
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      03</description>
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- <detector-report>
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      01B</description>
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- <detector-report>
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      02</description>
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        <avg-vehicle-length>0</avg-vehicle-length>
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    </lane-data>
  </detector-report>
- <detector-report>
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    <description>S/B Route 15 TRUCKS, CC15-01, VDS15-
      01B</description>
  - <lane-data>
    - <lane-data-item>
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- <detector-report>
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      04</description>
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      04</description>
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        <lane-vehicle-volume>4500</lane-vehicle-volume>
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    </lane-data>
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- <detector-report>
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      05</description>
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        <lane-vehicle-volume>1440</lane-vehicle-volume>
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      06</description>
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- <detector-report>
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- <detector-report>
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    - <lane-data-item>
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        <lane-vehicle-volume>0</lane-vehicle-volume>
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        <lane-vehicle-speed>0</lane-vehicle-speed>
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- <detector-report>
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    - <lane-data-item>
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        <vds-id>15908</vds-id>
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        - <lane-data-item>
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            <lane-vehicle-speed>0</lane-vehicle-speed>
            <avg-vehicle-length>0</avg-vehicle-length>
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        </lane-data>
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  </collection-period-item>
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Appendix E: Loop Detector Translation Table

Note: Loop detectors that are highlighted are used for calculating volume.

ATIS DMS Loop ID	Country	Direction	Owner	Road	Lane	Loop Name	Cabinet	Lane Type	Location	SRMP	Latitude	Longitude
	USA	NB	WSDOT	I-5	1	ES-275D: _MN_2	ES-275D		Northbound just after SR543 exit on I-5		48˚54'11.77806"	122˚44.06.85634"
	USA	NB	WSDOT	I-5	1	ES-275D: _MS_2	ES-275D		Northbound just after SR543 exit on I-5		48˚59'11.78070"	122˚44'06.85141"
	USA	SB	WSDOT	I-5	1	ES-275D: _MN_S1	ES-275D		Southbound at SR 543 exit on I-5		48˚59'11.61066"	122˚44'06.66775"
	USA	SB	WSDOT	I-5	1	ES-275D: _MS_S1	ES-275D		Southbound at SR 543 exit on I-5		48˚59'11.77505"	122˚44'06.86625"
	USA	SB	WSDOT	I-5	1	ES-275D: _MN_S2	ES-275D		Southbound at SR 543 exit on I-5		48˚59'11.61066"	122˚44'06.66775"
	USA	SB	WSDOT	I-5	1	ES-275D: _MS_S2	ES-275D		Southbound at SR 543 exit on I-5		48˚59'11.77505"	122˚44'06.86625"
	CAN	NB	WSDOT	I-5	1	ES-275D: _MN_X_7	ES-277D		Port of Entry	276.74		
	CAN	NB	WSDOT	I-5	1	ES-275D: DMN_X_7	ES-277D		Port of Entry	276.75		
	USA	NB	WSDOT	I-5	2	ES-275D: _MN_1	ES-275D		Northbound just after SR543 exit on I-5		48˚54'11.59438"	122˚44.06.62198"
	USA	NB	WSDOT	I-5	2	ES-275D: _MS_1	ES-275D		Northbound just after SR543 exit on I-5		48˚59'11.75214"	122˚44'06.85043"
	USA	NB	WSDOT	SR543	2	ES-275D: _MN_X_1	ES-275D	Off-ramp	I-5 exit 275 northbound (onto SR 543)		48˚59'19.76467"	122˚44'05.78233"
	USA	SB	WSDOT	SR543	2	ES-275D: _MN_O_1	ES-275D	On-ramp	Southbound I-5 onramp from SR 543		48˚59'19.79710"	122˚44'05.85048"
	CAN	NB	WSDOT	I-5	2	ES-275D: _MN_X_6	ES-277D		Port of Entry	276.74		
	CAN	NB	WSDOT	I-5	2	ES-275D: DMN_X_6	ES-277D		Port of Entry	276.75		
	CAN	NB	WSDOT	I-5	3	ES-275D: _MN_X_5	ES-277D		Port of Entry	276.74		
	CAN	NB	WSDOT	I-5	3	ES-275D: DMN_X_5	ES-277D		Port of Entry	276.75		
	CAN	NB	WSDOT	I-5	4	ES-275D: _MN_X_4	ES-277D		Port of Entry	276.74		
	CAN	NB	WSDOT	I-5	4	ES-275D: DMN_X_4	ES-277D		Port of Entry	276.75		
	CAN	NB	WSDOT	I-5	5	ES-275D: _MN_X_3	ES-277D		Port of Entry	276.74		
	CAN	NB	WSDOT	I-5	5	ES-275D: DMN_X_3	ES-277D		Port of Entry	276.75		
	CAN	NB	WSDOT	I-5	6	ES-275D: _MN_X_2	ES-277D		Port of Entry	276.74		
	CAN	NB	WSDOT	I-5	6	ES-275D: DMN_X_2	ES-277D		Port of Entry	276.75		
	CAN	NB	WSDOT	I-5	7	ES-275D: _MN_X_1	ES-277D	NEXUS	Port of Entry	276.74		
	CAN	NB	WSDOT	I-5	7	ES-275D: DMN_X_1	ES-277D		Port of Entry	276.75		
ES277D:AMN_3	CAN	NB	WSDOT	I-5	1	ES-277D: AMN_3	ES-277D		South of POE	276.65	49˚00'11.18759"	122˚45'24.48746"
	CAN	NB	WSDOT	I-5	1	ES-277D: AMN_S3	ES-277D		South of POE	276.66	49˚00'11.26385"	122˚45'24.54177"
ES277D:_MN_3	CAN	NB	WSDOT	I-5	1	ES-277D: _MN_3	ES-277D		Just north of border marker	276.59	49˚00'08.79294"	122˚45'22.74403"
	CAN	NB	WSDOT	I-5	1	ES-277D: _MN_S3	ES-277D		Just north of border marker	276.6	49˚00'08.90515"	122˚45'22.83120"
ES277D:_MN_0_3	USA	NB	WSDOT	I-5	1	ES-277D: _MN_0_3	ES-277D		Just south of border marker	276.51	49˚00'05.15210"	122˚45'19.50191"
	USA	NB	WSDOT	I-5	1	ES-277D: _MN_0S3	ES-277D		Just south of border marker	276.52	49˚00'05.27530"	122˚45'19.61708"
ES277D:AMN_2	CAN	NB	WSDOT	I-5	2	ES-277D: AMN_2	ES-277D		South of POE	276.65	49˚00'11.18759"	122˚45'24.48746"
	CAN	NB	WSDOT	I-5	2	ES-277D: AMN_S2	ES-277D		South of POE	276.66	49˚00'11.26385"	122˚45'24.54177"
ES277D:_MN_2	CAN	NB	WSDOT	I-5	2	ES-277D: _MN_2	ES-277D		Just north of border marker	276.59	49˚00'08.79294"	122˚45'22.74403"
	CAN	NB	WSDOT	I-5	2	ES-277D: _MN_S2	ES-277D		Just north of border marker	276.6	49˚00'08.90515"	122˚45'22.83120"
ES277D:_MN_0_2	USA	NB	WSDOT	I-5	2	ES-277D: _MN_0_2	ES-277D		Just south of border marker	276.51	49˚00'05.15210"	122˚45'19.50191"
	USA	NB	WSDOT	I-5	2	ES-277D: _MN_0S2	ES-277D		Just south of border marker	276.52	49˚00'05.27530"	122˚45'19.61708"
ES277D:AMN_1	CAN	NB	WSDOT	I-5	3	ES-277D: AMN_1	ES-277D	NEXUS	South of POE	276.65	49˚00'11.18759"	122˚45'24.48746"
	CAN	NB	WSDOT	I-5	3	ES-277D: DMN_1	ES-277D	NEXUS	South of POE	276.66	49˚00'11.26385"	122˚45'24.54177"
ES277D:_MN_1	CAN	NB	WSDOT	I-5	3	ES-277D: _MN_1	ES-277D	NEXUS	Just north of border marker	276.59	49˚00'08.79294"	122˚45'22.74403"
	CAN	NB	WSDOT	I-5	3	ES-277D: _MN_S1	ES-277D	NEXUS	Just north of border marker	276.6	49˚00'08.90515"	122˚45'22.83120"
ES277D:_MN_0_1	USA	NB	WSDOT	I-5	3	ES-277D: _MN_0_1	ES-277D	NEXUS	Just south of border marker	276.51	49˚00'05.15210"	122˚45'19.50191"
	USA	NB	WSDOT	I-5	3	ES-277D: _MN_0S1	ES-277D	NEXUS	Just south of border marker	276.52	49˚00'05.27530"	122˚45'19.61708"
1501-1 upstream	CAN	SB	BC MoT	HWY15	1	VDS15-01A L1	CC15-01		US Pacific Highway POE Passenger Lanes		49˚00'06.05691"	122˚44'09.50649"
1501-1downstream	CAN	SB	BC MoT	HWY15	1	VDS15-01A L2	CC15-01		US Pacific Highway POE Passenger Lanes		49˚00'05.94779"	122˚44'09.19088"

ATIS DMS Loop ID	Country	Direction	Owner	Road	Lane	Loop Name	Cabinet	Lane Type	Location	SRMP	Latitude	Longitude
1501-2 upstream	CAN	SB	BC MoT	HWY15	2	VDS15-01A L3	CC15-01		US Pacific Highway POE Passenger Lanes		49°00'06.05691"	122°44'09.50649"
1501-2 downstream	CAN	SB	BC MoT	HWY15	2	VDS15-01A L4	CC15-01		US Pacific Highway POE Passenger Lanes		49°00'05.94779"	122°44'09.19088"
1501-3 upstream	CAN	SB	BC MoT	HWY15	3	VDS15-01A L5	CC15-01		US Pacific Highway POE Passenger Lanes		49°00'06.05691"	122°44'09.50649"
1501-3 downstream	CAN	SB	BC MoT	HWY15	3	VDS15-01A L6	CC15-01		US Pacific Highway POE Passenger Lanes		49°00'05.94779"	122°44'09.19088"
1501-4 upstream	CAN	SB	BC MoT	HWY15	4	VDS15-01A L7	CC15-01		US Pacific Highway POE Passenger Lanes		49°00'06.05691"	122°44'09.50649"
1501-4 downstream	CAN	SB	BC MoT	HWY15	4	VDS15-01A L8	CC15-01		US Pacific Highway POE Passenger Lanes		49°00'05.94779"	122°44'09.19088"
1501-5 upstream	CAN	SB	BC MoT	HWY15	5	VDS15-01A L9	CC15-01		US Pacific Highway POE Passenger Lanes		49°00'06.05691"	122°44'09.50649"
1501-5 downstream	CAN	SB	BC MoT	HWY15	5	VDS15-01A L10	CC15-01		US Pacific Highway POE Passenger Lanes		49°00'05.94779"	122°44'09.19088"
15101-1 upstream	CAN	SB	BC MoT	HWY15	6	VDS15-01A L11	CC15-01	NEXUS	US Pacific Highway POE Passenger Lanes		49°00'06.05691"	122°44'09.50649"
15101-1 downstream	CAN	SB	BC MoT	HWY15	6	VDS15-01A L12	CC15-01	NEXUS	US Pacific Highway POE Passenger Lanes		49°00'05.94779"	122°44'09.19088"
15801-1 upstream	CAN	SB	BC MoT	HWY15	1	VDS15-01B L49	CC15-01	Bus	US Pacific Highway POE Bus Lane		49°00'06.32698"	122°44'13.10165"
15801-1 downstream	CAN	SB	BC MoT	HWY15	1	VDS15-01B L50	CC15-01	Bus	US Pacific Highway POE Bus Lane		49°00'06.35082"	122°44'13.23441"
15401-1 upstream	CAN	SB	BC MoT	HWY15	2	VDS15-01B L51	CC15-01	FAST	US Pacific Highway POE Commercial Lanes		49°00'06.67653"	122°44'13.29706"
15401-1 downstream	CAN	SB	BC MoT	HWY15	2	VDS15-01B L52	CC15-01	FAST	US Pacific Highway POE Commercial Lanes		49°00'06.69407"	122°44'13.47880"
15901-1 upstream	CAN	SB	BC MoT	HWY15	3	VDS15-01B L53	CC15-01	Truck	US Pacific Highway POE Commercial Lanes		49°00'06.67653"	122°44'13.29706"
15901-1 downstream	CAN	SB	BC MoT	HWY15	3	VDS15-01B L54	CC15-01	Truck	US Pacific Highway POE Commercial Lanes		49°00'06.69407"	122°44'13.47880"
15901-2 upstream	CAN	SB	BC MoT	HWY15	4	VDS15-01B L55	CC15-01	Truck	US Pacific Highway POE Commercial Lanes		49°00'06.67653"	122°44'13.29706"
15901-2 downstream	CAN	SB	BC MoT	HWY15	4	VDS15-01B L56	CC15-01	Truck	US Pacific Highway POE Commercial Lanes		49°00'06.69407"	122°44'13.47880"
1502-1 upstream	CAN	SB	BC MoT	HWY15	1	VDS15-02 L100	CC15-01		SB 15 Approaching POE		49°00'08.92670"	122°44'06.95750"
1502-1 downstream	CAN	SB	BC MoT	HWY15	1	VDS15-02 L101	CC15-01		SB 15 Approaching POE		49°00'08.78865"	122°44'07.04026"
1502-2 upstream	CAN	SB	BC MoT	HWY15	2	VDS15-02 L102	CC15-01		SB 15 Approaching POE		49°00'08.89479"	122°44'06.97127"
1502-2 downstream	CAN	SB	BC MoT	HWY15	2	VDS15-02 L103	CC15-01		SB 15 Approaching POE		49°00'08.70672"	122°44'07.08363"
15102-1 upstream	CAN	SB	BC MoT	HWY15	3	VDS15-02 L104	CC15-01	NEXUS	SB 15 Approaching POE		49°00'08.98726"	122°44'06.95590"
15102-1 downstream	CAN	SB	BC MoT	HWY15	3	VDS15-02 L105	CC15-01	NEXUS	SB 15 Approaching POE		49°00'08.78865"	122°44'07.04026"
15802-1 upstream	CAN	SB	BC MoT	HWY15	4	VDS15-02 L106	CC15-01	Bus	SB 15 Approaching POE		49°00'08.89479"	122°44'06.97127"
15802-1 downstream	CAN	SB	BC MoT	HWY15	4	VDS15-02 L107	CC15-01	Bus	SB 15 Approaching POE		49°00'08.70672"	122°44'07.08363"
15402-1 upstream	CAN	SB	BC MoT	HWY15	5	VDS15-02 L108	CC15-01	FAST	SB 15 Approaching POE		49°00'09.00132"	122°44'06.95223"
15402-1 downstream	CAN	SB	BC MoT	HWY15	5	VDS15-02 L109	CC15-01	FAST	SB 15 Approaching POE		49°00'08.78865"	122°44'07.04026"
1503-1 upstream	CAN	SB	BC MoT	HWY15	1	VDS15-03 L110	CC15-01		SB 15 Across from CBSA POE		49°00'13.10306"	122°44'07.90430"
1503-1 downstream	CAN	SB	BC MoT	HWY15	1	VDS15-03 L111	CC15-01		SB 15 Across from CBSA POE		49°00'12.94414"	122°44'07.87904"
1503-2 upstream	CAN	SB	BC MoT	HWY15	2	VDS15-03 L112	CC15-01		SB 15 Across from CBSA POE		49°00'13.20920"	122°44'07.88081"
1503-2 downstream	CAN	SB	BC MoT	HWY15	2	VDS15-03 L113	CC15-01		SB 15 Across from CBSA POE		49°00'13.02449"	122°44'07.90378"
15203-1 upstream	CAN	SB	BC MoT	HWY15	3	VDS15-03 L114	CC15-01	NEXUS/Bus	SB 15 Across from CBSA POE		49°00'13.10306"	122°44'07.90430"
15203-1 downstream	CAN	SB	BC MoT	HWY15	3	VDS15-03 L115	CC15-01	NEXUS/Bus	SB 15 Across from CBSA POE		49°00'12.94414"	122°44'07.87904"
15403-1 upstream	CAN	SB	BC MoT	HWY15	4	VDS15-03 L116	CC15-01	FAST	SB 15 Across from CBSA POE		49°00'13.20920"	122°44'07.88081"
15403-1 downstream	CAN	SB	BC MoT	HWY15	4	VDS15-03 L117	CC15-01	FAST	SB 15 Across from CBSA POE		49°00'13.02449"	122°44'07.90378"
1504-1 upstream	CAN	SB	BC MoT	HWY15	1	VDS15-04 L118	CC15-02		SB 15 at Duty Free		49°00'18.16028"	122°44'07.93668"
1504-1 downstream	CAN	SB	BC MoT	HWY15	1	VDS15-04 L119	CC15-02		SB 15 at Duty Free		49°00'18.01151"	122°44'07.94349"
1504-2 upstream	CAN	SB	BC MoT	HWY15	2	VDS15-04 L122	CC15-02		SB 15 at Duty Free			
1504-2 downstream	CAN	SB	BC MoT	HWY15	2	VDS15-04 L123	CC15-02		SB 15 at Duty Free			
15204-1 upstream	CAN	SB	BC MoT	HWY15	3	VDS15-04 L120	CC15-02	NEXUS/Bus	SB 15 at Duty Free		49°00'18.24242"	122°44'07.92734"
15204-1 downstream	CAN	SB	BC MoT	HWY15	3	VDS15-04 L121	CC15-02	NEXUS/Bus	SB 15 at Duty Free		49°00'18.07724"	122°44'07.95209"
15304-1 upstream	CAN	SB	BC MoT	HWY15	4	VDS15-04 L124	CC15-02	NEXUS/FAST/Bus	SB 15 at Duty Free		49°00'18.16028"	122°44'07.93668"
15304-1 downstream	CAN	SB	BC MoT	HWY15	4	VDS15-04 L125	CC15-02	NEXUS/FAST/Bus	SB 15 at Duty Free		49°00'18.01151"	122°44'07.94349"

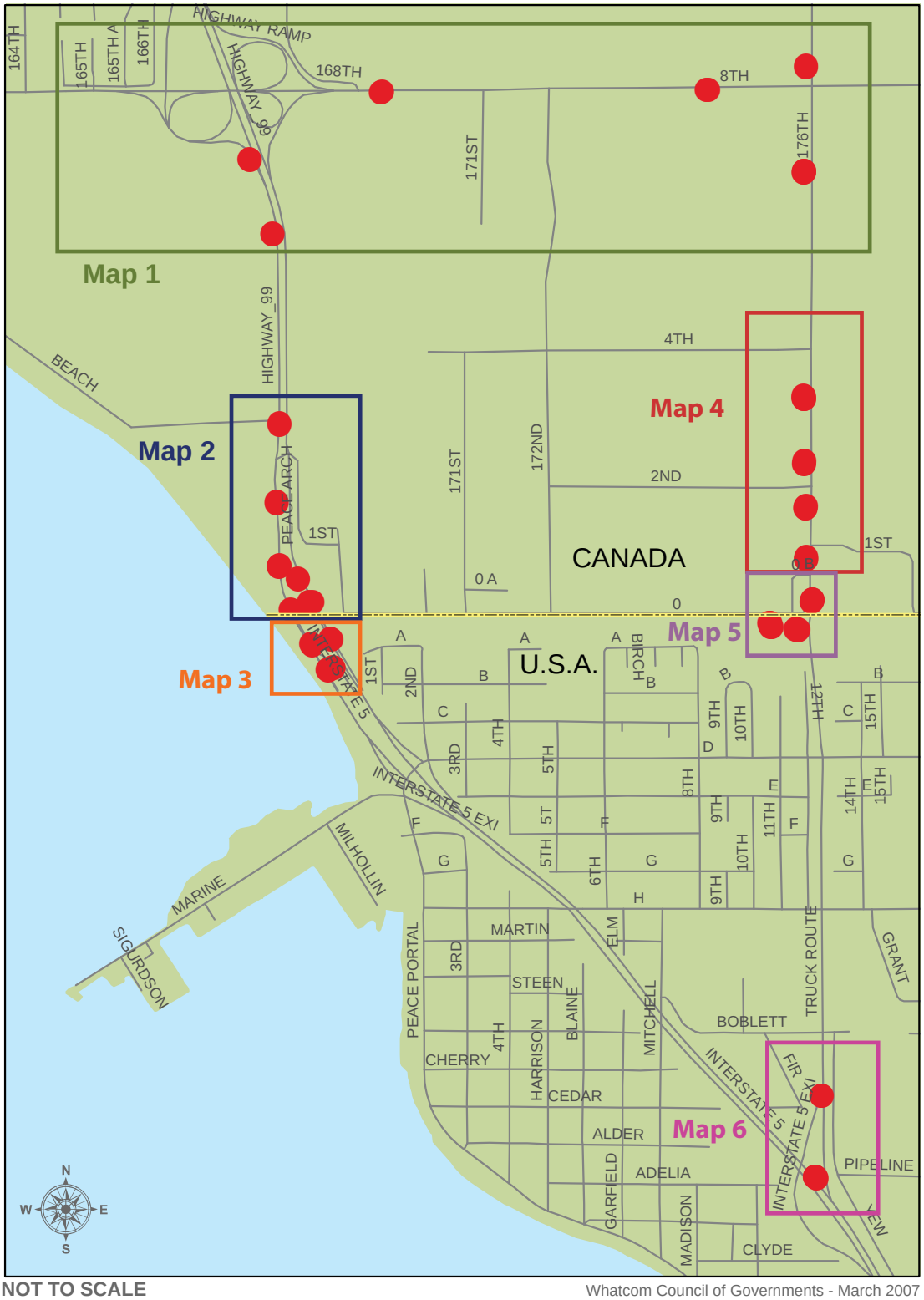
Appendix E: Loop Detector Translation Table

ATIS DMS Loop ID	Country	Direction	Owner	Road	Lane	Loop Name	Cabinet	Lane Type	Location	SRMP	Latitude	Longitude
1505-1 upstream	CAN	SB	BC MoT	HWY15	1	VDS15-05 L31	CC15-02		SB 15 before 2nd Avenue		49°00'22.40356"	122°44'08.15985"
1501-1 downstream	CAN	SB	BC MoT	HWY15	1	VDS15-05 L32	CC15-02		SB 15 before 2nd Avenue		49°00'22.53328"	122°44'08.11349"
1505-2 upstream	CAN	SB	BC MoT	HWY15	2	VDS15-05 L33	CC15-02		SB 15 before 2nd Avenue		49°00'22.40356"	122°44'08.15985"
1505-2 downstream	CAN	SB	BC MoT	HWY15	2	VDS15-05 L34	CC15-02		SB 15 before 2nd Avenue		49°00'22.53328"	122°44'08.11349"
15305-1 upstream	CAN	SB	BC MoT	HWY15	3	VDS15-05 L35	CC15-02	NEXUS/FAST/Bus	SB 15 before 2nd Avenue		49°00'22.40356"	122°44'08.15985"
15305-1 downstream	CAN	SB	BC MoT	HWY15	3	VDS15-05 L36	CC15-02	NEXUS/FAST/Bus	SB 15 before 2nd Avenue		49°00'22.53328"	122°44'08.11349"
15905-1 upstream	CAN	SB	BC MoT	HWY15	4	VDS15-05 L126	CC15-02	Truck	SB 15 before 2nd Avenue		49°00'22.71847"	122°44'08.10376"
15905-1 downstream	CAN	SB	BC MoT	HWY15	4	VDS15-05 L127	CC15-02	Truck	SB 15 before 2nd Avenue		49°00'22.40356"	122°44'08.15985"
1506-1 upstream	CAN	SB	BC MoT	HWY15	1	VDS15-06 L128	CC15-02		SB 15 at weigh scale		49°00'29.05081"	122°44'08.17738"
1506-1 downstream	CAN	SB	BC MoT	HWY15	1	VDS15-06 L129	CC15-02		SB 15 at weigh scale		49°00'28.95098"	122°44'08.15705"
1506-2 upstream	CAN	SB	BC MoT	HWY15	2	VDS15-06 L130	CC15-02		SB 15 at weigh scale		49°00'29.05081"	122°44'08.17738"
1506-2 downstream	CAN	SB	BC MoT	HWY15	2	VDS15-06 L131	CC15-02		SB 15 at weigh scale		49°00'28.95098"	122°44'08.15705"
15306-1 upstream	CAN	SB	BC MoT	HWY15	3	VDS15-06 L132	CC15-02	NEXUS/FAST/Bus	SB 15 at weigh scale		49°00'29.14132"	122°44'08.12781"
15306-1 downstream	CAN	SB	BC MoT	HWY15	3	VDS15-06 L133	CC15-02	NEXUS/FAST/Bus	SB 15 at weigh scale		49°00'29.05081"	122°44'08.17738"
15906-1 upstream	CAN	SB	BC MoT	HWY15	4	VDS15-06 L134	CC15-02	Truck	SB 15 at weigh scale		49°00'29.14132"	122°44'08.14405"
15906-1 downstream	CAN	SB	BC MoT	HWY15	4	VDS15-06 L135	CC15-02	Truck	SB 15 at weigh scale		49°00'29.05081"	122°44'08.17738"
1507-1 upstream	CAN	SB	BC MoT	HWY15	1	VDS15-07 L41	CC15-03		SB 15 south of 8th Ave interchange		49°00'51.52530"	122°44'08.00979"
1507-1 downstream	CAN	SB	BC MoT	HWY15	1	VDS15-07 L42	CC15-03		SB 15 south of 8th Ave interchange		49°00'51.35925"	122°44'08.05163"
15907-1 upstream	CAN	SB	BC MoT	HWY15	2	VDS15-07 L43	CC15-03	Truck	SB 15 south of 8th Ave interchange		49°00'51.44299"	122°44'08.01175"
15907-1 downstream	CAN	SB	BC MoT	HWY15	2	VDS15-07 L44	CC15-03	Truck	SB 15 south of 8th Ave interchange		49°00'51.30283"	122°44'08.05163"
1508-1 upstream	CAN	SB	BC MoT	HWY15	1	VDS15-08 L45	CC15-03		SB 15 north of 8th Ave interchange		49°01'01.95147"	122°44'07.66020"
1508-1 downstream	CAN	SB	BC MoT	HWY15	1	VDS15-08 L46	CC15-03		SB 15 north of 8th Ave interchange		49°01'01.82229"	122°44'07.67082"
15908-1 upstream	CAN	SB	BC MoT	HWY15	2	VDS15-08 L47	CC15-03	Truck	SB 15 north of 8th Ave interchange		49°01'01.95147"	122°44'07.66020"
15908-1 downstream	CAN	SB	BC MoT	HWY15	2	VDS15-08 L48	CC15-03	Truck	SB 15 north of 8th Ave interchange		49°01'01.82229"	122°44'07.67082"
801-1 upstream	CAN	EB	BC MoT	8thAve	1	VDS8-01 L1	CC8-01		8th Avenue eastbound after Hwy 99 roundabout		49°00'59.44940"	122°45'11.81102"
801-1 downstream	CAN	EB	BC MoT	8thAve	1	VDS8-01 L2	CC8-01		8th Avenue eastbound after Hwy 99 roundabout		49°00'59.49406"	122°45'11.58066"
801-2 upstream	CAN	EB	BC MoT	8thAve	2	VDS8-01 L3	CC8-01		8th Avenue eastbound after Hwy 99 roundabout		49°00'59.44940"	122°45'11.81102"
801-2 downstream	CAN	EB	BC MoT	8thAve	2	VDS8-01 L4	CC8-01		8th Avenue eastbound after Hwy 99 roundabout		49°00'59.49406"	122°45'11.58066"
802-1 upstream	CAN	EB	BC MoT	8thAve	1	VDS8-02 L5	CC15-03		8th Avenue eastbound near 15th interchange		49°00'59.60636"	122°44'22.65478"
802-1 downstream	CAN	EB	BC MoT	8thAve	1	VDS8-02 L6	CC15-03		8th Avenue eastbound near 15th interchange		49°00'59.58702"	122°44'22.40045"
802-2 upstream	CAN	EB	BC MoT	8thAve	2	VDS8-02 L7	CC15-03		8th Avenue eastbound near 15th interchange		49°00'59.60636"	122°44'22.65478"
802-2 downstream	CAN	EB	BC MoT	8thAve	2	VDS8-02 L8	CC15-03		8th Avenue eastbound near 15th interchange		49°00'59.58702"	122°44'22.40045"
9901-1 upstream	USA	SB	BC MoT	I-5	EAST 1	VDS99-01A L1	CC99-01		East Side Peace Arch POE Lane 1		49°00'02.47062"	122°45'19.29254"
9901-1 downstream	USA	SB	BC MoT	I-5	EAST 1	VDS99-01A L2	CC99-01		East Side Peace Arch POE Lane 1		49°00'02.37978"	122°45'19.16492"
9901-2 upstream	USA	SB	BC MoT	I-5	EAST 2	VDS99-01A L3	CC99-01		East Side Peace Arch POE Lane 2		49°00'02.47062"	122°45'19.29254"
9901-2 downstream	USA	SB	BC MoT	I-5	EAST 2	VDS99-01A L4	CC99-01		East Side Peace Arch POE Lane 2		49°00'02.37978"	122°45'19.16492"
9901-3 upstream	USA	SB	BC MoT	I-5	EAST 3	VDS99-01A L5	CC99-01		East Side Peace Arch POE Lane 3		49°00'02.47062"	122°45'19.29254"
9901-3 downstream	USA	SB	BC MoT	I-5	EAST 3	VDS99-01A L6	CC99-01		East Side Peace Arch POE Lane 3		49°00'02.37978"	122°45'19.16492"
9901-4 upstream	USA	SB	BC MoT	I-5	EAST 4	VDS99-01A L7	CC99-01		East Side Peace Arch POE Lane 4		49°00'02.47062"	122°45'19.29254"
9901-4 downstream	USA	SB	BC MoT	I-5	EAST 4	VDS99-01A L8	CC99-01		East Side Peace Arch POE Lane 4		49°00'02.37978"	122°45'19.16492"
9901-5 upstream	USA	SB	BC MoT	I-5	WEST 5	VDS99-01B L9	CC99-01		West Side Peace Arch POE Lane 5		49°00'02.23413"	122°45'20.06256"
9901-5 downstream	USA	SB	BC MoT	I-5	WEST 5	VDS99-01B L10	CC99-01		West Side Peace Arch POE Lane 5		49°00'02.13397"	122°45'19.97676"
9901-6 upstream	USA	SB	BC MoT	I-5	WEST 6	VDS99-01B L11	CC99-01		West Side Peace Arch POE Lane 6		49°00'02.23413"	122°45'20.06256"
9901-6 downstream	USA	SB	BC MoT	I-5	WEST 6	VDS99-01B L12	CC99-01		West Side Peace Arch POE Lane 6		49°00'02.13397"	122°45'19.97676"

Appendix E: Loop Detector Translation Table

ATIS DMS Loop ID	Country	Direction	Owner	Road	Lane	Loop Name	Cabinet	Lane Type	Location	SRMP	Latitude	Longitude
9901-7 upstream	USA	SB	BC MoT	I-5	WEST 7	VDS99-01B L13	CC99-01		West Side Peace Arch POE Lane 7		49°00'02.23413"	122°45'20.06256"
9901-7 downstream	USA	SB	BC MoT	I-5	WEST 7	VDS99-01B L14	CC99-01		West Side Peace Arch POE Lane 7		49°00'02.13397"	122°45'19.97676"
99101-1 upstream	USA	SB	BC MoT	I-5	WEST 8	VDS99-01B L15	CC99-01	NEXUS	West Side Peace Arch POE Lane 8		49°00'02.23413"	122°45'20.06256"
99101-1 downstream	USA	SB	BC MoT	I-5	WEST 8	VDS99-01B L16	CC99-01	NEXUS	West Side Peace Arch POE Lane 8		49°00'02.13397"	122°45'19.97676"
9902-1 upstream	USA	SB	BC MoT	I-5	1	VDS99-02 L17	CC99-01		SB Approach Peace Arch POE		49°00'04.74726"	122°45'22.52333"
9902-1 downstream	USA	SB	BC MoT	I-5	1	VDS99-02 L18	CC99-01		SB Approach Peace Arch POE		49°00'04.63948"	122°45'22.41027"
9902-2 upstream	USA	SB	BC MoT	I-5	2	VDS99-02 L19	CC99-01		SB Approach Peace Arch POE		49°00'04.74726"	122°45'22.52333"
9902-2 downstream	USA	SB	BC MoT	I-5	2	VDS99-02 L20	CC99-01		SB Approach Peace Arch POE		49°00'04.63948"	122°45'22.41027"
99102-1 upstream	USA	SB	BC MoT	I-5	3	VDS99-02 L21	CC99-01	NEXUS	SB Approach Peace Arch POE		49°00'04.74726"	122°45'22.52333"
99102-1 downstream	USA	SB	BC MoT	I-5	3	VDS99-02 L22	CC99-01	NEXUS	SB Approach Peace Arch POE		49°00'04.63948"	122°45'22.41027"
9903-1 upstream	CAN	SB	BC MoT	HWY99	1	VDS99-03 L23	CC99-01		SB 99 at border marker		49°00'08.14567"	122°45'25.59942"
9903-1 downstream	CAN	SB	BC MoT	HWY99	1	VDS99-03 L24	CC99-01		SB 99 at border marker		49°00'08.00672"	122°45'25.48521"
9903-2 upstream	CAN	SB	BC MoT	HWY99	2	VDS99-03 L25	CC99-01		SB 99 at border marker		49°00'08.14567"	122°45'25.59942"
9903-2 downstream	CAN	SB	BC MoT	HWY99	2	VDS99-03 L26	CC99-01		SB 99 at border marker		49°00'08.00672"	122°45'25.48521"
99103-1 upstream	CAN	SB	BC MoT	HWY99	3	VDS99-03 L27	CC99-01	NEXUS	SB 99 at border marker		49°00'08.14567"	122°45'25.59942"
99103-1 downstream	CAN	SB	BC MoT	HWY99	3	VDS99-03 L28	CC99-01	NEXUS	SB 99 at border marker		49°00'08.00672"	122°45'25.48521"
9904-1 upstream	CAN	SB	BC MoT	HWY99	1	VDS99-04 L29	CC99-01		SB 99 south of Peace Arch Park cabin		49°00'12.57845"	122°45'27.33938"
9904-1 downstream	CAN	SB	BC MoT	HWY99	1	VDS99-04 L30	CC99-01		SB 99 south of Peace Arch Park cabin		49°00'12.41678"	122°45'27.34102"
9904-2 upstream	CAN	SB	BC MoT	HWY99	2	VDS99-04 L31	CC99-01		SB 99 south of Peace Arch Park cabin		49°00'12.57845"	122°45'27.33938"
9904-2 downstream	CAN	SB	BC MoT	HWY99	2	VDS99-04 L32	CC99-01		SB 99 south of Peace Arch Park cabin		49°00'12.41678"	122°45'27.34102"
99104-1 upstream	CAN	SB	BC MoT	HWY99	3	VDS99-04 L33	CC99-01	NEXUS	SB 99 south of Peace Arch Park cabin		49°00'12.57845"	122°45'27.33938"
99104-1 downstream	CAN	SB	BC MoT	HWY99	3	VDS99-04 L34	CC99-01	NEXUS	SB 99 south of Peace Arch Park cabin		49°00'12.41678"	122°45'27.34102"
9905-1 upstream	CAN	SB	BC MoT	HWY99	1	VDS99-05 L35	CC99-02		SB 99 at Douglas Facility		49°00'18.84351"	122°45'27.69992"
9905-1 downstream	CAN	SB	BC MoT	HWY99	1	VDS99-05 L36	CC99-02		SB 99 at Douglas Facility		49°00'18.68570"	122°45'27.68108"
9905-2 upstream	CAN	SB	BC MoT	HWY99	2	VDS99-05 L37	CC99-02		SB 99 at Douglas Facility		49°00'18.84351"	122°45'27.69992"
9905-2 downstream	CAN	SB	BC MoT	HWY99	2	VDS99-05 L38	CC99-02		SB 99 at Douglas Facility		49°00'18.68570"	122°45'27.68108"
99105-1 upstream	CAN	SB	BC MoT	HWY99	3	VDS99-05 L39	CC99-02	NEXUS	SB 99 at Douglas Facility		49°00'18.84351"	122°45'27.69992"
99105-1 downstream	CAN	SB	BC MoT	HWY99	3	VDS99-05 L40	CC99-02	NEXUS	SB 99 at Douglas Facility		49°00'18.68570"	122°45'27.68108"
9906-1 upstream	CAN	SB	BC MoT	HWY99	1	VDS99-06 L41	CC99-02		SB 99 at Duty Free		49°00'26.66679"	122°45'27.25623"
9906-1 downstream	CAN	SB	BC MoT	HWY99	1	VDS99-06 L42	CC99-02		SB 99 at Duty Free		49°00'26.55600"	122°45'27.25426"
9906-2 upstream	CAN	SB	BC MoT	HWY99	2	VDS99-06 L43	CC99-02		SB 99 at Duty Free		49°00'26.66679"	122°45'27.25623"
9906-2 downstream	CAN	SB	BC MoT	HWY99	2	VDS99-06 L44	CC99-02		SB 99 at Duty Free		49°00'26.55600"	122°45'27.25426"
99106-1 upstream	CAN	SB	BC MoT	HWY99	3	VDS99-06 L45	CC99-02	NEXUS	SB 99 at Duty Free		49°00'26.66679"	122°45'27.25623"
99106-1 downstream	CAN	SB	BC MoT	HWY99	3	VDS99-06 L46	CC99-02	NEXUS	SB 99 at Duty Free		49°00'26.55600"	122°45'27.25426"
9907-1 upstream	CAN	SB	BC MoT	HWY99	1	VDS99-07 L47	CC99-02		SB 99 Halfway btwn 8th interchange and park		49°00'45.47970"	122°45'28.19190"
9907-1 downstream	CAN	SB	BC MoT	HWY99	1	VDS99-07 L48	CC99-02		SB 99 Halfway btwn 8th interchange and park		49°00'45.35062"	122°45'28.16827"
9907-2 upstream	CAN	SB	BC MoT	HWY99	2	VDS99-07 L49	CC99-02		SB 99 Halfway btwn 8th interchange and park		49°00'45.47970"	122°45'28.19190"
9907-2 downstream	CAN	SB	BC MoT	HWY99	2	VDS99-07 L50	CC99-02		SB 99 Halfway btwn 8th interchange and park		49°00'45.35062"	122°45'28.16827"
9908-1 upstream	CAN	SB	BC MoT	HWY99	1	VDS99-08 L51	CC99-03		SB 99 at 8th Ave SB onramp		49°00'52.88822"	122°45'31.60483"
9908-1 downstream	CAN	SB	BC MoT	HWY99	1	VDS99-08 L52	CC99-03		SB 99 at 8th Ave SB onramp		49°00'52.75474"	122°45'31.54464"
9908-2 upstream	CAN	SB	BC MoT	HWY99	2	VDS99-08 L53	CC99-03		SB 99 at 8th Ave SB onramp		49°00'52.88822"	122°45'31.60483"
9908-2 downstream	CAN	SB	BC MoT	HWY99	2	VDS99-08 L54	CC99-03		SB 99 at 8th Ave SB onramp		49°00'52.75474"	122°45'31.54464"

Border Data Warehouse
Detector Map - Master View



Note: Data from Map 6 loop detectors are not currently included in the system. As soon as the data are archived, Map 6 will be completed.

NOT TO SCALE

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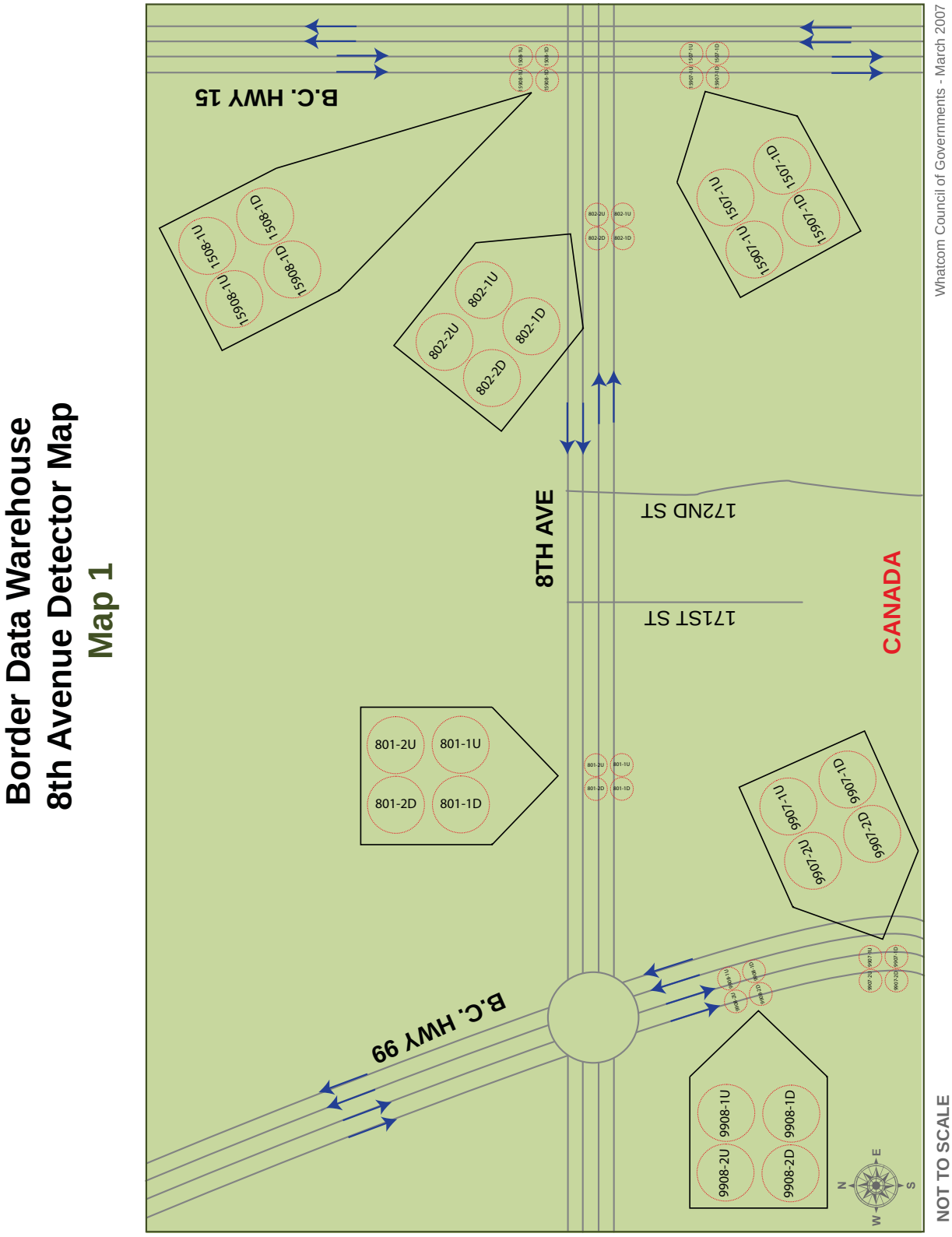
Border Data Warehouse
8th Avenue Detector Map
Map 1
B.C. HWY 15
1508-1U
1508-1D
1508-2U
1508-2D
802-1U
802-1D
802-2U
802-2D
1507-1U
1507-1D
1507-2U
1507-2D
8TH AVE
172ND ST
171ST ST
CANADA
801-2U
801-1U
801-2D
801-1D
9907-1U
9907-1D
9907-2U
9907-2D
B.C. HWY 99
9908-1U
9908-1D
9908-2U
9908-2D
N
E
S
W
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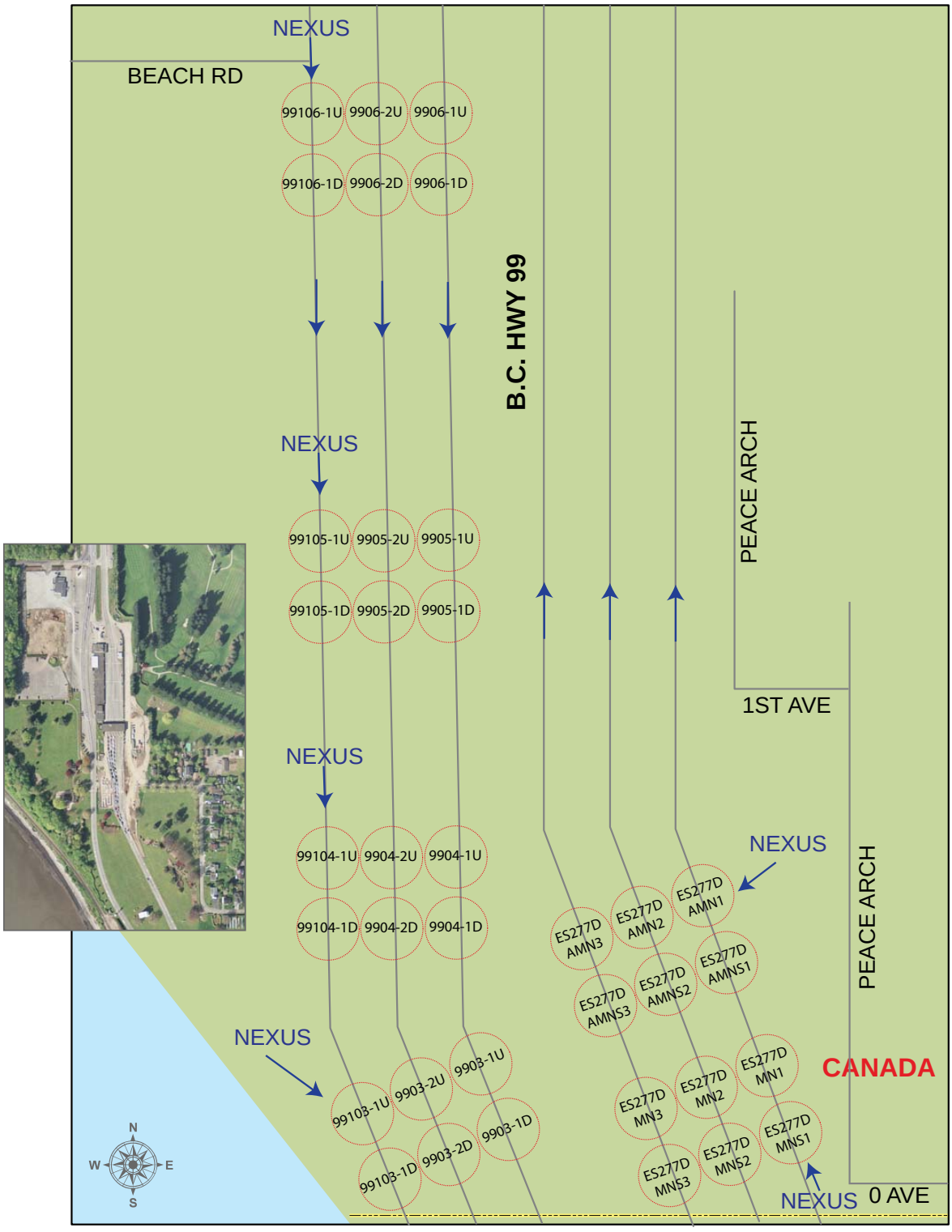
NOT TO SCALE

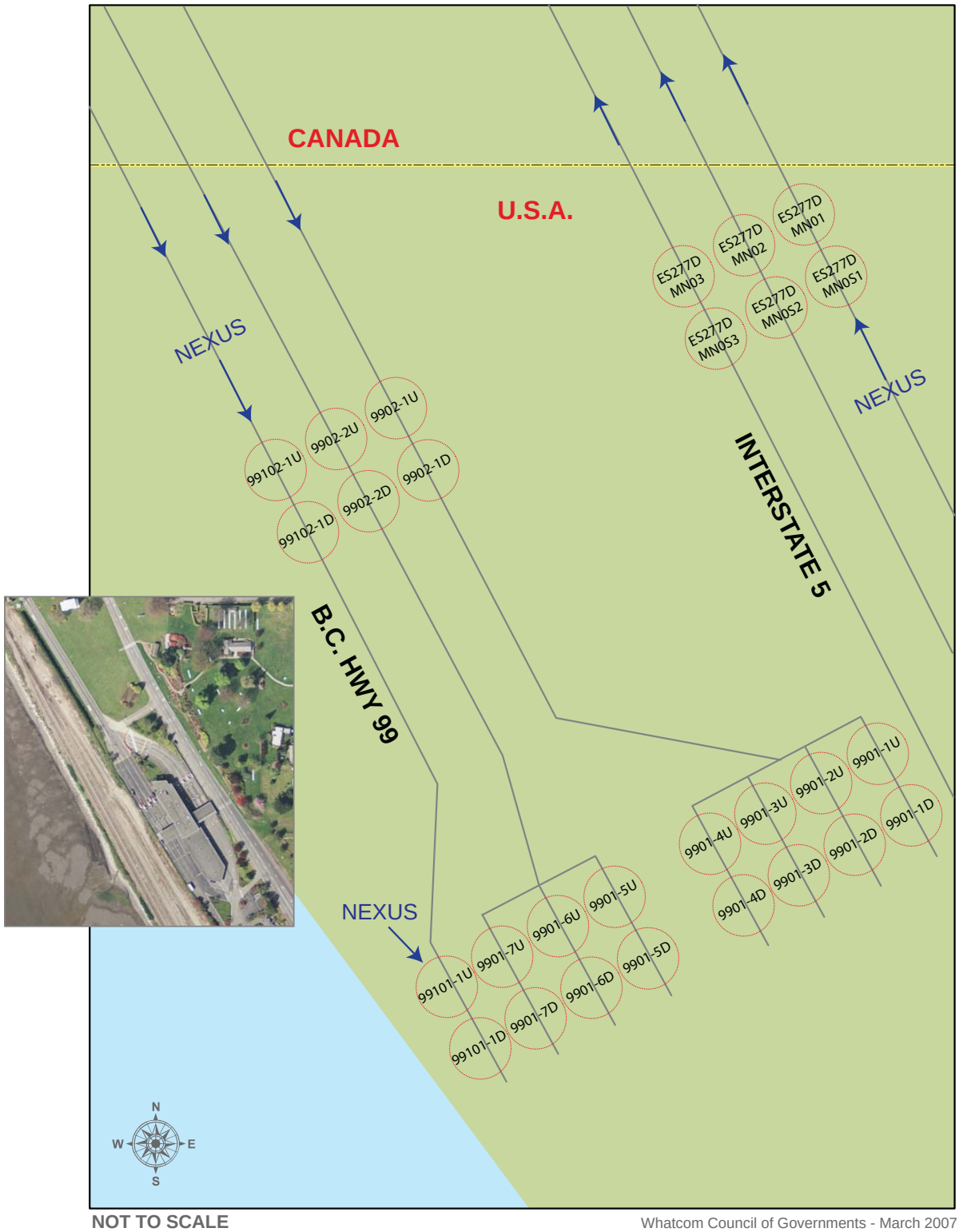
Border Data Warehouse
Peace Arch Detector Map
Map 2



NOT TO SCALE

Whatcom Council of Governments - March 2007

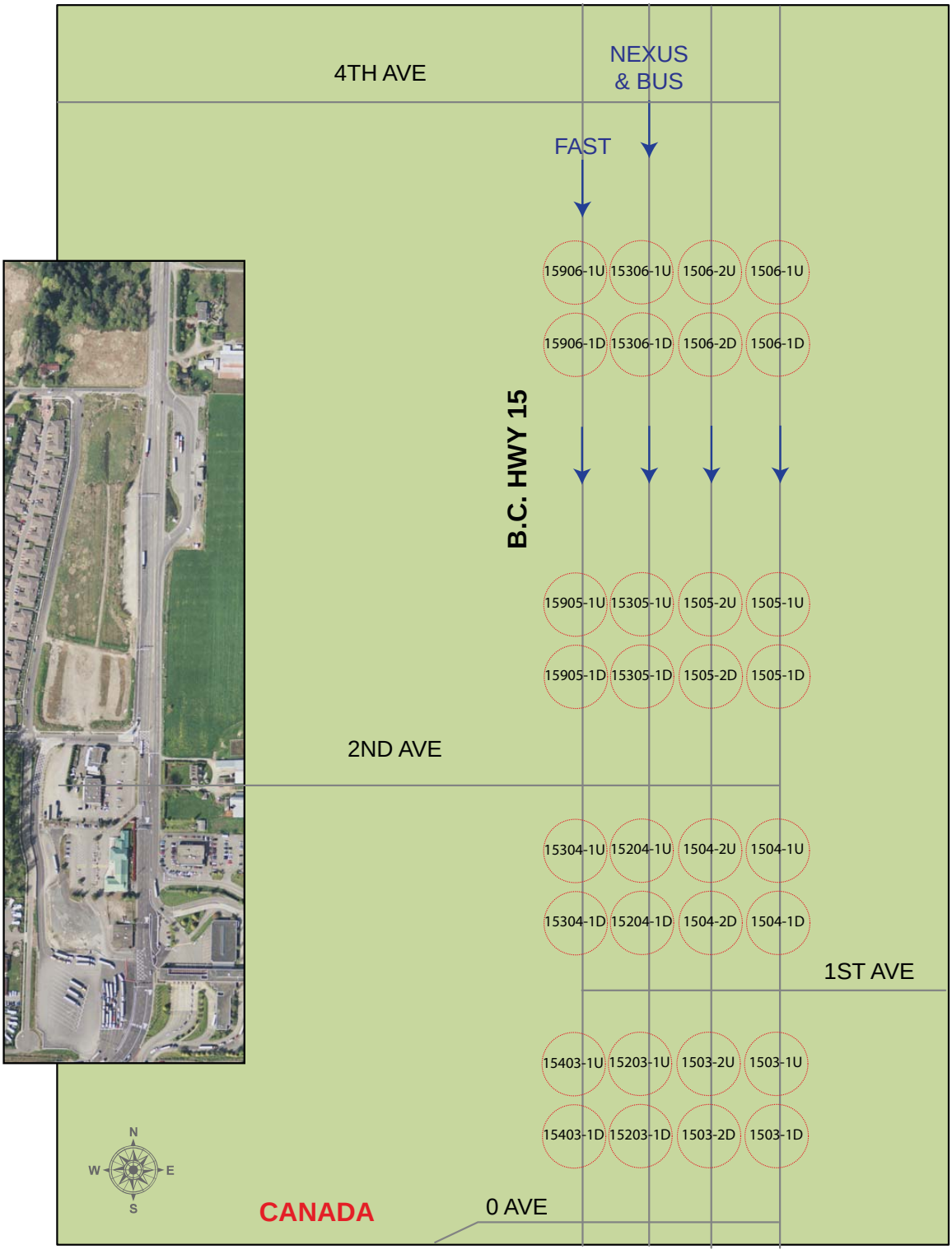
Border Data Warehouse
Peace Arch Port-of-Entry Detector Map
Map 3



NOT TO SCALE

Whatcom Council of Governments - March 2007

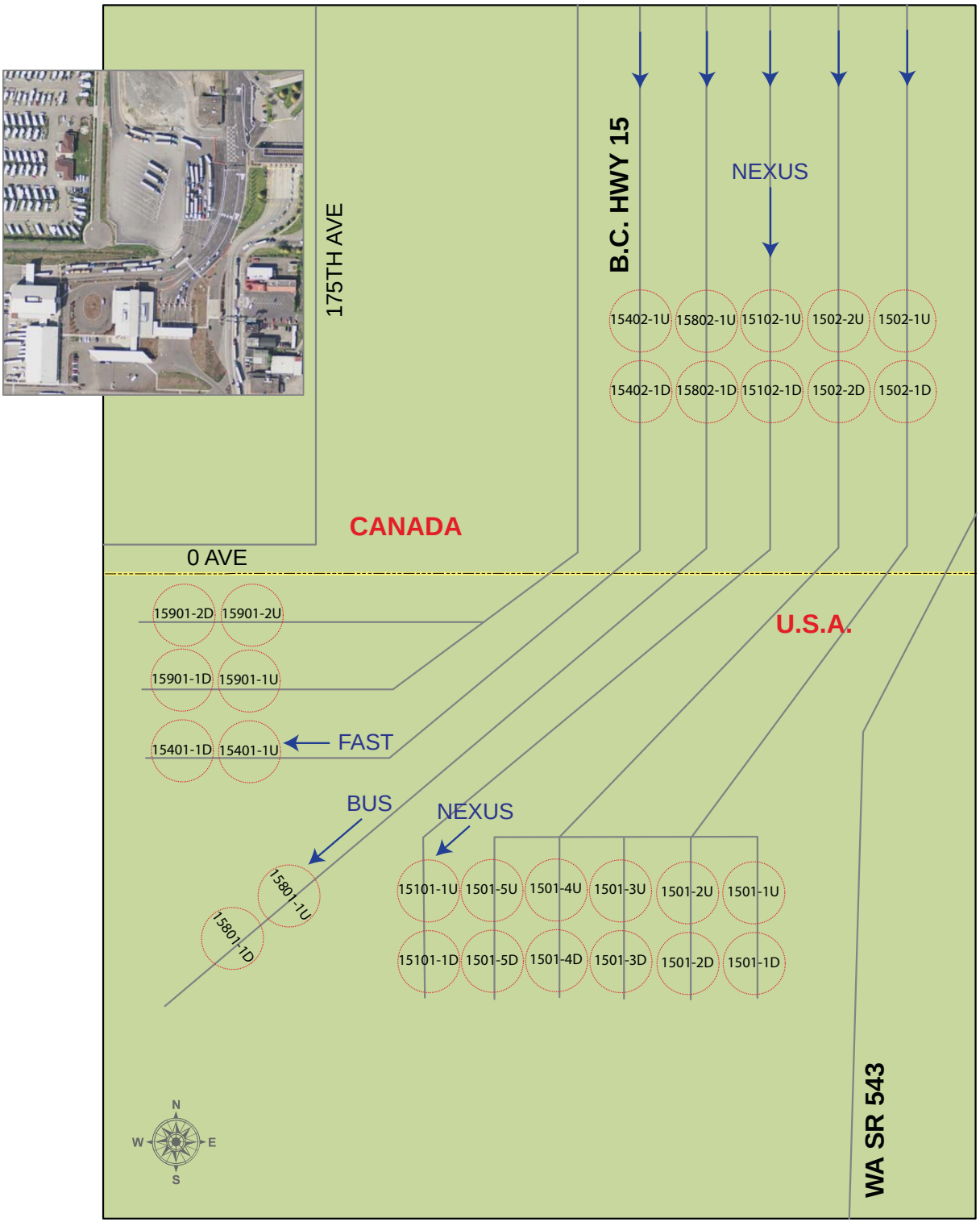
Border Data Warehouse
Pacific Highway Detector Map
Map 4



NOT TO SCALE

Whatcom Council of Governments - March 2007

Border Data Warehouse
Pacific Highway Port-of-Entry Detector Map
Map 5



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Whatcom Council of Governments - March 2007

www.CascadeGatewayData.com

User Guide

April, 2007

Whatcom Council of Governments
(360) 676-6974

1. Introduction

The **CascadeGatewayData.com** website provides a highly functional and flexible interface to an archive of vehicle volume, wait time, and queue length data from the Cascade Gateway land port-of entry between Whatcom County, Washington State and the Lower Mainland of British Columbia.

The data are collected from the northbound Washington State Department of Transportation (WSDOT) Advanced Traveler Information System (ATIS), which collects real-time border delay information and displays this information on the WSDOT website as well as on variable message signs (VMS) at the border. The system is designed to provide travelers with information to help them choose which border crossing will be the fastest to use.

Data are also collected from the southbound British Columbia Ministry of Transportation (BCMOT) ATIS, which serves the same purpose as the northbound system in providing travelers with border delay information to make better transportation system choices.

The border data warehouse uses the information collected from these two systems to provide historical wait-time, volume, queue length, and service rate data to regional organizations, agencies, and the public. There are numerous ways to view the data available via website. This guide describes how to use the website to access the information you need.

For more information on the project itself (its formation, the data systems used, and what data are compiled), please read the ATIS Data Management System Project Final Report, available online at: www.wcog.org/imtc

2. Data viewing choices

The website home page allows users to access the warehouse data in three different ways:

- **Browse data by crossing**: This function allows you to look at the data from a specific crossing by year, month, and day. This is the most common usage of the data.
- **Browse data by detector**: This function allows you to query data from one specific loop detector in the system. This is for more advanced or specific data searched.
- **Custom query**: This tool allows users to customize the information they want from the system in terms of date ranges, locations, and measurements.

Which option you choose should be based on what level of detail you are interested in. If you are looking for the specific information from one loop detector in the system, and nothing more, then you will want to browse by detector. However, most users will be looking at a crossing location, in one direction or another, and so should use Browse Data and then do so by Crossings.

Figure 1 - Home page.

3. Browse Data by Crossing

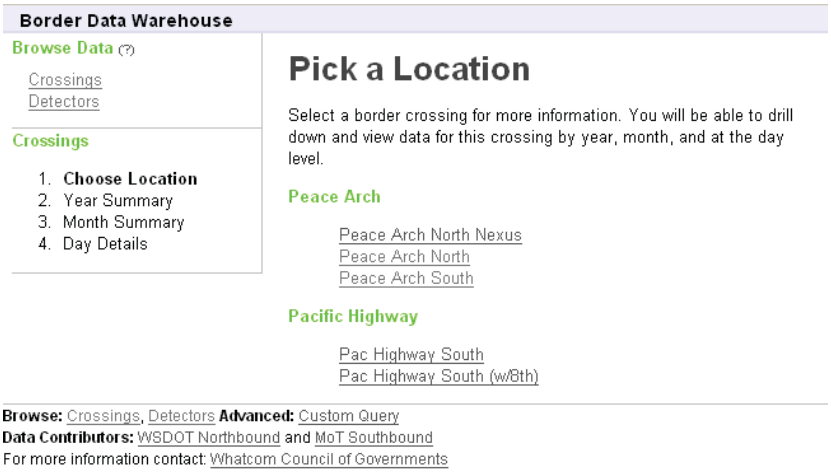
Choose either Browse Data or the border crossings underlined links from the home page (see **Figure 1**).

Choose a location

Once you enter the browse data page, you will first be asked to choose a location. Locations are listed in green, and currently include Peace Arch and Pacific Highway ports-of-entry (the system will later be expanded to include Lynden/Aldergrove and Sumas/Huntingdon ports-of-entry as well).

Each location can show information for either the northbound (into Canada) or southbound (into the United States) direction. In addition, specialized lanes such as NEXUS have their own dataset (see **Figure 2**).

Figure 2 - Browse Data.



Year Summary

Once a location is chosen, users can view a year summary of the data for this crossing and direction.

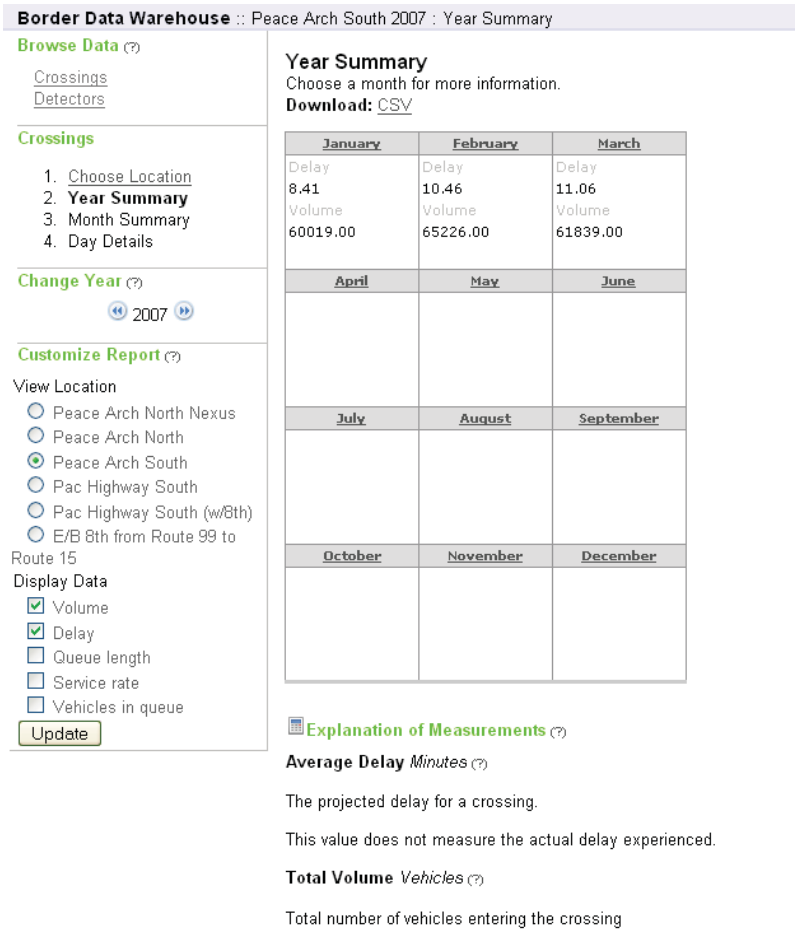
From this screen, there are multiple ways to drill down and see more specific data.

A summary of the data being viewed is listed at the top of the page. In the example in **Figure 3**, the title bar shows a view of "Peace Arch South 2007: Year Summary" to explain what information is shown in the calendar.

By default, the system will automatically show the average measured delay, or wait-time (in minutes), and the estimated volume crossing through that port-of-entry that month.

To view more statistics for each month, choose queue length, service rate, and/or

Figure 3 - Year Summary.



volume from the left navigation bar to see these data (more information about each of these data types are in **Chapter 6**).

Clicking on any of the months will provide a daily view of that particular month.

The year summary can be downloaded as a .CSV file (compatible with Microsoft Excel) by clicking the CSV link at the top of the page.

A definition of the measurements used on the page can be found at the bottom of the page.

Left Navigation Bar

The left navigation bar has information as well as tools to customize the report in the main screen. The following sections describe the navigation bar:

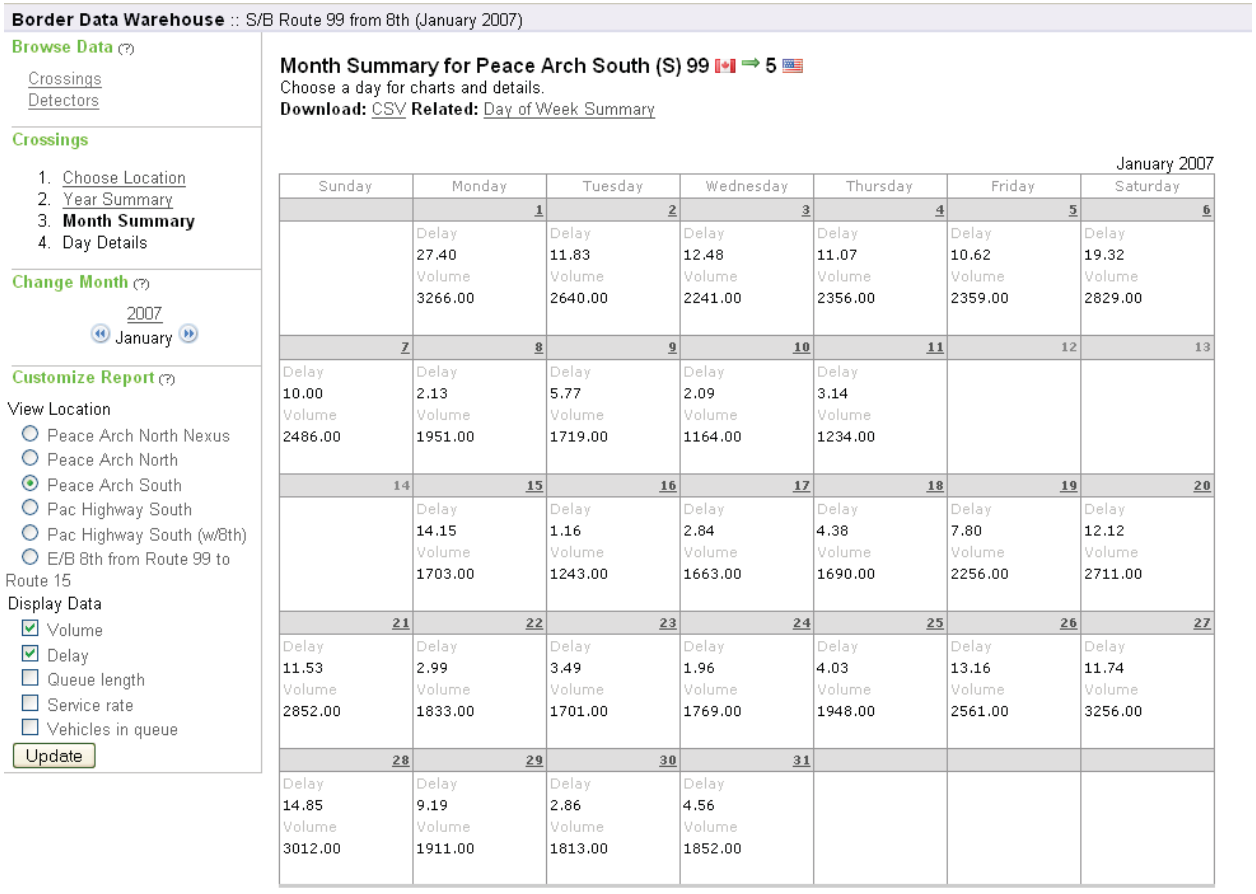
- **Browse Data**: This allows users to switch between the browse data viewing (being described here) and the detector viewing (described in **Chapter 4**).

- **Crossings**: This list shows users where they are in the dataset. Step 1 is always choosing a location. Step 2 shows the year summary, which is bolded because that is being viewed at present. The third detail is monthly summaries, which can be navigated to by clicking on any of the month titles. And the fourth level is the individual day details.
- **Change Year**: Use the right and left arrows to switch between years of data for that crossing.
- **Customize Report**: This is where you can easily change which location you are viewing, and also what data are to be displayed. At any time, users can click the display data checkboxes to select one or more data sets to be shown in the corresponding calendar.

Month Summary

Click on one of the months listed in the yearly calendar that has data. This will drill down to the month view. The same information that is available at the year summary

Figure 4 - Month Summary.



level is now viewable for each day. As in the year summary view, users can select which data to display using the check boxes on the left navigation bar. An explanation of the measurements used can be found at the bottom of the screen (see **Figure 4**).

Note that at the top of the page the Port-of-Entry, direction, and highway are clarified in the header (i.e. "Peace Arch South (S) 99") and an arrow shows which direction the traffic is traveling between the United States and Canada.

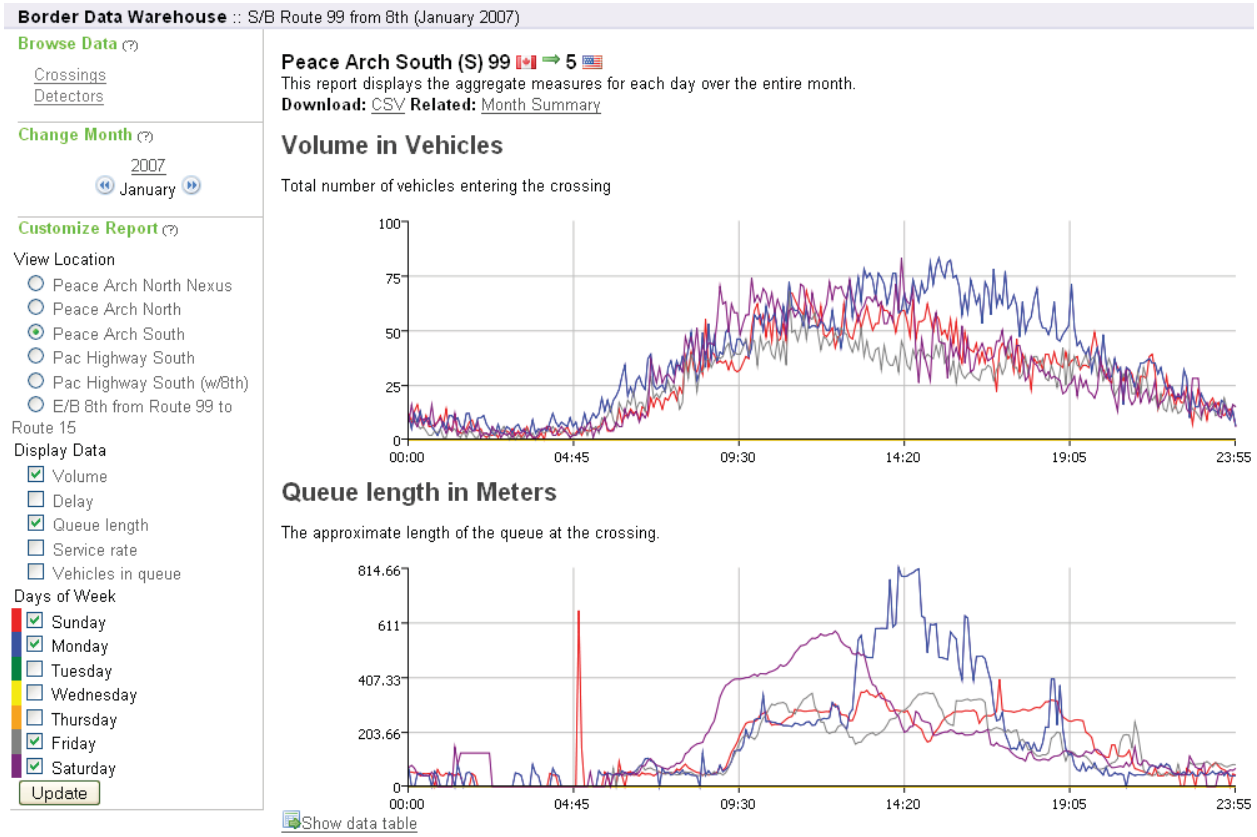
The month being viewed can be changed using the "Change Month" feature on the left navigation bar. Click the left and right arrows to reverse or advance through the months.

Downloading Month Detail

To download a copy of the month summary data onto your computer, click the CSV link at the top of the page.

Most browsers will then open a dialog box and prompt you to either open the .csv file directly using Microsoft Excel, or to save the file to disk. Data will now be available in a worksheet for further analysis.

Figure 5 - Day of Week Summary.



Day of Week Summary

By clicking the Day of Week Summary at the top of the page, you can see the data displayed in graphic format by day of week (see **Figure 5**).

Additional data can be shown by checking the data boxes on the left navigation bar. Also added to the left navigation bar is a color key showing which days of the week are being displayed for that month.

In Figure 5, only Friday – Monday are shown, with volume and queue length.

To view the data table for these graphs, click the Show data table link at the bottom of the page. A data chart will appear below the graphs with the relevant information included.

To return to the month summary, click the Month Summary link at the top of the page.

Day Summary

Clicking on any individual day on the calendar will bring up a day summary, showing graphs of all the data types selected on the left navigation bar (see **Figure 6**).

The day being viewed can be changed using the "Change Date" feature on the left navigation bar. Click the left and right arrows to reverse or advance through the days.

To view the data in table format rather than as graphs, you can either click the Show data table link at the bottom of the page to view the data on the web page itself, or click the CSV link at the top of the page to download the data set into a spreadsheet which can be saved on your computer.

Clicking the Delay Report link at the top of the page will give users the option to set a delay threshold to see when that threshold is broken on a particular day. The default threshold is set at 60 minutes (See **Figure 7**). This view includes a graph with a notation of the delay threshold, hourly factors shown in table format at the bottom of the screen (and downloadable as a CSV file by clicking CSV at the top of the page), and a summary which comes up to illustrate the maximum delays (when the threshold is breached).

To change the threshold, go to the left of the screen and highlight the "60 minutes" text, changing it to whatever minute value you would like. Then click the "Update" button. Note the summary statistics will change (or disappear if the threshold is never reached).

Figure 6 - Day Summary.

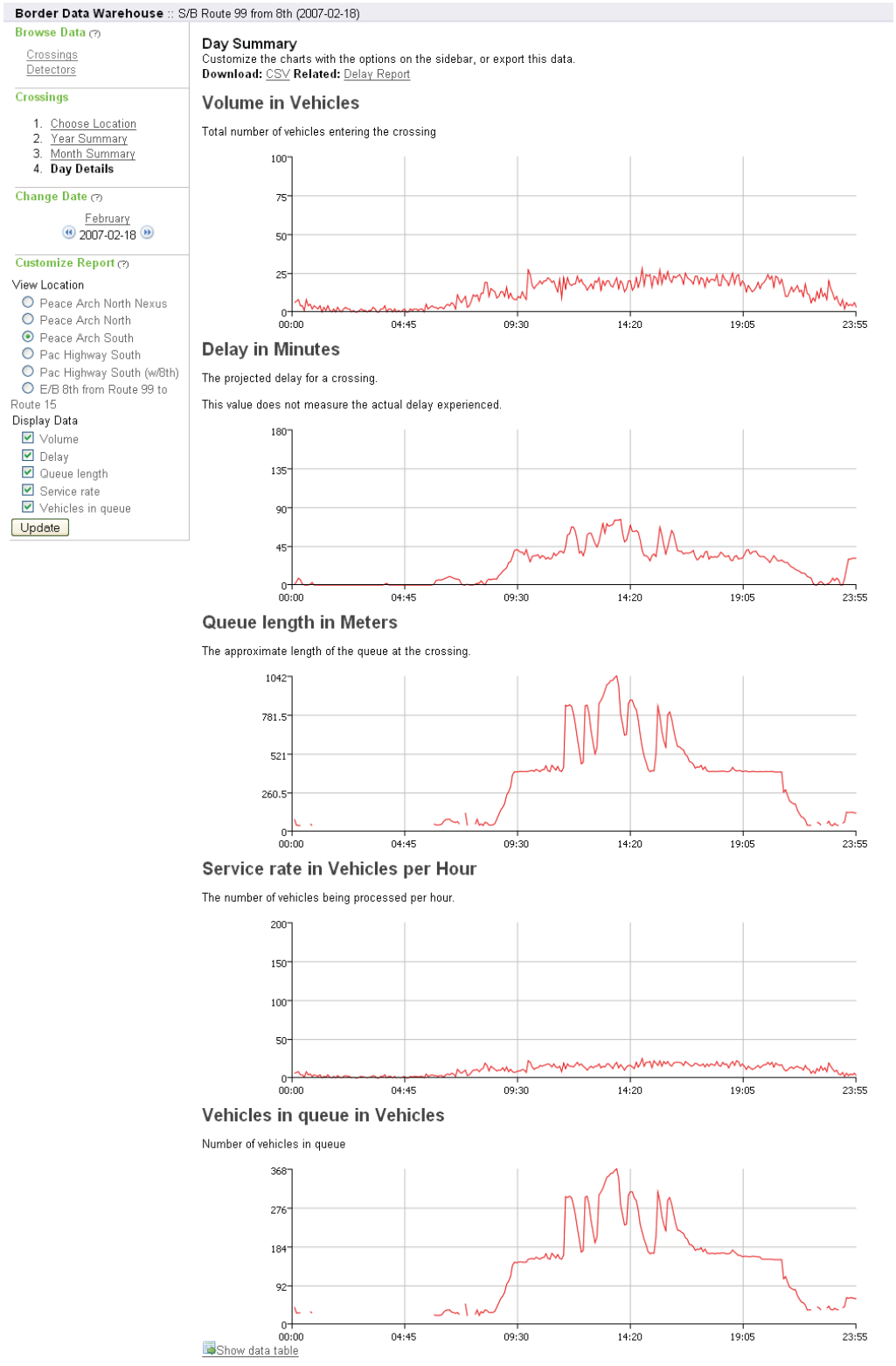
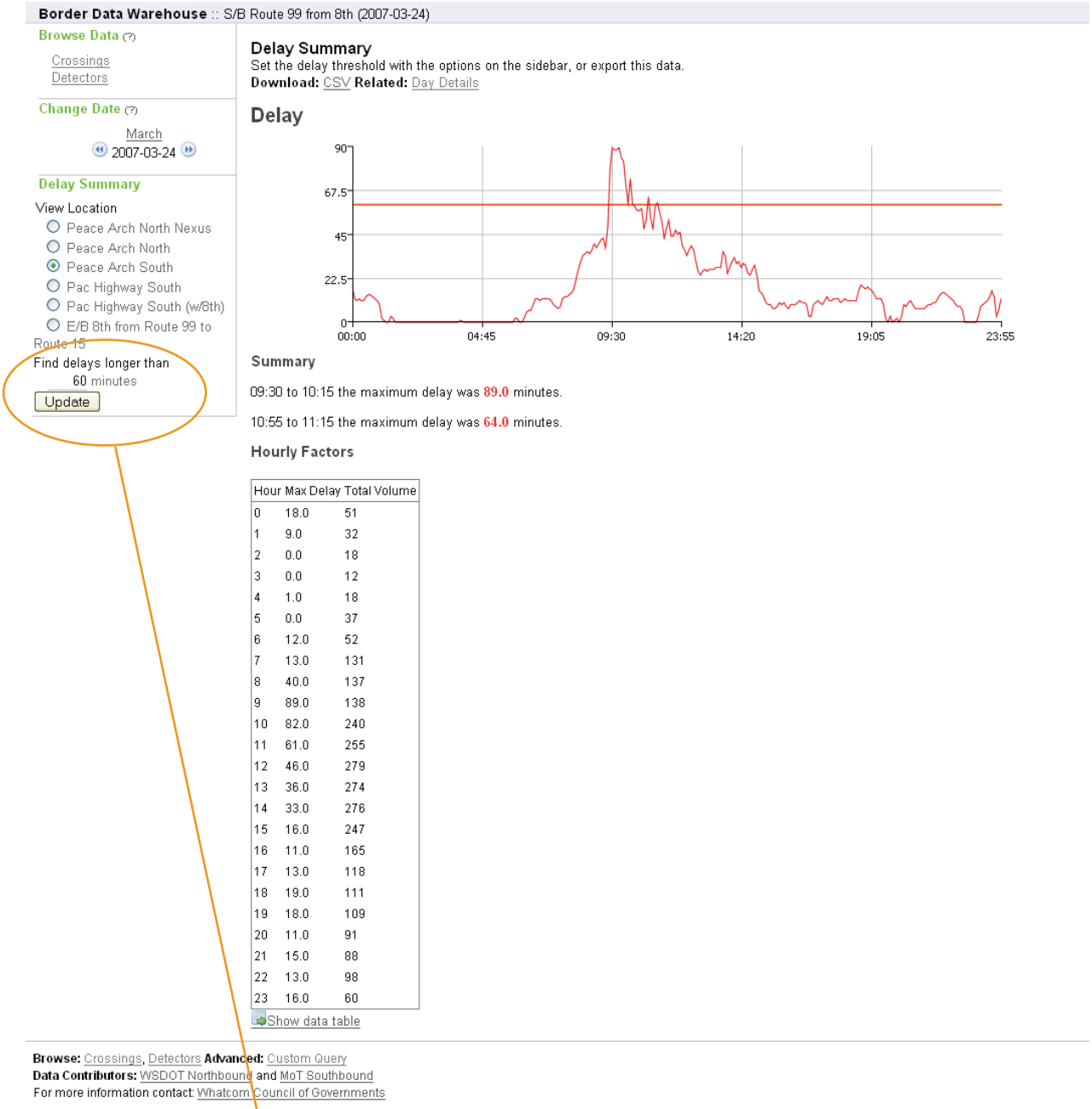


Figure 7 - Delay Summary.



You can change this value by clicking on the “60 minutes” and typing in any number. Then click the Update button.

4. Browse Data by Detectors

Chapter 2 discussed viewing the data by crossing and direction. Data can also be viewed by individual detector.

The ATIS data management system uses over 170 loop detectors embedded in the pavement to both count vehicles and to determine queue length.

The northbound and southbound ATIS systems use different naming schemes for their loops, but all are recorded together in the same way in this system. For each lane location, there are two loops, one "upstream" and one "downstream."

The following information guides users to looking up the data gathered at individual detectors in the system, which can help identify problems within the system, help count volumes in a particular lane, or can be used to see how traffic is moving.

Browse Loop Detectors

From the website home page, click the Loop Detectors link under the Browse Data category. Similarly, users can click the Detectors link at the top left of the navigation panel at any time to switch to viewing the system's loop detectors.

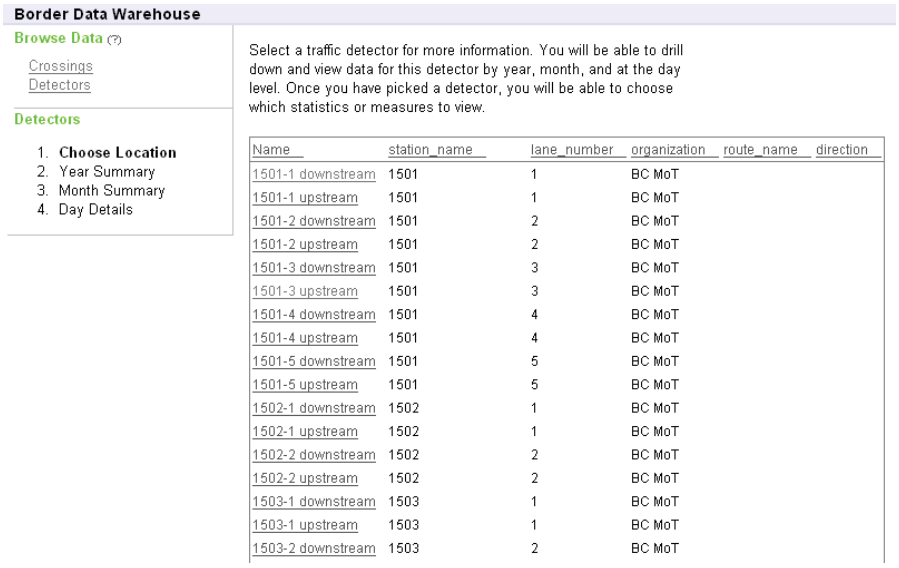
The main detector page shows a list of all the loop detectors being used in the system (see **Figure 8**). By default the list is organized alphabetically by name. However, you can alter the sort order by clicking on the titles of each column (Name, Station Name, Lane number, Organization, Route Name, and Direction). Clicking on the column title twice will change the sort order from ascending to descending.

The list shows the loops by the name used in the archive system. The "Station Name" refers to the set of detectors across all lanes at that location.

Lanes are numbered 1-4 from left to right in the direction of traffic. Therefore, in either direction, Lane 1 is the lane closest to the center line, and Lane 2 would be to the right of that.

"Organization" lists the agency who owns and maintains the specific loop detector.

Figure 8 - Detectors List.



Year, Month, and Day Summaries

Click on a specific detector to view the year summary of that detector's data. The data viewing options and left navigation bar are very similar to the selections available in the Crossings section of the website (see **Figure 9**).

The data available for display include volume, occupancy, average speed, and average length. More information about these measurements is in **Chapter 6**.

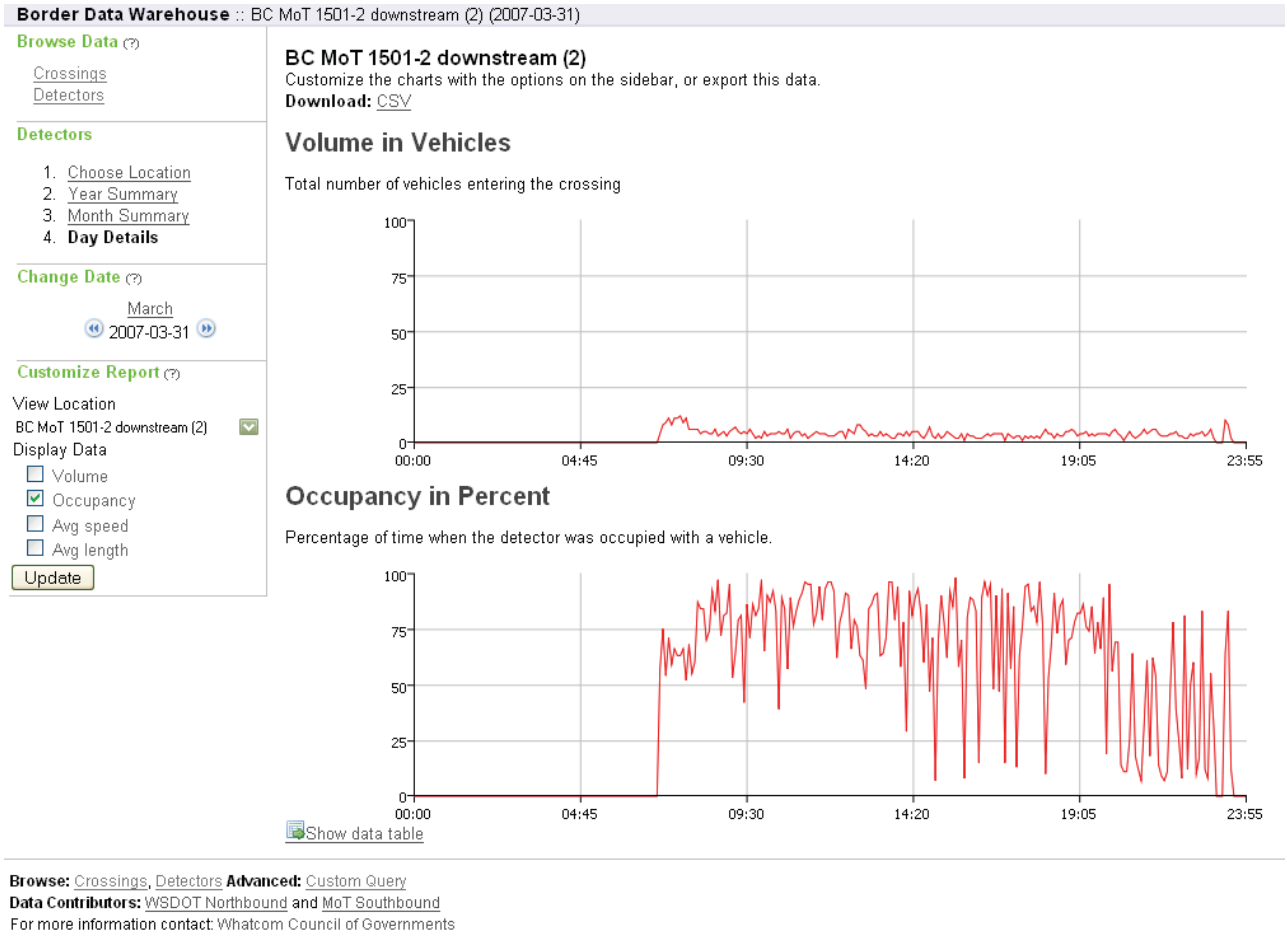
As with the crossings section, clicking on any particular month will provide daily summaries of the data, with greater daily detail available as well by clicking on any individual day.

See the descriptions in **Chapter 3** to review the various functions and views available on the daily, monthly, and yearly summaries.

Using the Detector Maps

Another way to access the individual detector data archives is by clicking on the

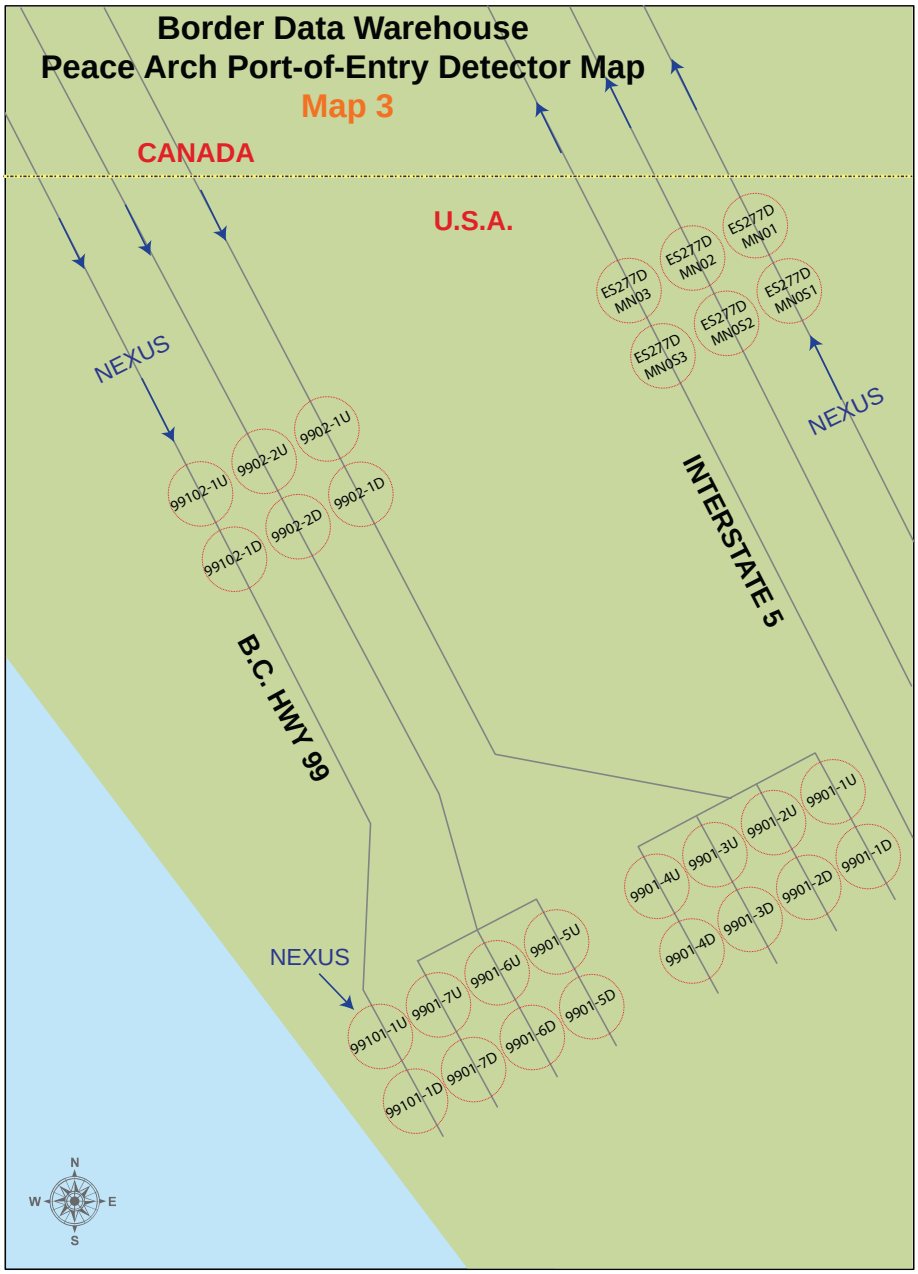
Figure 9 - Detector Day Summary.



Detector Maps link on the left navigation bar of the main detector page. This will open a map showing all detectors in the border data warehouse. Clicking on the boxed areas of the map will open a close-up map of that area, where users can click on an individual detector and be taken to its day summary page (see **Figure 10**).

The maps require the Flash web browser plug-in to view properly. If a user's computer does not already have Flash installed, they may be prompted to install the reader.

Figure 10 - Loop detector map sample.



5. Custom Queries

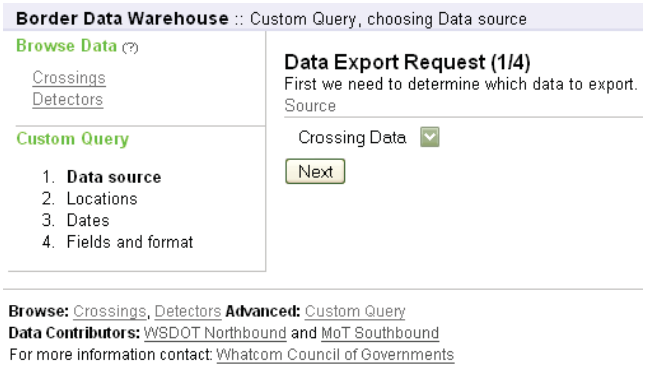
The advanced custom query functionality of the website allows users who are familiar with the system to set up more specific tabulations.

To access the custom query section of the website from the home page, click the Custom Query link in the center of the page. It is also available anywhere on the website by clicking the Custom Query link at the bottom of each web page.

The custom query tool develops a data report which is available in table form only (as a .csv file for exporting or as an .html table).

There are four steps to customizing a data report.

Figure 11 - Custom Query Step 1.



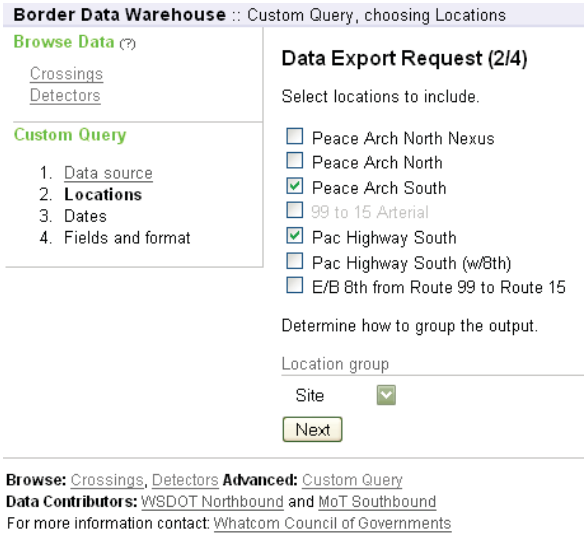
Step 1: Source

Data can be exported from the crossing section of the archive (by port-of-entry) or from each individual loop detector (See **Figure 11**).

Step 2: Locations or Detectors

If you chose to export crossing data, then a list of locations to include in the data report are presented. You can choose one or more locations, which is the benefit of the custom query (in the browse section, data are only available by one port and direction at a time). For example, if you would like the southbound data from both Peace Arch and Pacific Highway ports-of-entry, both directions can be chosen (see **Figure 12**).

Figure 12 - Custom Query Step 2.



Likewise, if you chose detectors, you can now select more than one detector to view data from.

Location Group: at the bottom of this page, you can choose to have the data grouped by either site (Port-of-entry or detector) or by direction (northbound or southbound).

Step 3: Date Range

Choose a start and end date range for the data to be exported, which days of the week to include, and then how you would like the data to be organized. They can be organized by each date, day of week, month, or by

Figure 13 - Custom Query Step 3.

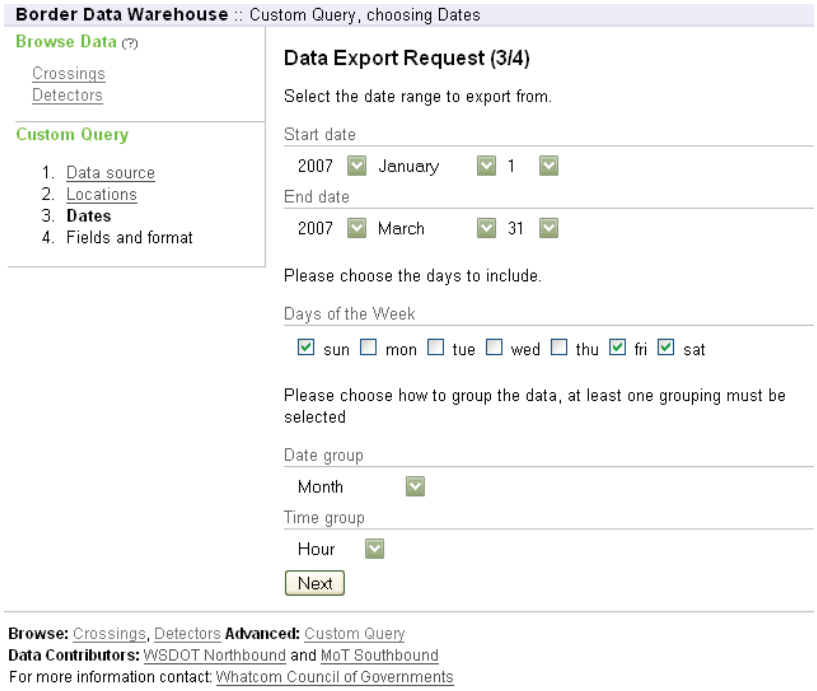
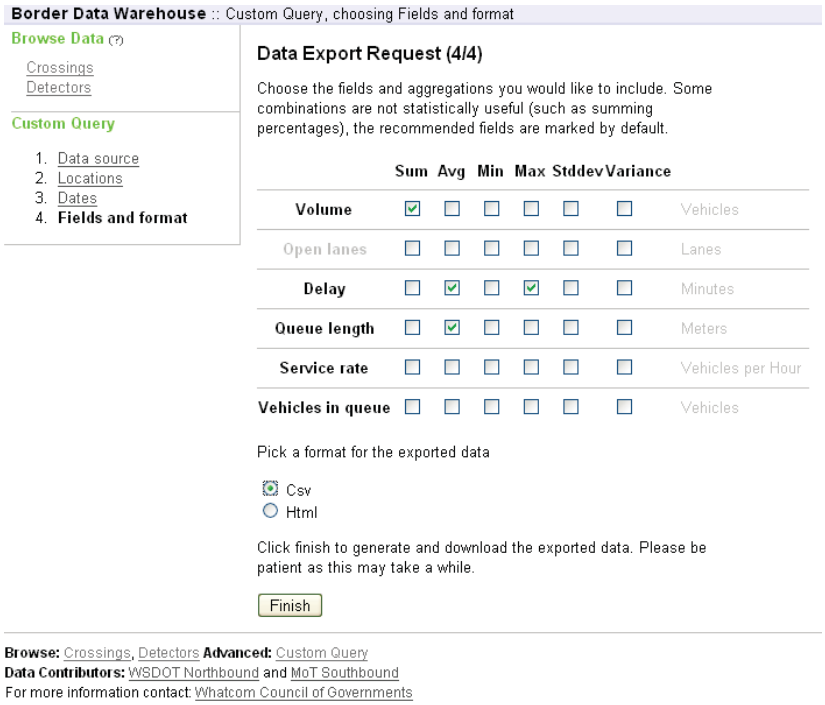


Figure 14 - Custom Query Step 4.



year. In addition, they can be organized by minute, hour, or by larger AM/PM groups (see **Figure 13**).

Step 4: Fields and Aggregations

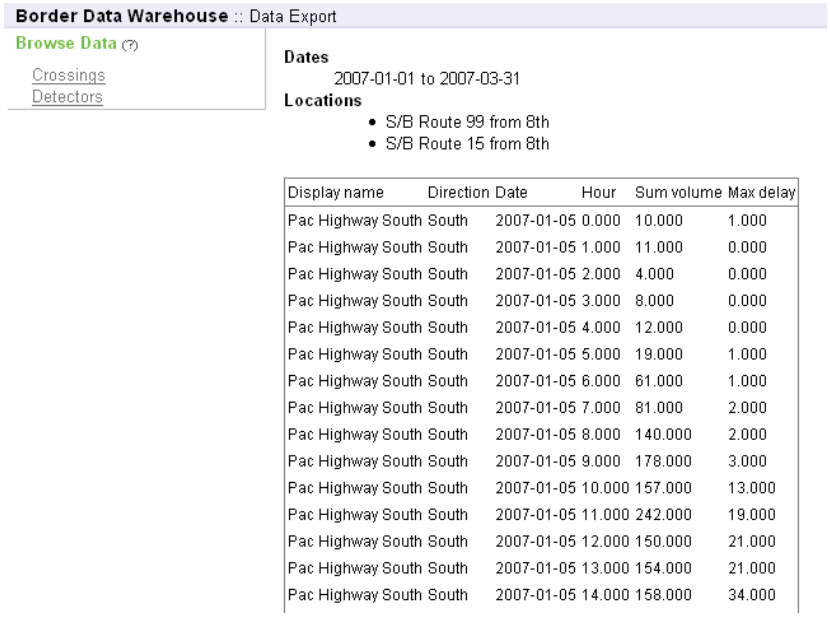
Choose the data fields you would like to view and how they should be aggregated (sum, average, minimum value, maximum value, standard deviation, and/or variance). The custom tool allows users to choose more than one data field and more than one way to aggregate these data (see **Figure 14**).

The last step is to choose the format of the data. Choosing HTML will display the data table on screen in your web browser (note: graphs are not available for custom query results). Choosing CSV will create a file which can be opened using a spreadsheet program such as Microsoft Excel, from which the data can then be manipulated or made into charts.

Data Output Results

Examples of how different date and time groupings are shown in **Figures 15 – 21**.

Figure 15 - Grouped by POE, Date and Hour



Border Data Warehouse :: Data Export

Browse Data (?)

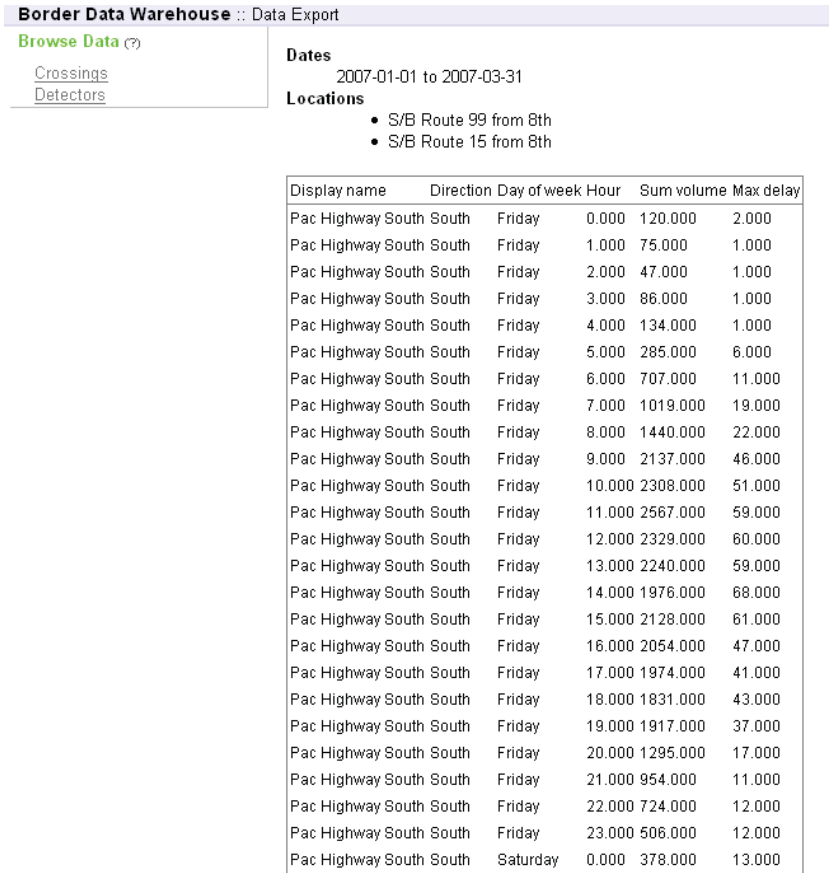
Crossings
Detectors

Dates
2007-01-01 to 2007-03-31

Locations
- S/B Route 99 from 8th
- S/B Route 15 from 8th

Display name	Direction	Date	Hour	Sum volume	Max delay
Pac Highway South	South	2007-01-05	0.000	10.000	1.000
Pac Highway South	South	2007-01-05	1.000	11.000	0.000
Pac Highway South	South	2007-01-05	2.000	4.000	0.000
Pac Highway South	South	2007-01-05	3.000	8.000	0.000
Pac Highway South	South	2007-01-05	4.000	12.000	0.000
Pac Highway South	South	2007-01-05	5.000	19.000	1.000
Pac Highway South	South	2007-01-05	6.000	61.000	1.000
Pac Highway South	South	2007-01-05	7.000	81.000	2.000
Pac Highway South	South	2007-01-05	8.000	140.000	2.000
Pac Highway South	South	2007-01-05	9.000	178.000	3.000
Pac Highway South	South	2007-01-05	10.000	157.000	13.000
Pac Highway South	South	2007-01-05	11.000	242.000	19.000
Pac Highway South	South	2007-01-05	12.000	150.000	21.000
Pac Highway South	South	2007-01-05	13.000	154.000	21.000
Pac Highway South	South	2007-01-05	14.000	158.000	34.000

Figure 16 - Grouped by POE, Day of Week and Hour



Border Data Warehouse :: Data Export

Browse Data (?)

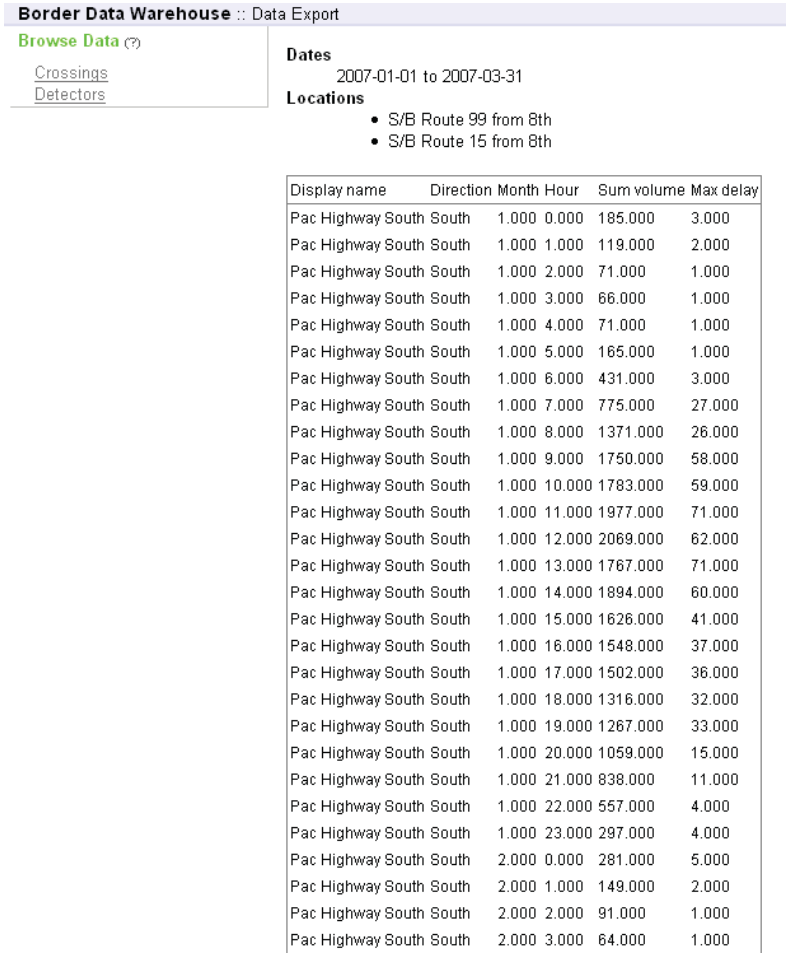
Crossings
Detectors

Dates
2007-01-01 to 2007-03-31

Locations
- S/B Route 99 from 8th
- S/B Route 15 from 8th

Display name	Direction	Day of week	Hour	Sum volume	Max delay
Pac Highway South	South	Friday	0.000	120.000	2.000
Pac Highway South	South	Friday	1.000	75.000	1.000
Pac Highway South	South	Friday	2.000	47.000	1.000
Pac Highway South	South	Friday	3.000	86.000	1.000
Pac Highway South	South	Friday	4.000	134.000	1.000
Pac Highway South	South	Friday	5.000	285.000	6.000
Pac Highway South	South	Friday	6.000	707.000	11.000
Pac Highway South	South	Friday	7.000	1019.000	19.000
Pac Highway South	South	Friday	8.000	1440.000	22.000
Pac Highway South	South	Friday	9.000	2137.000	46.000
Pac Highway South	South	Friday	10.000	2308.000	51.000
Pac Highway South	South	Friday	11.000	2567.000	59.000
Pac Highway South	South	Friday	12.000	2329.000	60.000
Pac Highway South	South	Friday	13.000	2240.000	59.000
Pac Highway South	South	Friday	14.000	1976.000	68.000
Pac Highway South	South	Friday	15.000	2128.000	61.000
Pac Highway South	South	Friday	16.000	2054.000	47.000
Pac Highway South	South	Friday	17.000	1974.000	41.000
Pac Highway South	South	Friday	18.000	1831.000	43.000
Pac Highway South	South	Friday	19.000	1917.000	37.000
Pac Highway South	South	Friday	20.000	1295.000	17.000
Pac Highway South	South	Friday	21.000	954.000	11.000
Pac Highway South	South	Friday	22.000	724.000	12.000
Pac Highway South	South	Friday	23.000	506.000	12.000
Pac Highway South	South	Saturday	0.000	378.000	13.000

Figure 17 - Grouped by POE, Month and Hour



Border Data Warehouse :: Data Export

Browse Data (?)

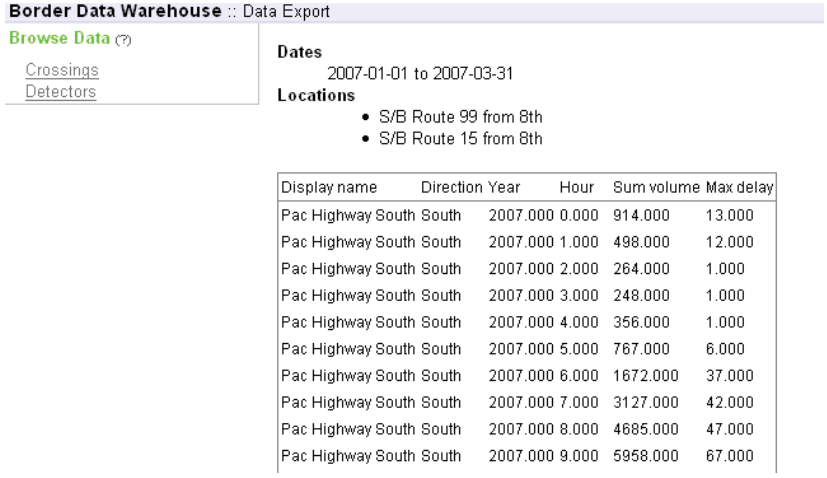
Crossings
Detectors

Dates
2007-01-01 to 2007-03-31

Locations
- S/B Route 99 from 8th
- S/B Route 15 from 8th

Display name	Direction	Month	Hour	Sum volume	Max delay
Pac Highway South	South	1.000	0.000	185.000	3.000
Pac Highway South	South	1.000	1.000	119.000	2.000
Pac Highway South	South	1.000	2.000	71.000	1.000
Pac Highway South	South	1.000	3.000	66.000	1.000
Pac Highway South	South	1.000	4.000	71.000	1.000
Pac Highway South	South	1.000	5.000	165.000	1.000
Pac Highway South	South	1.000	6.000	431.000	3.000
Pac Highway South	South	1.000	7.000	775.000	27.000
Pac Highway South	South	1.000	8.000	1371.000	26.000
Pac Highway South	South	1.000	9.000	1750.000	58.000
Pac Highway South	South	1.000	10.000	1783.000	59.000
Pac Highway South	South	1.000	11.000	1977.000	71.000
Pac Highway South	South	1.000	12.000	2069.000	62.000
Pac Highway South	South	1.000	13.000	1767.000	71.000
Pac Highway South	South	1.000	14.000	1894.000	60.000
Pac Highway South	South	1.000	15.000	1626.000	41.000
Pac Highway South	South	1.000	16.000	1548.000	37.000
Pac Highway South	South	1.000	17.000	1502.000	36.000
Pac Highway South	South	1.000	18.000	1316.000	32.000
Pac Highway South	South	1.000	19.000	1267.000	33.000
Pac Highway South	South	1.000	20.000	1059.000	15.000
Pac Highway South	South	1.000	21.000	838.000	11.000
Pac Highway South	South	1.000	22.000	557.000	4.000
Pac Highway South	South	1.000	23.000	297.000	4.000
Pac Highway South	South	2.000	0.000	281.000	5.000
Pac Highway South	South	2.000	1.000	149.000	2.000
Pac Highway South	South	2.000	2.000	91.000	1.000
Pac Highway South	South	2.000	3.000	64.000	1.000

Figure 18 - Grouped by POE, Year and Hour



Border Data Warehouse :: Data Export

Browse Data (?)

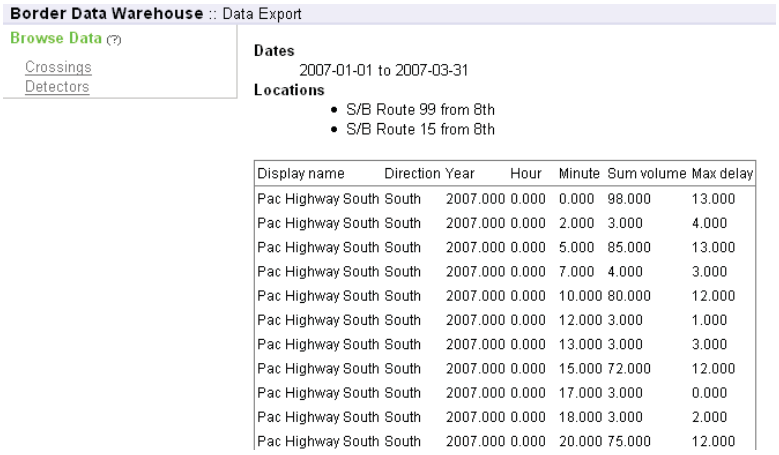
Crossings
Detectors

Dates
2007-01-01 to 2007-03-31

Locations
- S/B Route 99 from 8th
- S/B Route 15 from 8th

Display name	Direction	Year	Hour	Sum volume	Max delay
Pac Highway South	South	2007.000	0.000	914.000	13.000
Pac Highway South	South	2007.000	1.000	498.000	12.000
Pac Highway South	South	2007.000	2.000	264.000	1.000
Pac Highway South	South	2007.000	3.000	248.000	1.000
Pac Highway South	South	2007.000	4.000	356.000	1.000
Pac Highway South	South	2007.000	5.000	767.000	6.000
Pac Highway South	South	2007.000	6.000	1672.000	37.000
Pac Highway South	South	2007.000	7.000	3127.000	42.000
Pac Highway South	South	2007.000	8.000	4685.000	47.000
Pac Highway South	South	2007.000	9.000	5958.000	67.000

Figure 19 - Grouped by POE, Year and Minute



Border Data Warehouse :: Data Export

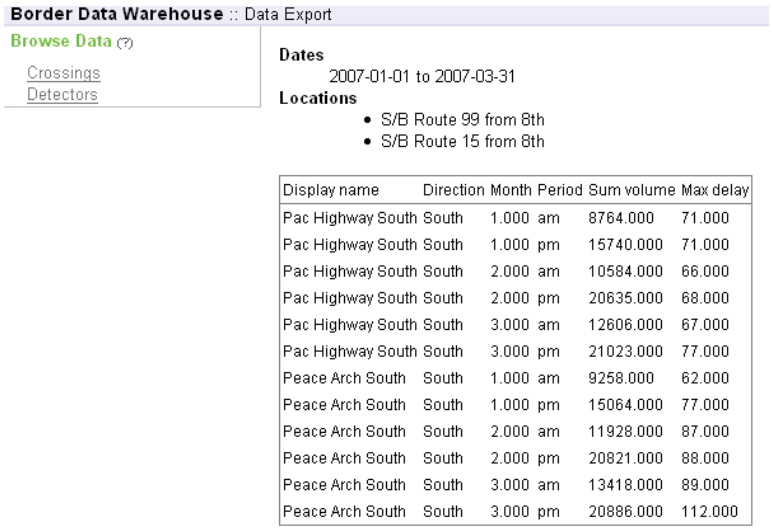
Browse Data (?)

Crossings
Detectors

Dates
2007-01-01 to 2007-03-31
Locations
- S/B Route 99 from 8th
- S/B Route 15 from 8th

Display name	Direction	Year	Hour	Minute	Sum volume	Max delay
Pac Highway South	South	2007.000	0.000	0.000	98.000	13.000
Pac Highway South	South	2007.000	0.000	2.000	3.000	4.000
Pac Highway South	South	2007.000	0.000	5.000	85.000	13.000
Pac Highway South	South	2007.000	0.000	7.000	4.000	3.000
Pac Highway South	South	2007.000	0.000	10.000	80.000	12.000
Pac Highway South	South	2007.000	0.000	12.000	3.000	1.000
Pac Highway South	South	2007.000	0.000	13.000	3.000	3.000
Pac Highway South	South	2007.000	0.000	15.000	72.000	12.000
Pac Highway South	South	2007.000	0.000	17.000	3.000	0.000
Pac Highway South	South	2007.000	0.000	18.000	3.000	2.000
Pac Highway South	South	2007.000	0.000	20.000	75.000	12.000

Figure 20 - Grouped by POE, Month and AM/PM



Border Data Warehouse :: Data Export

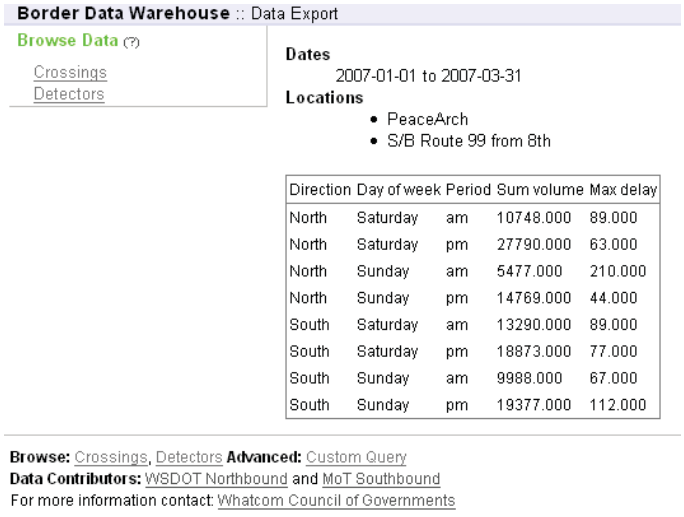
Browse Data (?)

Crossings
Detectors

Dates
2007-01-01 to 2007-03-31
Locations
- S/B Route 99 from 8th
- S/B Route 15 from 8th

Display name	Direction	Month	Period	Sum volume	Max delay
Pac Highway South	South	1.000	am	8764.000	71.000
Pac Highway South	South	1.000	pm	15740.000	71.000
Pac Highway South	South	2.000	am	10584.000	66.000
Pac Highway South	South	2.000	pm	20635.000	68.000
Pac Highway South	South	3.000	am	12606.000	67.000
Pac Highway South	South	3.000	pm	21023.000	77.000
Peace Arch South	South	1.000	am	9258.000	62.000
Peace Arch South	South	1.000	pm	15064.000	77.000
Peace Arch South	South	2.000	am	11928.000	87.000
Peace Arch South	South	2.000	pm	20821.000	88.000
Peace Arch South	South	3.000	am	13418.000	89.000
Peace Arch South	South	3.000	pm	20886.000	112.000

Figure 21 - Grouped by Direction, Day of Week, and AM/PM



Border Data Warehouse :: Data Export

Browse Data (?)

Crossings
Detectors

Dates
2007-01-01 to 2007-03-31
Locations
- PeaceArch
- S/B Route 99 from 8th

Direction	Day of week	Period	Sum volume	Max delay
North	Saturday	am	10748.000	89.000
North	Saturday	pm	27790.000	63.000
North	Sunday	am	5477.000	210.000
North	Sunday	pm	14769.000	44.000
South	Saturday	am	13290.000	89.000
South	Saturday	pm	18873.000	77.000
South	Sunday	am	9988.000	67.000
South	Sunday	pm	19377.000	112.000

Browse: Crossings, Detectors **Advanced:** Custom Query
Data Contributors: WSDOT Northbound and MoT Southbound
For more information contact: Whatcom Council of Governments

6. Explanation of Data Types and Measurements

Crossing Data

Volume

Total number of vehicles entering the crossing. This number is calculated by using the specific loop detectors selected from the northbound and southbound systems as volume counters. To see which loops are being used to calculate this volume, please consult the project loop translation table, which is available online at:

http://www.wcog.org/library/imtc/atisdms_looptable.pdf

Please note that this is an estimated value. A comparison is on-going between these volumes and the official traffic volumes collected by U.S. Customs and Border Protection and Canada Border Services Agency. The U.S. collects volumes using the portal radiation monitors in each primary lane, and the Canadian customs officials use license plate reader counts to establish their volume counts.

Delay

This number is the estimated delay for a vehicle arriving at queue-end during that five-minute time increment. It is specific to that particular crossing and listed in minutes. This value does **not** measure the actual delay experienced, but rather an estimate based on the service rate, and queue length.

Queue Length

The approximate length of the queue at the crossing is listed in meters and is determined by the occupancy of loop detectors along each route. For example, the loop that is farthest south and occupied in the northbound system indicates the end of the queue.

For example, the northbound system at Peace Arch has loop detectors 128 meters, 257 meters, 388 meters, 517 meters, 638 meters, and 767 meters from the primary booths. Queue lengths beyond 767 meters northbound cannot be recorded. However, improvements to the system in the coming years will increase the number of detectors and provide for more accurate queue length calculations.

More specific queue length calculations can be derived with the southbound system, due to the larger number of detector stations.

Service Rate

Service rate is an estimate of the number of vehicles being processed per five-minute period at the entire crossing (not including the NEXUS lane).

Vehicles in Queue

The number of vehicles in queue is derived by dividing the queue length by the average number of cars.

Detector Data

Volume

Total number of vehicles that cross over that particular detection loop. Please note that this is an estimated value, based on the occupancy of the loop. If vehicles are at a stop or in a queue over the loop, the volume may be underestimated, as it is possible that two cars will cross over the detector at one time and be counted as one vehicle.

Occupancy

This number represents the percentage of time during the five-minute interval that the detector was occupied.

Average Speed

The average speed of vehicles over the detector, in kilometers per hour. Note that detectors closer to the primary lanes will have less accurate speeds since the queue tends to extend out over them.

Average Length

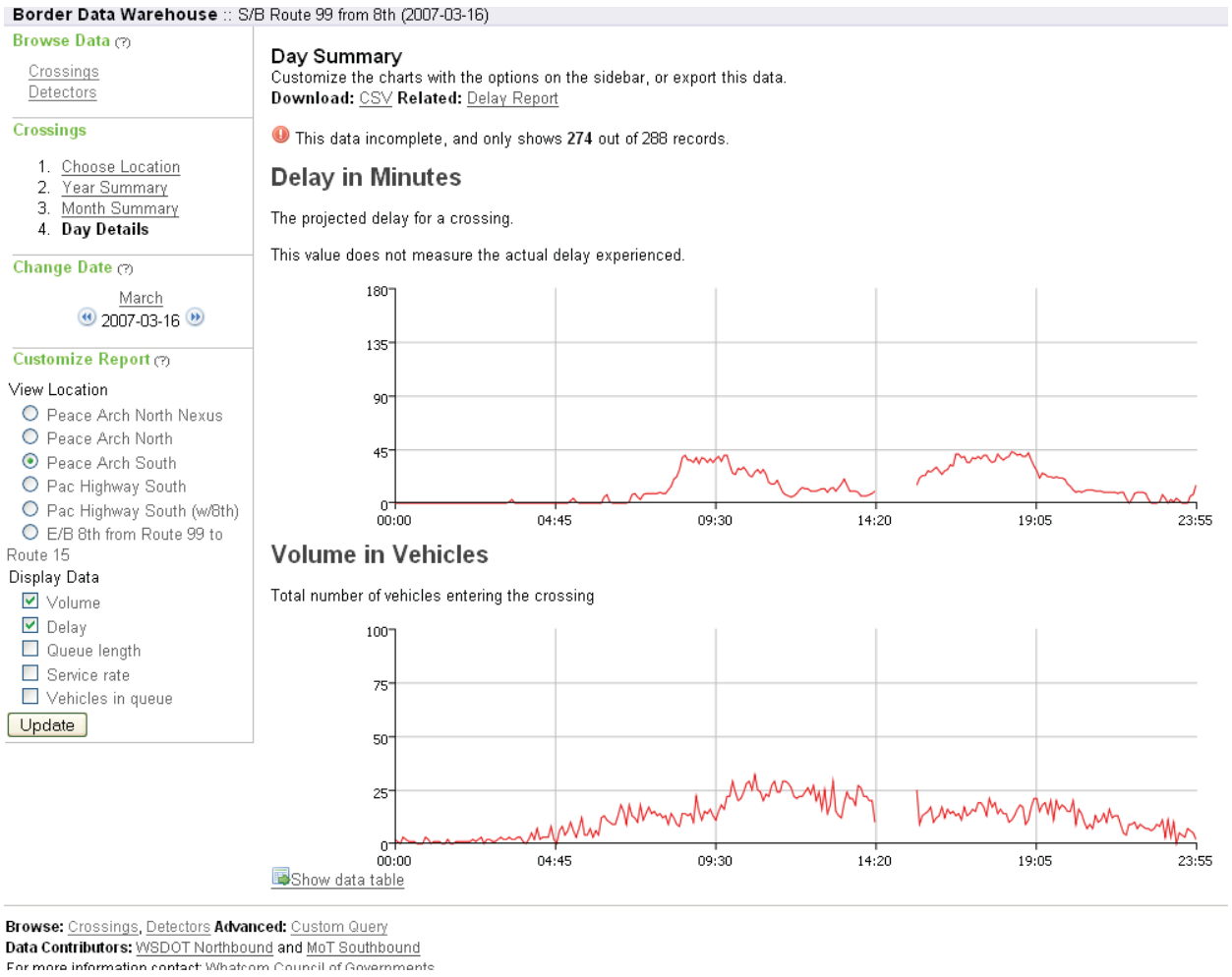
The average length of the vehicles crossing the detector in meters. This number shows the individual vehicle length (size of the vehicle). This number may be approximated for some detectors.

7. Missing Data

The archive collects data in five-minute intervals from both northbound and southbound systems. However, occasionally data packets from specific loops are not collected, if the system is down or loops are not working correctly. A full 24-hour period includes 288 records (one for each five-minute interval). However, if not all records are available, a warning message is included on that particular day summary (see **Figure 22**).

Data that are missing are not included in any graphic representation of the data, therefore showing a broken line.

Figure 22 - Example of incomplete data.



8. More Information

More information about the Border Data Warehouse and the Advanced Traveler Information System (ATIS) Data Management project is available through the Whatcom Council of Governments by calling (360) 676-6974.

In addition, the following resources are available online:

The border data warehouse:
www.CascadeGatewayData.com

The ATIS Data Management Project: http://www.wcog.org/DesktopDefault.aspx?tabid=203

The northbound Border Traveler Information System (WA State Department of Transportation):

http://www.wsdot.wa.gov/traffic/border/

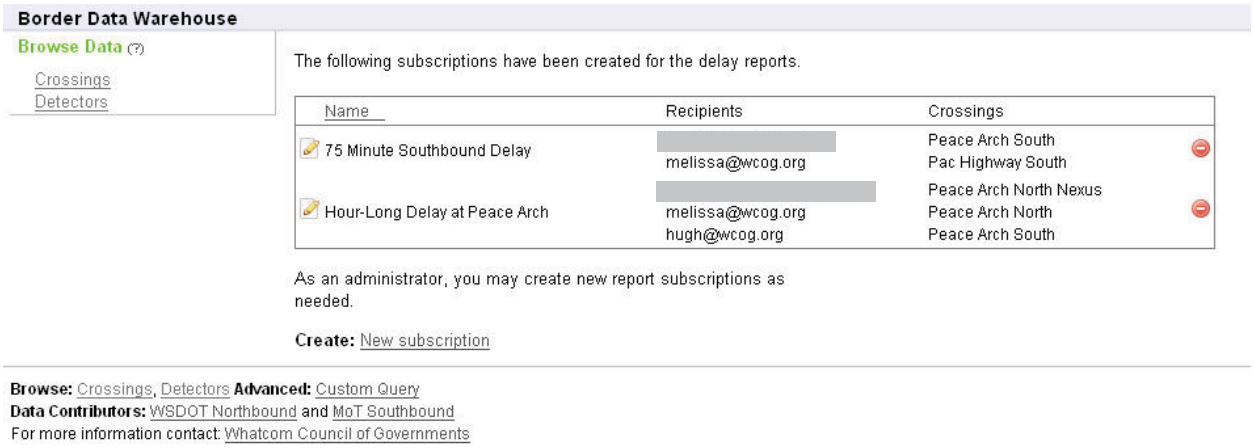
The southbound Border Traveler Information System (B.C. Ministry of Transportation):

http://www.th.gov.bc.ca/ATIS/index.htm

E-Mail Reports

Customizable e-mail reports are available for frequent website users who want delay notifications sent to them if a certain delay threshold is reached. For example, if a user would like to be informed by email every time the delay at Peace Arch is longer than one hour, a request can be sent to Whatcom Council of Governments and a customized e-mail report will be automatically set up.

End users cannot set up the e-mail reports on their own. The following graphic shows how the request is administered by the website administration. The following page shows an example of an e-mail report sent to users.



Melissa Miller

From: reports@cascadegatewaydata.com
Sent: Saturday, March 24, 2007 11:04 AM
To: [redacted]; Melissa Miller
Subject: 75 Minute Southbound Delay

Delay Report

One or more of the following crossings had more than 75 minutes of delay on 2007-03-24 from the hours of 10 to 11.

- Peace Arch South
- Pac Highway South

Details

The delay reported below is based on the reported delay predictions for these crossings.

Peace Arch South

Time	Delay in Minutes
10:00	82.0
10:05	70.0
10:10	61.0
10:15	73.0
10:20	60.0
10:25	59.0
10:30	57.0
10:35	57.0
10:40	58.0
10:45	48.0
10:50	52.0
10:55	64.0

More details are available at this crossing's page for 2007-03-24

Pac Highway South

Time	Delay in Minutes
10:00	48.0
10:05	45.0
10:10	40.0
10:15	34.0
10:20	34.0
10:25	41.0
10:30	38.0
10:35	45.0
10:40	46.0
10:45	49.0
10:50	40.0
10:55	45.0

More details are available at this crossing's page for 2007-03-24

Appendix I: Border Information Flow Architecture (BIFA) Backgrounder

The following description of the Border Information Flow Architecture (BIFA) is excerpted from the Border Information Flow Architecture Final Report, prepared by the National ITS Architecture Team for the U.S. Federal Highway Administration, U.S. Department of Transportation, and Transport Canada on January, 2006.

The full report is available online at: http://www.iteris.com/itsarch/bifa

1. Introduction/Background

FHWA (Office of Freight Management and Operations, with sponsorship from the US DOT Intelligent Transportation System Joint Program Office) and Transport Canada (ITS Office), in partnership with state and provincial transportation organizations, regional planning organizations and other federal agencnies, are spearheading an effort to develop a border information flow architecture. The initiative involves numerous stakeholders and is intended to be a framework that depicts the flow of information between government (federal, state and local) agencies and components of the transportation system, as they relate to border processes (e.g., the flow of advanced traveler information from inspection and enforcement agencies to transportation organizations). The architecture is a tool that can be used by agencies that operate at or near to border to guide the planning, development, and implementation of ITS and other technology. The end state objective is to develop an architecture that promotes information sharing and coordination among agencies and stakeholders and increases interoperability of technologies used to support their operations.

There are a multitude of agencies from numerous jurisdictions (federal, state, provincial) that operate at or on the approach to Canada-U.S. border crossings. Many of these agencies are currently planning or implementing technology and information systems to help them accomplish their work. Lack of coordination and collaboration among these various agencies often results in the deployment of technology that is not interoperable, is redundant or is an impediment to efficient operations. The Border Information Flow Architecture seeks to address these problems and is intended to aid agencies in planning and implementing interoperable technologies at or on the approach to Canada-U.S. land border crossings.

1.1. Border information Flow Architecture Concepts

The Border Information Flow Architecture (BIFA) is an example of a Regional ITS Architecture, which has been defined by FHWA Rule 940 as a "regional framework for ensuring institutional agreement and technical integration for implementation of ITS projects". Regional ITS architectures, including BIFA, are developed in order to provide a guide for the integration of transportation systems. BIFA is based upon two general versions of ITS architecture that have been developed at the national levels:

- US National ITS Architecture Version 5.1. A complete description of this architecture can be found at http://www.iteris.com/itsarch.
- ITS Architecture for Canada Version 1.1. A complete description of this architecture can be found at http://www.its-sti.gc.ca/Architecture/english/static/content.htm or http://www.its-sti.gc.ca/Architecture/Francais/static/content.htm.

These architectures both use a set of common concepts or terms to describe the architectures. This section will provide a description of the most common concepts or terms as an aid to the understanding the remainder of the document.

What are some of the main parts of an ITS architecture? They are made of the following:

- Organizations
- Systems operated
- Services provided
- Functions performed
- Information exchanged

The organizations that operate systems in the region covered by the architecture are referred to as **stakeholders**. These are public agencies, private organizations or the traveling public with a vested interest, or a "stake" in one or more transportation elements within a Regional ITS Architecture.

The systems operated by the stakeholders are referred to as **elements**. In BIFA the elements represent actual systems, such as a *Provincial Ministry of Transport TMC* (Traffic Management Center). An element may also represent field devices, for example the BIFA element *Provincial Ministry of Transport Field Equipment*. A more thorough discussion of the BIFA elements is contained in Section 4. As mentioned above BIFA is based upon National ITS Architectures which also contain general terms for these systems. Since these terms show up repeatedly in later discussion they will be defined here.

The National ITS Architectures use two terms to describe the systems that make up an architecture. They are:

- **Subsystems**, which represent the primary systems described by the architectures. For example the TMC element mentioned above represents a regional ITS architecture example of the Traffic Management Subsystem defined in the National ITS Architectures. The US National ITS Architecture has 22 subsystems, while the ITS Architecture for Canada has 23 subsystems defined.

- **Terminators**, which represent systems that are on the boundary of the architecture. In general only interfaces to the terminators are described in the national architectures. An example of a terminator from the US National ITS Architecture is the Weather Service. The US National ITS Architecture has 73 terminators defined, while the ITS Architecture for Canada has 71.

As a part of developing a regional ITS architecture, each element of the region is mapped to the subsystems and/or terminators that most closely define the functions of the element. This mapping allows the regional version to use the details associated with the subsystems and terminators in the national ITS architectures. As an example, the element in BIFA called *US Weather Service Forecasting System* is mapped to the National ITS Architecture terminator Weather Service.

The information exchanged between elements (in BIFA) or between subsystems and terminators in the national ITS architectures is described by **information flows or architecture flows.** There are hundreds of these flows defined in the national ITS

architectures, and it is this information that is used to create the interface definitions in BIFA. For example in Figure 1 the top two boxes show an interface between two subsystems, with its information flows defining the exchange of information. A corresponding interface in BIFA is shown in the bottom two boxes.

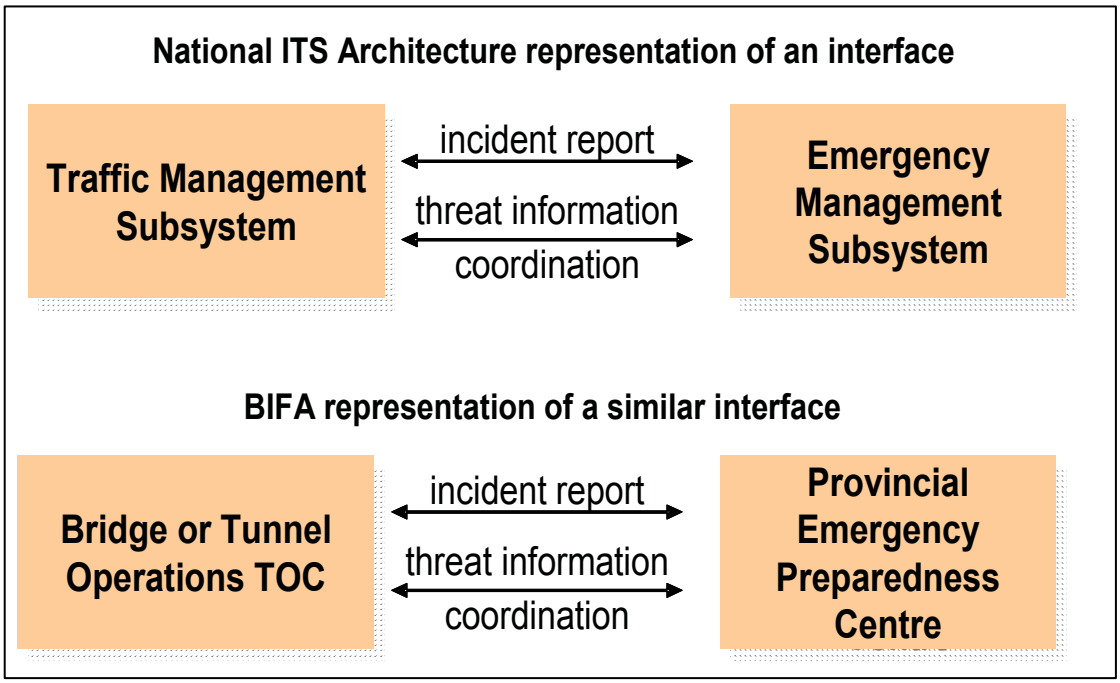


Figure 1: Information flows

By mapping the BIFA elements (e.g. Bridge and Tunnel Operations TOC) to National ITS Architecture subsystems (or terminators) (e.g. Traffic Management Subsystem), the interfaces defined in the national ITS architectures can be used as the basis for defining the interfaces in BIFA.

The next key concept used by the architectures is that of **market packages**. These represent slices of an architecture that provide a transportation service. In the national ITS architectures, these market packages are combinations of subsystems and information flows that are used to provide the service. An example of a National ITS Architecture market package is shown in Figure 2. This shows the subsystems and information flows (some of which go to terminators) that perform the collection and distribution of traffic flow and traffic images used to monitor a road network. In the development of BIFA, a set of customized market packages were created that define the elements and interfaces used to provide the service in BIFA. Figure 3 shows one of the customized market packages, in this case for the State DOT TMC. This diagram shows how the State DOT might implement this service. There are two types of interfaces shown in the customized market package:

- Traffic Management Center to Roadside Equipment and
- Traffic management Center to Information Service Provider (of which *US 511 Systems* is an example).

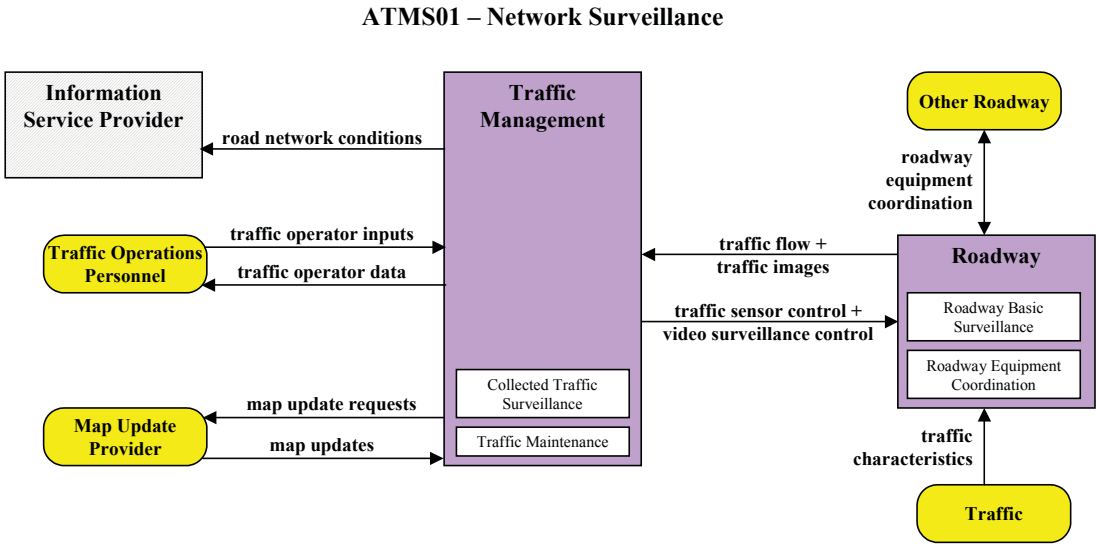


Figure 2: Example of national ITS architecture market package

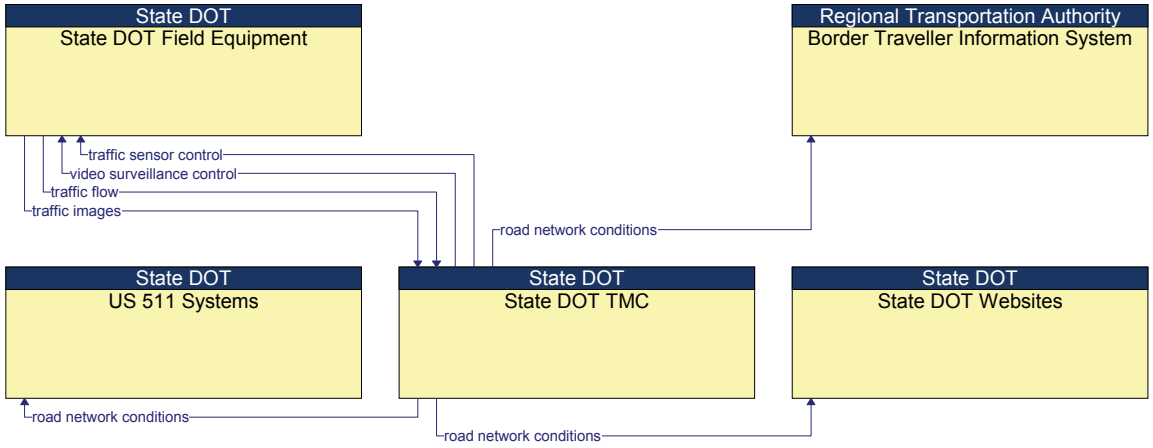


Figure 3: Example of BIFA customized market package

Notice that the customized market package includes only some of the interfaces that were in the national ITS architecture market package. It does not include interfaces to personnel or a map update provider element. Elements mapping to these are not included in BIFA.

One final concept to mention relates to the functions performed by the elements in the architecture. The national ITS architectures have the concept of an **equipment package,** which define a piece of functionality within a subsystem. For example in Figure 2, Collect Traffic Surveillance is a function (or equipment package) that is performed by the Traffic Management Subsystem in performing the Network Surveillance. In the BIFA outputs functions have been identified for the key elements from a mapping of equipment

packages to elements. Further information regarding this is found in Section 7 on Functional Requirements.

1.2. Border Information Flow Architecture Development Process

The Border Information Flow Architecture (BIFA) has truly been a collaborative effort involving stakeholders from both sides of the border from both the public and private sectors. One could say that BIFA began in 2003 when the Transportation Border Working Group (TBWG) established the Border Information Flow Architecture Working Group (BIFAWG) to oversee the development of BIFA.

In 2004, FHWA brought in the National ITS Architecture development team to act as consultants to develop the architecture. With the first web cast held in the fall of 2004, the process to develop BIFA has generally followed the process to develop a regional ITS architecture described in the US DOT document "Regional ITS Architecture Guidance – Developing, Using, and Maintaining an ITS Architecture for Your Region."

The process involved the following basic steps:

1. Establish the Scope of the architecture
2. Identify the stakeholder agencies involved
3. Document the operational concept
4. Documenting the Inventory of systems
5. Understanding the needs of the stakeholders and the services they will provide
6. Capturing the information exchange between systems
7. Documenting functional requirements for the systems
8. Identifying relevant interface standards

Along the way, the architecture team held web casts and workshops to present the concepts of the architecture and gather feedback.

- Webcast #1, held in December 2004 established the terminology and process that was to be followed during the architecture development
- Workshop #1, held in March 2005 in Ottawa, presented and discussed the initial inventory and services.
- Webcast #2, held in June 2005, presented the updated architecture based on user comments since the last workshop including a preliminary document and web site.
- Workshop #2, held in August 2005 in Chicago, presented and discussed the detailed interfaces included in the architecture and finalized plans to complete BIFA
- Webcast #3, in December 2005, presented the final version of BIFA – including its document and website and discuss how the architecture can be used to support other regional planning efforts and deployments

Agreements and Sequencing of Projects have been discussed informally as part of the development of BIFA. As this architecture will be used to support a range of planning

processes and deployment efforts on both sides of the border the agreements and projects will need to be developed by the local agencies involved.

1.3. Document Overview

This document is organized into twelve main sections.

- Section 1 provides introductory information.
- Section 2 describes the scope of BIFA.
- Section 3 describes the stakeholders and provides a description of their roles and responsibilities in an operational concept.
- Section 4 describes the systems operated by the stakeholders.
- Section 5 addresses the needs that drove the development of BIFA and identifies the services that the architecture will provide.
- Section 6 considers the interfaces and information exchanges defined by the architecture and describes the key diagrammatic outputs that can be found on the website.
- Section 7 covers the area of functional requirements, explaining how these are defined and described on the website.
- Section 8 provides an overview of standards as they apply to the architecture.
- Section 9 discusses the are of project sequencing.
- Section 10 discusses the agreements needed between stakeholders to maximize system benefits.
- Section 11 provides guidance on using the regional ITS architecture and
- Section 12 summarizes the architecture maintenance plan.

Appendix A contains a report listing the comments that were received from the stakeholders during the development of BIFA along with their dispositions for each.

Appendix B contains a report that shows all of the Market Packages that were included in BIFA including a description of each and a mapping to the elements of the BIFA inventory.

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.

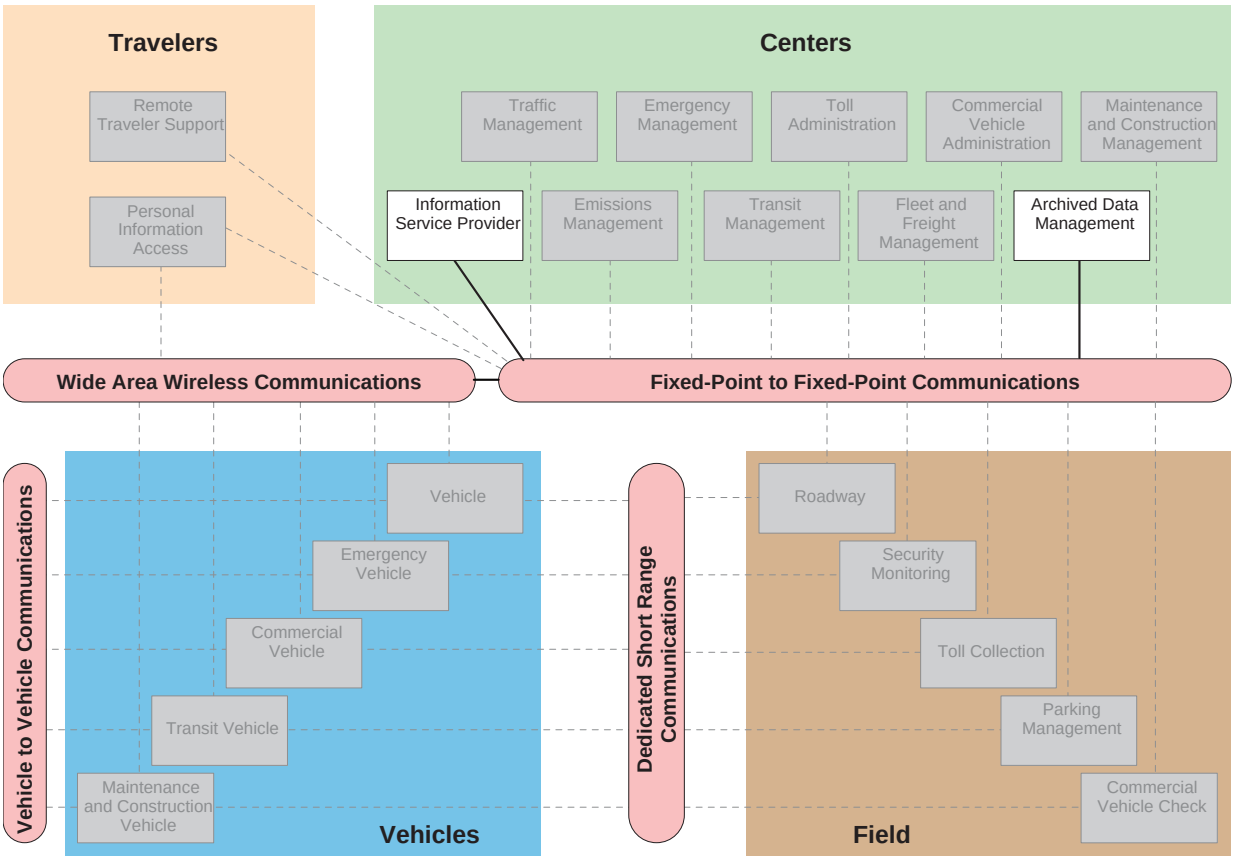
10 Projects Required for Implementation

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

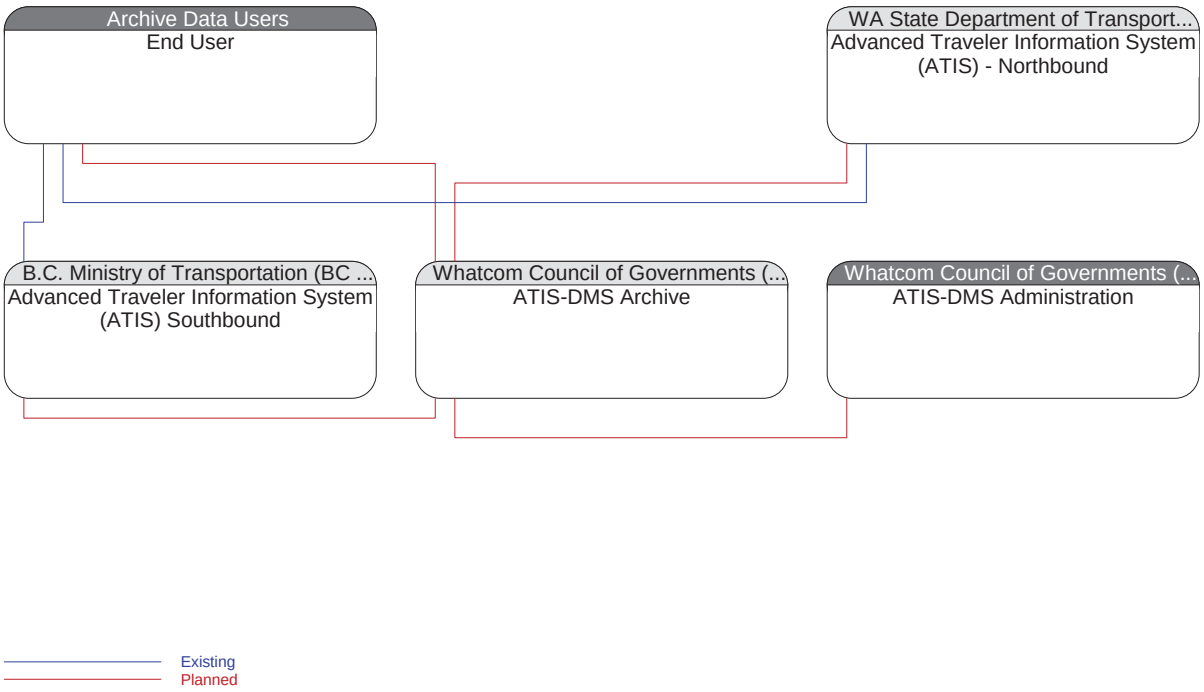
Architecture Diagram 1: ATIS-DMS Subsystms



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

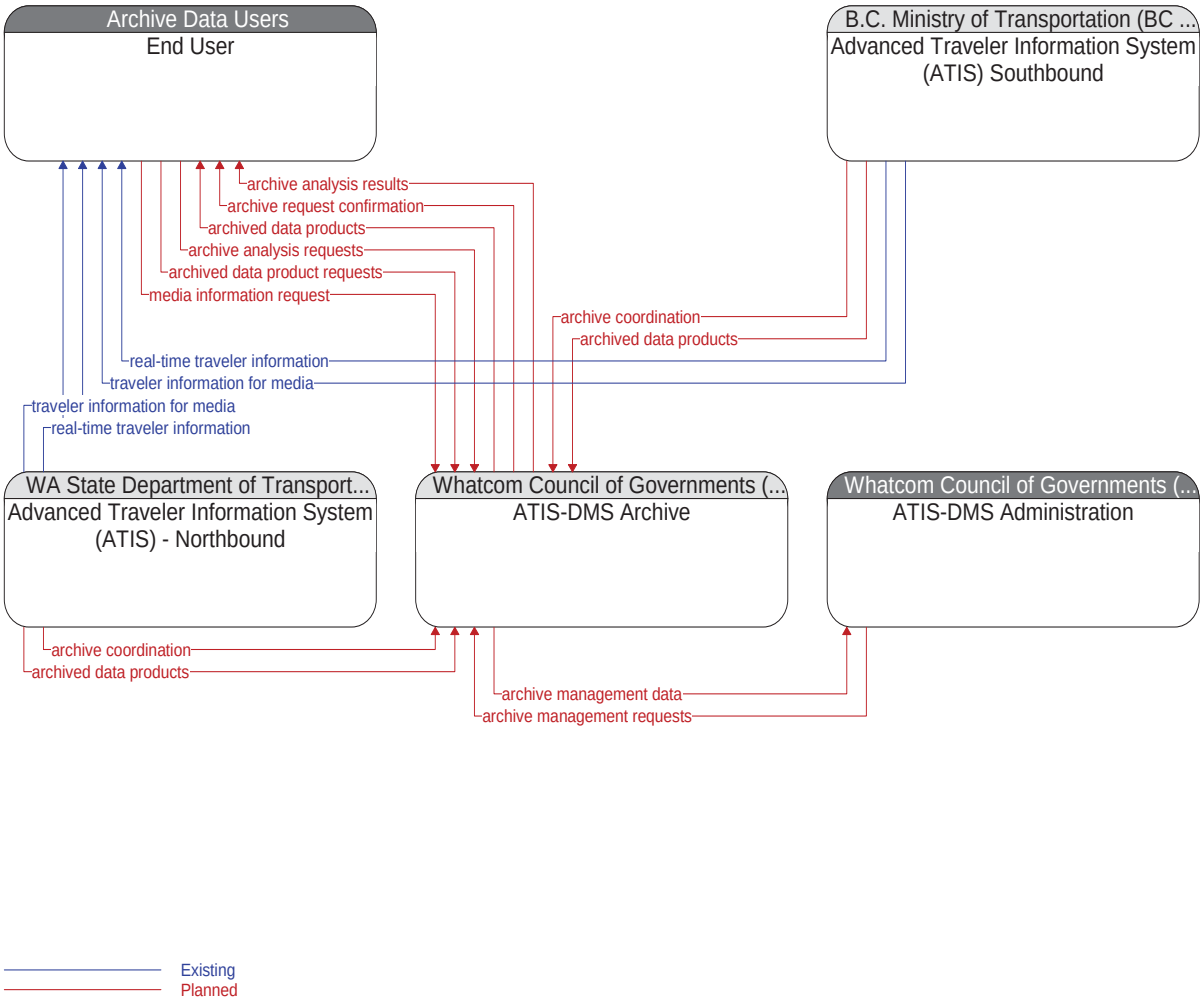
Architecture Diagram 2: ATIS-DMS Interconnects



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. Ths 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

DRAFT TEXT FOR DISCUSSION & EVALUATION ONLY
CANADA-UNITED STATES BORDER
JOINT MAINTENANCE AGREEMENT
BC-WA (ITS)

This Agreement is made as of this 1st day of April 2006 by and between the WASHINGTON STATE DEPARTMENT OF TRANSPORTATION, hereinafter "WSDOT" and HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA as represented by the Minister of Transportation, hereinafter "BCMOT."

WHEREAS, the parties seek to cooperatively maintain hardware supporting Intelligent Transportation Systems (ITS) that support improved traffic efficiencies and information for travelers and the respective agencies, AND

WHEREAS, this agreement covers provincial and state highway corridors leading to the four Ports of Entry (POE) that comprise the "Cascade Gateway", namely

- Sumas/Huntingdon;
- Lynden/Aldergrove;
- Blaine/Pacific Highway; and
- Blaine/Douglas.

AND

WHEREAS, United States Customs and Border Protection (CBP) and Canada Border Services Agency (CBSA) operate the above-listed POEs and will need to authorize worker access to the inspection-facility areas that they manage, AND,

WHEREAS, the BCMOT has authority to maintain ITS systems along provincial routes within the province of British Columbia; AND

WHEREAS, the WSDOT has authority to maintain ITS systems along provincial routes within the State of Washington, AND

WHEREAS, the BCMOT has legal authority to enter into this Agreement pursuant to OIC 539 regarding Contribution Agreements related to Border Projects, AND

WHEREAS, the WSDOT has legal authority to enter into this Agreement pursuant to ...

NOW, THEREFORE, in consideration of the foregoing recitals, the mutual covenants contained herein, and the other goods and valuable consideration, the receipt and sufficiency of which are hereby acknowledged,

IT IS MUTUALLY AGREED AS FOLLOWS:

1) **Term of Agreement.** Notwithstanding the date of execution hereof, this Agreement shall terminate by its own terms on December 31, 2010, unless the Agreement has been terminated or extended by the parties as provided herein.

2) **Scope of Work.** Each of WSDOT and BCMOT shall perform or cause to be performed all work, labor, materials and services necessary to complete the work as outlined below.

   The type of work involved generally includes maintenance of any and all ITS hardware that has been installed by either or both of WSDOT and BCMOT to support their individual or joint ITS programmes.

   "Hardware" is defined as cabling/wiring, conduiting, cabinets, cameras and any mounting equipment, and other ancillary equipment that forms part of an ITS system that is managed by WSDOT and BCMOT individually or jointly.

   In addition to accepting responsibility for maintaining all ITS hardware located within its own jurisdiction, WSDOT and BCMOT agree that:
   - WSDOT will accept responsibility to maintain ITS hardware that resides within the northbound portions of the corridors up to, but not including, the CBSA Primary Inspection Line (PIL) booth.
   - BCMOT will accept responsibility to maintain ITS hardware that resides within the southbound portions of the corridors up to, but not including, the US CBP Primary Inspection Line (PIL) booth.
   -

3) **WSDOT Responsibilities.** In addition to the obligations set forth under Scope of Work, WSDOT shall:
   a) Secure agreement with the International Boundary Commission for access to the International Boundary for the purpose of maintaining any ITS hardware located thereon;
   b) Secure all permits, approvals, licenses and inspections necessary for maintenance on US Customs and Border Protection (CBP) property as appropriate;
   c) Ensure that CBP and CBSA, as appropriate, are informed for each maintenance event at a POE.

4) **BCMOT Responsibilities.** In addition to the obligations set forth under Scope of Work, BCMOT shall:
   a) Secure agreement with the International Boundary Commission for access to the International Boundary for the purpose of maintaining any ITS hardware located thereon;
   b) Secure, or cause its electrical maintenance contractor to secure, all permits, approvals, licenses and inspections necessary for maintenance on Canada Border Services Agency (CBSA) property as appropriate;
   c) Ensure that CBP and CBSA, as appropriate, are informed for each maintenance event at a POE.

5) **Payments.** The costs for maintaining the ITS hardware will be borne by each of BCMOT and WSDOT, or as per other separate agreement that might be in place.

a) Each of WSDOT and BCMOT shall not incur any participation costs on any work on this maintenance by the other party, unless authorized in writing by the other party.

6) **Records.** WSDOT and BCMOT shall retain, for a period consistent with their respective documentation regulations, all financial, environmental, or other maintenance records. If any litigation, claim, negotiation, audit or other action involving the records has been started before the expiration of these periods, the records must be retained until the completion of the action and resolution of all issues which arise from it, or until the end of the respective periods, whichever is later.

7) **Administration and Inspection.**

a) Auditing Procedures: In accordance with local, state and U.S. federal procurement procedures, all project expenditures will be approved by project managers. Prior to payment, expenditures will be reviewed by Finance staff for conformity with state and U.S. federal finance and costing principles and policies. WSDOT is audited annually by the Washington State Auditor. All payments are subject to review by the State Auditor.

8) **Hold Harmless.**

a) WSDOT, its successors and assigns, shall hold harmless the Province of British Columbia, including its Ministry of Transportation (BCMOT), and their respective officers and employees (collectively "Indemnities"), from and shall process and defend at its own expense all claims, demands, or suits, whether at law or in equity for bodily injury to persons or death or damage to property brought against WSDOT and/or the Indemnities , arising from WSDOT's execution, performance, or failure to perform any of the provisions of this Agreement, or of any other agreement or contract or work connected with this Agreement, or arising by reason of the participation of the Indemnities in any of the maintenance activities, PROVIDED that, nothing herein shall require BCMOT to pay for or reimburse the Indemnities for damages arising out of bodily injury to persons or death or damage to property caused by or resulting from an act or omission of the Indemnities. If the claims or damages are caused by or result from the concurrent negligence of (a) WSDOT, its contractors, authorized agents and/or employees and (b) the Province of British Columbia, the Washington State Department of Transportation, and/or BCMOT and/or their respective officers and employees, this indemnity provision shall be valid and enforceable only to the extent of the negligence of WSDOT, its contractors, authorized agents, and/or employees.

b) BCMOT, its successors and assigns, shall hold harmless the State of Washington, including its Department of Transportation (WSDOT), and their respective officers and employees (collectively "Indemnities"), from and shall process and defend at its own expense all claims, demands, or suits, whether at law or in equity for bodily injury to persons or death or damage to property brought against BCMOT and/or the Indemnities , arising from BCMOT's execution, performance, or failure to perform any of the provisions of this Agreement, or of any other agreement or contract or work connected

with this Agreement, or arising by reason of the participation of the Indemnities in any of the maintenance activities, PROVIDED that, nothing herein shall require WSDOT to pay for or reimburse the Indemnities for damages arising out of bodily injury to persons or death or damage to property caused by or resulting from an act or omission of the Indemnities. If the claims or damages are caused by or result from the concurrent negligence of (a) BCMOT, its contractors, authorized agents and/or employees and (b) the Province of British Columbia, the Washington State Department of Transportation, and/or BCMOT and/or their respective officers and employees, this indemnity provision shall be valid and enforceable only to the extent of the negligence of BCMOT, its contractors, authorized agents, and/or employees.

c) The provisions of this section shall survive the termination or expiration of the Agreement.

9) **Termination for Public Convenience.** WSDOT or BCMOT may terminate this Agreement in whole, or in part, whenever:

a) The requisite WSDOT or BCMOT funding becomes unavailable through failure of appropriation or otherwise.

b) BCMOT is prevented from proceeding with the maintenance as a direct result of an Executive Order of the Prime Minister of Canada or an Executive Order of the Premier of the Province of British Columbia.

c) WSDOT is prevented from proceeding with the maintenance as a direct result of an Executive Order of the President of the United States or an Executive Order of the Governor of the State of Washington.

d) WSDOT or BCMOT is prevented from proceeding with the work by reason of a preliminary, special, or permanent restraining order of a court of competent jurisdiction where such order is primarily caused by the acts or omissions of persons or agencies other than WSDOT or BCMOT.

e) BCMOT determines that such termination is in the best interests of the country of Canada and/or the Province of British Columbia.

f) WSDOT determines that such termination is in the best interests of the country of United States of America and/or the State of Washington.

10) **Termination Schedule.** If either party decides to terminate this agreement, notice of sixty (60) days will be given to the other party.

11) **Modification.** Any change, extension, addition, deletion or other modification to this Agreement shall not be valid or binding upon either party hereto unless such change,

extension, addition, deletion or other modification is in writing and executed by the authorized representatives of the parties hereto.

12) **Jurisdiction and Venue.** Any claims and/or causes of action which one party has against the other, growing out of this Agreement or the project with which it is concerned, shall be brought only in the Federal District Court, Western District, in Seattle, Washington, USA. The laws of the United States of America and the State of Washington shall apply to any such claims and/or causes of action.

13) **Disputes Resolution.** Disputes between the parties, growing out of this Agreement or the project with which it is concerned, may be resolved between the parties on an informal basis, by employment of a mutually acceptable independent mediator, or by arbitration, as mutually agreed upon by the parties. The parties agree to diligently cooperate with one another and the person or body appointed to resolve the matter and shall perform such acts as may be necessary to obtain a prompt and expeditious resolution of the disputes.

14) **Attorneys Fees and Costs.** Each party shall bear its own attorneys' fees and costs in any dispute resolution procedure and/or any litigation; no party shall seek or accept an award of attorneys' fees or costs.

15) **Entire Agreement.** This document and any modifications or amendments thereto is the complete and exclusive Agreement between the parties. It supercedes all oral or written proposals and/or other communications among the parties regarding this project.

16) **Third Parties.** Nothing contained within this Agreement shall create, provide or be construed as to create or provide any rights or benefits in or for any entity, organization or person that is not a party to this Agreement.

17) **Notice.** Whenever in this Agreement written notices are to be given or made, they will be served, personally delivered or sent by certified or overnight mail, addressed to the parties at the address listed below unless a different address has been designated in writing and delivered to the other party.

WSDOT: Washington State Department of Transportation
Attention:

BCMOT: British Columbia Ministry of Transportation
Attention: Pat Cruickshank, P.Eng., MBA.
Regional Manager, Programming, Partnerships and Planning
7818 6th Street
Burnaby, BC V3N 4N8

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

BC MINISTRY OF TRANSPORTATION

By

Name

Title

Dated: _____

Name

Title

Dated: _____

U.S.-Canada Transportation Border Working Group – TBWG
Policy & Research Subcommittee

(INCOMPLETE DRAFT)
Policy Assessment 2:
Maintenance of Cross-border Traffic-information Systems Hardware

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Introduction

The United States-Canada Transportation Border Working Group (TBWG) formed in 2002 largely in response to a memorandum of cooperation between Transport Canada (TC) and the U.S. Department of Transportation (USDOT) singed in 2000 between then U.S. Secretary of Transportation Rodney Slater and Canadian Minister of Transport David Collenette. The TBWG involves staff from USDOT and TC as well as from states and provinces, U.S. Customs and Border Protection, Canada Border Services Agency, and other federal and state agencies with responsibilities covering cross-border transportation, inspection, and facilities.

Since its inception the TBWG has added to the terms of the original MOU with the following mission statement.

> The mission of the Transportation Border Working Group is to facilitate the safe, secure, efficient, and environmentally responsible movement of people and goods across the Canada-U.S. border. The TBWG brings together multiple transportation and border agencies, and other organizations, to coordinate transportation planning, policy implementation, and the deployment of technology to enhance border infrastructure and operations. As such, this forum fosters ongoing communication, information sharing, and the exchange of best practices to improve the transportation and inspections systems that connect our two countries.

To deliver on the above mission, the TBWG has formulated an action plan consisting of five main categories.

- Planning and programming
- Policy
- Deployment of technology
- TBWG communication
- TBWG facilitation

Several specific initiatives as well as TBWG administrative functions are grouped within these categories. The work described here is being pursued under the Policy objective of TBWG.

The TBWG policy objective

The TBWG Policy Subgroup has been established to give added push to specific initiatives under the Action Plan.

The Action Plan reflects goals agreed to by our countries' leadership: the 2000 Memorandum of Understanding, the Smart Border Declaration, and the Security and Prosperity Partnership to name a few binational agreements. Many of these objectives, which cover federal programming, infrastructure acquisition, and system operations, cannot be fully advanced through communication and coordination alone. Meeting the challenges addressed by these initiatives often entails detailed evaluations of operational environments and the regulatory environments of our countries, and our states and provinces.

Full realization of such mandates will regularly require determinations that relevant laws and regulations support a specific outcome *or,* determinations that finishing the job will entail coordinated modifications to law.

Neither the Policy Subgroup nor the TBWG as a whole will be proposing changes to law or regulations. Assessments of laws and regulations relevant to specific Action Plan items will be undertaken, as needed. Completed assessments will be availed as information for TBWG and for the parts of our governments who can consider and propose modifications in law. Our heads of state and our legislators crafted these bi-national agreements and remain vested in their success.

A second function that TBWG has vested in the Policy Subcommittee is to serve as a liaison with research organizations doing work of interest to the TBWG. In addition to a facilitated dialog with these institutions, the Policy Committee expects to provide a forum for proposing research topics to these bodies and, from time-to-time, facilitating information exchange via presentations at TBWG meetings and other media.

Policy assessments

To elaborate on the above overview, the policy o Action Plan objective consists of five purposes.

1. Monitor the interaction of binational, TBWG objectives and national agency policies.
2. Assess the fit of existing policies with TBWG Action Plan objectives.
3. Assess the fit of new and proposed policies with TBWG Action Plan objectives.
4. Evaluate research for inclusion, as appropriate, in the TBWG dialog.
5. Suggest research topics, for possible undertaking by external research bodies.

This paper is focused on an assessment of existing policies. The subcommittee has indicated an interest in how current policies affect a number of border-related issues listed in the following table.

PURPOSE 2 (Ties to Action Plan policy section)	Assess the fit of *existing policies* with TBWG Action Plan objectives.		ACTOR Policy Subcommittee
	Issue	**Related Action Plan Objective**	**Status**
2.1	Develop a cross-border transportation institutional policy map.	Policy	**Active** Draft template to document policy assessments.
2.2	Operation and maintenance of cross-border systems and infrastructure - ITS hardware	Planning & Progreamming, Technology	**Active** (ITS)
2.3	State-Province arrangements for cross-border ITS hardware maintenance & service.	Technology	**Active** Assessment of the BC-WA needs and current options supported by regulations and laws.
2.4	Multi-agency binational agreement for adopting common border-incident communications protocol.	Planning & Programming	**Active** BC-WA / IMTC initiative . Policy Map being used to research options for formal adoption & use.
2.5	U.S.-Canada information-sharing policies/privacy rules etc. affecting ITS initiatives.	Technology	**Pending** Will evaluate need based on BIFA.
2.6	U.S.-Canada policies on intermodalism & intermodal activity	Planning & Programming	**Pending** U.S. and Canadian intermodal policies are not developed enough to start this work.
2.7	Planning and building of shared port facilities (Smart Border Declaration #16) and integration of such facilities with the transportation system	Planning & Programming	**Pending** Implications from ruling to be made regarding the reverse-inspection initiatives.
2.8	Reverse inspections	Planning & Programming	**Pending** Contingent on such issues arising within BIFA effort.
2.9	Compilation of policies affecting cross-border transit	Planning & Programming	**Pending** Possible interest in regional assessments of Detroit-Windsor and BC-WA
2.10	Binational project contracting	Planning & Programming	**Pending**
2.11	Incident response	Planning & Programming / Technology	**Pending**

The research documented in following sections is an assessment of existing policies surrounding a specific issue – maintenance of cross-border hardware related to intelligent transportation systems (ITS).

Problem statement

As part of ongoing efforts to improve cooperation, information sharing, and coordinated operation of cross-border transportation and inspection systems, this policy assessment starts by acknowledging that recent years have seen coordinated installation of information technology (IT) at and across land border ports-of-entry. While arrangements for installation of such systems vary by location and application, a remaining issue is the need for state and provincial transportation agencies (and possibly bridge owner/operators and others) to establish a standard, arrangement for providing maintenance of system hardware (cables, sensors, controllers, cameras, etc.) when this equipment extends across the international boundary.

As an initial case-study for this analysis, this assessment evaluates the options available for establishing such an arrangement between the British Columbia Ministry of Transportation, the U.S. Bureau of Customs and Border Protection, the Washington State Department of Transportation, and the Canada Border Services Agency, to provide access for the respective transportation-agency personnel to maintain and repair IT hardware.

TBWG interest

The U.S.-Canada Transportation Border Working Group has a mandate to advance programmatic coordination and coordination of ITS systems management.

Policy questions

As noted above, the primary jurisdictions involved in this initiative, and thus the focus of this binational policy analysis, are U.S. and Canadian federal governments and U.S. state and Canadian provincial governments. Local counties, districts, cities, and townships will also be included as needed.

A binational evaluation of this initiative includes the questions: Do existing laws and or regulations:

1) Validate and/or limit agency authorities to enter into biniational arrangements?

1) Provide a mandate for formalizing or improving cooperative maintenance of mutually beneficial infrastructure or shared systems?

3) Provide adequate allowances for temporary admission of the required type of worker to do the required type of work.

With these questions in mind, laws and regulations have been reviewed, relevant sections identified and cited in the following pages. An assessment of the cumulative effect of existing codes follows.

Authority to make international arrangements

Relative to the policy issues at hand, the issue of authority seems more easily addressed at the state and provincial level than at the federal level.

(Pending more research) United Stated and Canadian federal law seems more focused on the narrower subject of treaties – understood in international law to be an agreement with legally enforceable consequences.[1]

Below are citations identified (to date) that codify sources of authority from the federal and state and provincial governments.

Canadian federal review

Statutes of Canada

- **30.(1)** A foreign national may not work or study in Canada unless authorized to do so under this Act. **32.** The regulations may provide for any matter relating to **(a)** classes of temporary residents, such as students and workers. **24.(1)** A foreign national who, in the opinion of an officer, is inadmissible or does not meet the requirements of this Act becomes a temporary resident if an officer is of the opinion that it is justified in the circumstances and issues a temporary resident permit**…(Immigration and Refuge Protection Act)**
- **186.** A foreign national may work in Canada without a work permit…**(e)** as an officer of a foreign government sent, under an exchange agreement between Canada and one or more countries, to take up duties with a federal or provincial agency…**(o)** as an expert who conducts surveys or analyses that are to be used as evidence before a federal or

[1] *ASIL Insights*, International Agreements and U.S. Law, by Frederic L. Kirgis, May 1997, http://www.asil.org/insights/insigh10.htm

provincial regulatory body, a tribunal or court of law or as an expert witness before such a body, tribunal or court of law;" **(Immigration and Refugee Protection Regulations)**

United States federal review

U.S. Code

Code of Federal Regulations

Title 8, Chapter I, Part 214, Sec. 214.6

Canadian and Mexican citizens seeking temporary entry to engage in business activities at a professional level.

(a) General. Under section 214(e) of the Act, a citizen of Canada or Mexico who seeks temporary entry as a business person to engage in business activities at a professional level may be admitted to the United States in accordance with the North American Free Trade Agreement (NAFTA).

(b) Definitions. As used in this section, the terms:

Business activities at a professional level means those undertakings which require that, for successful completion, the individual has at least a baccalaureate degree or appropriate credentials demonstrating status as a professional in a profession set forth in Appendix 1603.D.1 of the NAFTA.

Business person, as defined in the NAFTA, means a citizen of Canada or Mexico who is engaged in the trade of goods, the provision of services, or the conduct of investment activities.

Engage in business activities at a professional level means the performance of prearranged business activities for a United States entity, including an individual. It does not authorize the establishment of a business or practice in the United States in which the professional will be, in substance, self-employed. A professional will be deemed to be self-employed if he or she will be rendering services to a corporation or entity of which the professional is the sole or controlling shareholder or owner.

Temporary entry, as defined in the NAFTA, means entry without the intent to establish permanent residence. The alien must satisfy the inspecting immigration officer that the proposed stay is temporary. A temporary period has a reasonable, finite end that does not equate to permanent residence. In order to establish that the alien's entry will be temporary, the alien must demonstrate to the satisfaction of the inspecting immigration officer that his or her work assignment in the United States will end at a predictable time and that he or she will depart upon completion of the assignment.

(c) Appendix 1603.D.1 to Annex 1603 of the NAFTA. Pursuant to the NAFTA, an applicant seeking admission under this section shall demonstrate business activity at a professional level in one of the professions set forth in Appendix 1603.D.1 to Annex 1603.[2]

[2] The appendix has a long list of professions. While this assessment doesn't venture an interpretation on the applicability of the listed categories to this policy-question, it is of potential note that the list does include "engineer" "land surveyor," and "technologist."

British Columbia province review

"The Minister [of Transportation] may…enter into arrangements or agreements…for the exchange of information, or for the payment or sharing of the cost of anything related to provincial public undertakings or to transportation, with any person… including the government of Canada, the government of a province or territory within Canada, or the government of a jurisdiction outside of Canada, or an agent, agency, department or official of any of those governments;" **(Transportation Act [SBC 2004] Ch. 44, Part 2, Division 1, (1) (e) (i))**

Washington state review

- "The Governor is empowered, on behalf of the State, to enter into mutual aid arrangements with other states and territories, or provinces of the Dominion of Canada…" (**RCW 38.52.050 – Governor's powers & duties**)

CascadeGatewayData.com User Statistics

User statistics for the website www.CascadeGatewayData.com are compiled by the Google Analytics program.

The following data are for the period of January 1, 2007 - March 31, 2007 and show a general increase in the number of website visitors. It is important to note, however, that the official announcement of the website and its linking to other websites was not completed until the middle of April, 2007.

These statistics will be collected over the next two years to look at visitor volumes and which features and data tools are used most often. It will also provide a geographic scope of where users are checking from and provide a glimpse as to how the data are being used.